

# CRS Report for Congress

## The Information Superhighway: Status and Issues

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# THE INFORMATION SUPERHIGHWAY: STATUS AND ISSUES

## SUMMARY

As the media devote increasing attention to the "information superhighway," many question whether this latest high-tech creation is fact, fantasy, or a distant future. The answer is one of perspective and expectations.

For those who think of the Information Superhighway ("I-way") in terms of computers around the country and the world connected to each other, forming large networks that allow instant access to vast amounts of information and people, a prototype system already exists, the Internet. To those with a more expansive vision, Internet is at best a two-lane road, and the Superhighway still in its earliest stages of construction. Vice President Gore's vision, called the National Information Infrastructure (NII), would provide "a seamless web of communications networks, computers, databases, and consumer electronics that will put vast amounts of information at users' fingertips." The Vice President's frequent references to enabling every school in America to access the collections of the Library of Congress has become symbolic of the ultimate capability of the Superhighway, but such access will require billions of dollars of investment in technology, hardware, software, training, and "digitizing" the vast amounts of text, audio, and video material currently in other forms. Clearly that vision is far from realization, even though the private sector is already making substantial investments. The Vice President also wants the NII expanded to the world, calling it the Global Information Infrastructure (GII).

A key ingredient in how fast construction of the Superhighway proceeds is developing applications that are so vital or fun that consumers, businesses, and government organizations will invest in the equipment, software and training needed (called "killer applications" or "killer apps"). *How* information and services are transmitted -- by fiber optic cables, terrestrial radio waves, or satellites -- will be less important than *what* is transmitted. The regulatory environment will be another important factor in how quickly the Superhighway develops. Legislation to enable cable television and telephone companies to offer each other's services under certain conditions ("cable-telco crossownership") was debated in, but did not clear, the 103d Congress. Further debate is expected in the 104th. The Government also has an important role to play in issues such as protection of copyright, privacy, security, and ensuring that the Superhighway is accessible to rich and poor, urban and rural Americans alike.

Just as the automobile changed American society, so could the Information Superhighway. Telecommuting ("commuting" to the office by linking a home computer with one at the office, rather than actually driving there) may become more common, and voters may participate more in public policy through "town hall" meetings in the comfort of their living rooms, for example. Widespread delivery of services ranging from home shopping to health care to education could further the impact of the Information Superhighway on all aspects of society.

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## **THE INFORMATION SUPERHIGHWAY: STATUS AND ISSUES**

I believe that, for a long time to come, this information superhighway, far from resembling a modern interstate, will more likely approach a roadway in India: chaotic, crowded and swarming with cows.

*Arthur Ochs Sulzberger*  
*Publisher, New York Times*  
*May 25, 1994*<sup>1</sup>

## **THE NATIONAL INFORMATION INFRASTRUCTURE (NII) AND THE GLOBAL INFORMATION INFRASTRUCTURE (GII)**

Though development and use of information technologies has been expanding dramatically for many years, the current media blitz about the Information Superhighway was stimulated by a September 1993 report initiated by Vice President Gore in which he proposed creating a "National Information Infrastructure" (NII). He defined the NII as "a seamless web of communications networks, computers, databases, and consumer electronics that will put vast amounts of information at users' fingertips." The terms "Information Superhighway" and "National Information Infrastructure" (NII) have become virtually synonymous, though strictly speaking the "superhighway" refers to the telecommunications links while NII also encompasses the applications enabled by it.

In March 1994, Vice President Gore expanded his vision from the Nation to the world in a speech in Buenos Aires, Argentina. Coining the phrase "Global Information Infrastructure" (GII), he discussed how the type of capabilities announced in the NII report (see below) should be made available to everyone around the globe.

NII and GII are not technologies, but capabilities enabled by advances in technology. The extent to which the Information Superhighway, or "I-way," exists today depends on an individual's expectations and perceptions. Clearly Mr. Sulzberger (quoted above) feels that the Superhighway is not here yet, at least in a workable form. Others may disagree, especially the 25 million users

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<sup>1</sup> Quoted in: New York Times Chief: 'Info Superhighway' Swarming with Cows. Associated Press, May 26, 1994. 02:55 AET.

of Internet, a "network of networks" often described as a prototype of the I-way.<sup>2</sup> While Internet is arguably a two-lane road, not a superhighway, it is one example of the building blocks of Vice President Gore's vision that exists already.

### **The September 1993 NII Report**

Shortly after taking office, Vice President Gore created the Information Infrastructure Task Force (IITF), chaired by Secretary of Commerce Ron Brown. On September 15, 1993, the IITF released the report *National Information Infrastructure: Agenda for Action*.<sup>3</sup>

The Vice President's report notes that the NII encompasses a wide range of equipment including cameras, scanners, keyboards, telephones, fax machines, computers, switches, compact disks, video and audio tape, cable, wire, satellites, optical fiber transmission lines, microwave nets, televisions, monitors, and printers. All of these would be interconnected "in a technologically neutral manner so that no one industry will be favored over any other."

The Vice President's report identifies nine principles for Government action: to promote private sector investment; extend "universal service" to ensure that information resources are available to all at affordable prices; promote technological innovation and new applications; promote seamless, interactive, user-driven operation; ensure information security and network reliability; improve management of the radio frequency spectrum; protect intellectual property rights; coordinate with other levels of Government (domestic and foreign) and other bodies; and provide access to Government information and improve Government procurement.

The report also points out anticipated economic benefits of the NII, and outlines major applications. Subsequently, the Vice President made two speeches providing further details on the NII, one at the National Press Club (Washington, D.C.) on December 21, 1993, and the other to the Academy of Television Arts and Sciences (Los Angeles, CA) on January 11, 1994. In these

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<sup>2</sup> Internet originated in 1969 when the U.S. Department of Defense (DOD) established a world-wide network to preserve communications capabilities in the event routine communications pathways were disrupted. Called ARPANET (after DOD's Advanced Research Projects Agency), it was split into two networks in 1984. One, DDN (Defense Data Network) continues to exist and is part of Internet, while the other (which retained the name ARPANET) ceased operation because other networks, particularly the National Science Foundation's NSFNet, made it obsolete. See: U.S. Library of Congress. Congressional Research Service. Welcome to Cyberia: An Internet Guide. CRS Report 94-471 C, by Rita Tehan. Washington, May 12, 1994.

<sup>3</sup> U.S. Vice President Albert Gore. Information Infrastructure Task Force. The National Information Infrastructure: Agenda for Action. [Washington], Sept. 15, 1993. Hereinafter called "the Vice President's report."

speeches, he narrowed to five the principles on which he saw the Government taking the lead role: encourage private investment; provide and protect competition; provide "open access"; avoid creating information "haves and have nots"; and encourage flexible and responsive Government action. A particular emphasis is on assuring that all classrooms, libraries, hospitals and clinics are connected to the superhighway by the year 2000. In many of his speeches, the Vice President refers to the goal of allowing a schoolchild in his hometown of Carthage, Tennessee to go home, turn on her computer, and plug into the Library of Congress. Hence, future access to the collections of the Library of Congress has become symbolic of the promise of the Superhighway.

The IITF continues to explore the multitude of issues involved in this complex endeavor, with committees established to address specific issues such as privacy and access to government information. On September 23, 1993, the same day IITF's report was released, President Clinton established a National Information Infrastructure Advisory Council to facilitate private sector input to these issues (Executive Order 12864). A May 1994 IITF report explores many of the issues associated with and potential applications of the NII, including manufacturing, electronic commerce, health care, education, environmental monitoring, libraries, and government service delivery.<sup>4</sup> The IITF working group on intellectual property rights released its preliminary report in July 1994, and the applications working group released its second report in September 1994.<sup>5</sup>

### **The March 1994 GII Speech**

On March 21, 1994, in Buenos Aires, Argentina, the Vice President gave an address to the International Telecommunication Union (ITU) in which he expanded the concept of the NII from the Nation to the world, calling it the Global Information Infrastructure (GII), a global network of networks.

In the speech, the Vice President called creation of a GII "an essential prerequisite to sustainable development, for all members of the human family" and asserted that it would "spread participatory democracy," becoming "a metaphor for democracy itself." Furthermore he argued that GII would be "the key to economic growth for national and international economies." He proposed that the GII be built using the same five principles he outlined for the NII.

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<sup>4</sup> U.S. Dept. of Commerce. National Institute of Standards and Technology. Putting the Information Infrastructure to Work: Report of the Information Infrastructure Task Force Committee on Applications and Technology. Washington, U.S. Govt. Print. Off., 1994. 109 p.

<sup>5</sup> U.S. Dept. of Commerce. Information Infrastructure Task Force. (1) Intellectual Property Rights and the National Information Infrastructure: a Preliminary Draft of the Report of the Working Group on Intellectual Property Rights. July 1994; and (2) The Information Infrastructure: Reaching Society's Goals, Sept. 1994.

The speech focused attention on the role of satellites, which are especially useful for global communications. While undersea cables (copper and fiber optic) connect the United States with Europe and parts of Asia, it is expensive to lay cables to link continents, so satellites are used instead (satellites also provide additional capacity for areas that are linked by cable). Satellites are uniquely valuable in areas such as developing countries that lack terrestrial infrastructure. The need for developing countries to tie into the GII was emphasized by Vice President Gore, who commented that it is not lack of economic development that causes poor telecommunications, but primitive telecommunications that cause poor economic development.

### **STATUS OF CONSTRUCTION: SUPERHIGHWAY OR SUPERHYPEWAY?**

Whether or not the Information Superhighway exists today is chiefly a matter of perspective and expectations. Skeptics disdainfully label it the "superhypeway" because there is so much media "hype" about it. The frustration evident in Arthur Sulzberger's comment stems from that hype versus reality.

While the full vision embodied in the NII is billions of dollars and decades away from realization, a significant number of building blocks *are* here. In its broadest sense, the Superhighway connects users throughout the world to enable the exchange of information. Hence, telephones, television (broadcast and cable), and radio are elements of the Superhighway. Ninety-four percent of American households have telephone service, 99 percent have radio and broadcast (over-the-air) television, and 62.5 percent of households with television subscribe to cable television.<sup>6</sup> Four million households receive television directly from satellites via back-yard dish antennas. Other electronic and telecommunications systems are becoming equally commonplace. Nineteen million Americans have pagers. Forty seven percent of adult Americans have automatic teller machine (ATM) cards, and there are more than 16 million cellular telephone subscribers in the United States. All of these are building blocks of the Superhighway.

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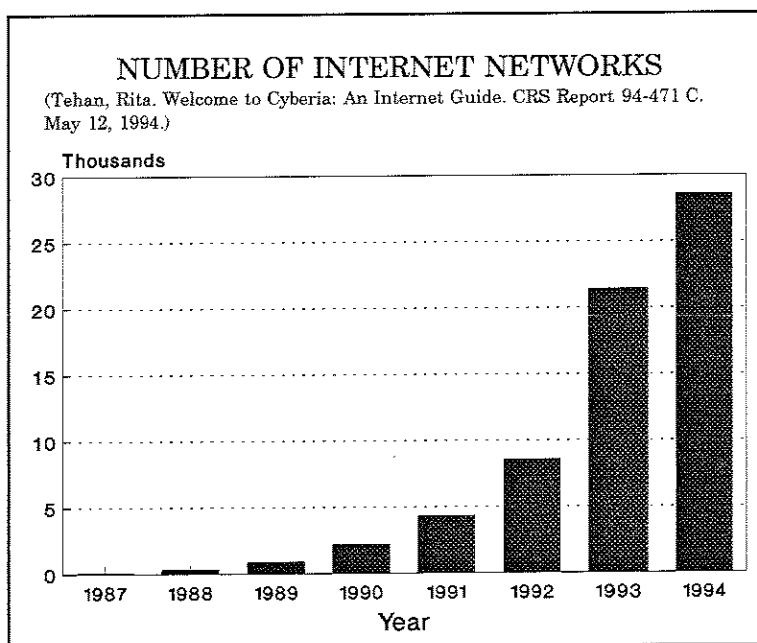
<sup>6</sup> The statistics cited here are from a variety of sources published at different times during 1994, and reflect percentages that were valid at certain points in time. Not surprisingly, the number of people using the I-way or equipped to do so, such as those owning computers, is steadily increasing. Hence, the figures in this report quickly will be out of date. Among the sources for specific statistics are speeches by Vice President Gore; Transnational Data and Communications Report (July/Aug. 1994, p. 11); Broadcasting and Cable (Aug. 22, 1994, p. 50); and the Wall Street Journal (Nov. 21, 1994, p. B5).

Still, most people associate the Information Superhighway concept with computers. Computers provide digital links (rather than analog)<sup>7</sup> and many people assume that computers will be the appliance that connects people (the "on-ramp") to the Superhighway. Thirty-two percent of American homes have computers today, though only 12 percent also have modems that connect computers with each other via telephone lines. Modems allow access to computer services such as electronic mail (e-mail) and information retrieval through networks like CompuServe, Prodigy and America On-Line (AOL). Those companies alone have 4.6 million users (CompuServe, 1.6 million; Prodigy, 2 million; AOL, 1 million). Millions more access computer services through systems at universities, government institutions, and private businesses. Internet, in turn, connects these and other networks worldwide (hence the term "network of networks").

A computer and modem ("hardware") and a set of computer instructions ("software") enable any person ("wetware") to reach into the Internet system ("the Net"). A high school student in Dallas can connect with fellow students next door in Fort Worth or as far away as Russia. If she has other software and her computer is properly equipped

with "graphics drivers" and other specialized hardware, she can call up images from the Vatican exhibit held at the Library of Congress or pictures of the Moon from the Clementine spacecraft.<sup>8</sup>

In fact, one of the biggest complaints about Internet is not that it accesses too little information, but how difficult it is to find a specific item amidst the



<sup>7</sup> For a definition of "digital," "analog," and other terms in this report, see: U.S. Library of Congress. Congressional Research Service. The Information Superhighway: An Annotated Glossary. CRS Report 94-468 C, by James Riehl. Washington, June 2, 1994. 6 p.

<sup>8</sup> Clementine is a joint Department of Defense-National Aeronautics and Space Administration spacecraft that sent back data about the Moon in early 1994.



vast number of sources instantly available from around the world. Another complaint is that, as a highway, it has a lot of potholes. Descriptions of information available by "clicking" on a menu item with a computer pointing device called a "mouse" often do not match users' expectations. A researcher may think he has struck a goldmine of information on a particular topic, only to discover it is no more than a terse index with little utility. Retrieving graphic images may require specialized software or hardware, which users cannot determine until attempting to display the image on their computer monitors, with frustrating results. Meanwhile, Internet's new popularity has veteran users complaining that their network, once the province of scientific researchers communicating among each other at universities and government laboratories, has been taken over by "squatters" who use it for commerce or junk mail instead of research.<sup>9</sup>

Also, even with the millions of Internet users already on-line, access to this wealth of information is limited to a small segment of society today. As noted, only 12 percent of homes have computers with modems, and an April 1994 Harris poll found that only one-third of the people surveyed had heard, seen or read anything about the Superhighway. Of those who had, 11 percent said they understood the superhighway "very well," 29 percent understood it "quite well," while 59 percent said they understood it "not very well" or "not at all."<sup>10</sup> On the other hand, a poll by Porter/Novelli Consumer Technology Group, asked 1,000 Americans where they were on the Superhighway and 33 percent said that were "going the speed limit in the right lane" while 11 percent said they were "passing everyone on the left."<sup>11</sup> Only 1 percent responded "going nowhere," and 9 percent said they were "going the wrong way." Eleven percent said they were "at a nearby pit stop," and 18 percent were "on the entrance ramp."

The more expansive expectations associated with the I-way, such as enabling all schools in America to instantly access the contents of the Library of Congress, is far in the future. What is missing is the rest of the physical infrastructure including interactive (two-way) links, and the immense amount of untapped information not in digital form. For example, though a small number of exhibits at the Library of Congress, selected collections, and the Library's computerized card catalog can be viewed via Internet, these are only a small percentage of the millions of books, photographs, maps, recordings, and other items in the Library's collections -- and the Library is only one example of the collections of video and text data that could someday be available over telecommunications links.

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<sup>9</sup> Culture Shock on the Networks. *Science*, Aug. 12, 1994. p. 879.

<sup>10</sup> Maddox, Kate. Poll: 59 Percent in the Dark on Information Highway. *Electronic Media*, May 16, 1994. p. 8.

<sup>11</sup> Mills, Mike. Doing the Speed Limit on the Information Superhighway. *Washington Post*, Aug. 2, 1994. p. D1.

Does the I-way exist today or not? Certainly pockets of highly visible projects exist; these are the ones making headlines. But widespread use and integration of these information services has not been achieved yet. A number of building blocks already are in place, such as telephones, radio and television which are used by virtually everyone in America. Thousands of computer networks exist, and Internet ties many of them together. Still, whether these collectively constitute even a highway is a matter of debate, but they are not yet a superhighway. Rather they whet the appetite for (or induce anxiety about) the Information Superhighway to come.

### **What Traverses the Highway**

For the purposes of this report, what exists today *is* a highway. Information that traverses it includes routine services such as telephony, television, radio, electronic banking, and paging and messaging services, as well as electronic mail (e-mail), which includes bulletin boards that allow users to chat with one another (anonymously if desired). Whether for fun or business, e-mail has become a favorite method of communications among those with modem-equipped computers. Though accessing Internet is not a requirement (users of a particular network can communicate with each other without going through Internet), Internet is widely used because of its reach.

Over these networks, what is transmitted can be as banal as an endless dialogue about teenage fashion on a "chat" bulletin board, or as poignant as medical data on a sick child in Arizona whose life depends on the expertise of doctors at the Mayo Clinic. It can be as erudite as the complete works of Shakespeare, or as controversial as pornography. Any information that can be transmitted in digital form can travel on the electronic paths that already exist.

Businesses are well established users of the highway. Local Area Networks (LANs) have become widespread for intra-office connectivity, and electronic mail is used in offices as well as at home. Transmitting business data via telecommunications links has been common domestically and internationally for decades, and with each new revolution in telecommunications technologies, companies become increasingly dependent on high-bandwidth,<sup>12</sup> secure, reliable communications. "Telecommuting" by connecting homes and offices electronically to enable people to work from home rather than commuting into an office is practiced by relatively few people today, but is viewed by some as a promising alternative for the future.<sup>13</sup>

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<sup>12</sup> Bandwidth is a measure of a system's capacity. The higher the bandwidth, the more information can be transmitted.

<sup>13</sup> A Times Mirror Center for the People survey found that 21 million people telecommuted at least one day a week last winter. Technology in the American Household. Transnational Data and Communications Report, July/Aug. 1994. p. 11

Still, some analysts conclude that it is the home market, not business, that now is driving the development of personal computer (PC) technology. *Business Week* published statistics in November 1994 showing that the share of U.S. PC shipments for home users will surpass that for business users in 1997, concluding that "Nearly 20 years after the first crude personal computers were cobbled together, the PC is finding a home -- yours."<sup>14</sup>

### **How It Travels: Wired and Wireless, Highways and Skyways**

Three pathways are available for transmitting information today: terrestrial radiowaves (broadcast television, radio, cellular telephones, some long distance telephone routes etc.); cables (cable television, most local and some long distance telephone and data services); and satellites (domestic and international telephone, television and data). Cables are referred to as "wired" means of communications, while terrestrial radiowave and satellite systems are "wireless."<sup>15</sup> Cables and terrestrial radiowave systems are located on the Earth so are called "highways" while satellites, in space, are called "skyways." Together, wired and wireless highways and skyways provide the means for transmitting information locally, nationally and globally. While it is popular to debate whether or not satellites are needed in the era of fiber optic cables (which rival satellites in terms of bandwidth, an important measure of how much information can be transmitted at a time), in fact it is likely that both will have a place in the information future just as they do today. In fact, the two can work together, and ensuring that satellite and terrestrial systems are interoperable is an issue being addressed by NII advocates in the White House.<sup>16</sup>

Large areas of developed countries like the United States and most European countries have been wired with coaxial (coax) cables for cable television and copper wires for telephones during the past decades. These older cables are being replaced on high-traffic routes with fiber optic cables that can carry much more information, but coax and copper are expected to remain the mainstay of "the last mile" between the cables and an individual home or office. Rewiring the last mile with fiber optic cables would be quite expensive, and new

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<sup>14</sup> Home Computers. *Business Week*, Nov. 28, 1994. p. 91.

<sup>15</sup> Over-the-air transmission of subscription television programming similar to cable television has yielded the oxymoron "wireless cable," formally called Multimedia Multipoint Distribution System (MMDS). For more on wireless cable, see: U.S. Library of Congress. Congressional Research Service. *Cable Television--And Eight Other Contributors to Competition in Multichannel TV Service*. CRS Report 92-785 SPR, by David Hack. Washington, Nov. 3, 1992.

<sup>16</sup> Two articles in the February 1994 issue of *Via Satellite* by representatives of the White House's Office of Science and Technology Policy address this issue: *The Role of Satellites in the National Information Infrastructure Initiative* by Richard DalBello, and *Satellite Communications in the National Information Infrastructure*, by Robert J. Bonometti.

digital compression technologies increase the amount of information copper and coax can carry. At least two options exist for high-capacity local access by business and residential customers. The first is integrated service digital network (ISDN) technology now available to about 50 percent of all telephone company customers. ISDN service substantially boosts the carrying capacity and transmission quality of ordinary telephone lines. For a variety of reasons, demand for ISDN service among telephone customers has been slow to materialize, but is now picking up. The second option is to make use of the enormous carrying capacity of the coaxial cable connections used by the cable television industry. This option would require extensive interconnection of the existing cable systems to the digital switching infrastructure owned by telephone companies. While a few cable systems have begun to offer limited telephone services to large business customers as "competitive access providers" and experiment with providing high-capacity Internet access, little of the required interconnection between cable networks and telephone networks has taken place, in part due to regulatory barriers (which are being addressed by Congress, as discussed below).

Cables do not reach into all low-density traffic areas (rural communities) even in the United States, and are largely non-existent in developing countries. In these circumstances, satellites are a useful alternative. The first communications satellites were launched in the early 1960s,<sup>17</sup> primarily for international telephony. Uses spread to television and data transmission, and, since the 1970s, satellites have become commonplace in domestic markets as well. Large-diameter satellite dishes have popped up in rural and suburban backyards for the past decade for direct-to-home satellite television viewing. A new satellite television service -- direct broadcast satellites (DBS) -- has become available nationwide in the United States this year (DBS has been available in Europe for several years). This new DBS service will use much smaller antennas (18 inches) than those with the original satellite television systems, and can be placed on rooftops or windowsills.

Apart from television reception, satellites offer ubiquity, mobility, distance insensitivity, and resiliency<sup>18</sup> for other telecommunications services, and are expected to have an important role in the NII and GII. The next major development in satellite communications is expected to be a variety of satellite systems that provide paging, messaging, mobile telephone, FAX and, in one case, two-way video, in competition with existing terrestrial services. The proposals gaining the most media attention are companies that plan to launch constellations of satellites into low Earth orbit (LEO). The Federal

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<sup>17</sup> For a history of U.S. communications satellite developments through 1982, see: U.S. Congress. House. Committee on Science and Technology. United States Civilian Space Programs 1958-1978, Vol. II. Chapter 3: Communications Satellites (by Jane Bortnick, Congressional Research Service). Committee Print. Washington, U.S. Govt. Print. Off., 1983.

<sup>18</sup> DalBello, Richard. The Role of Satellites in the National Information Infrastructure Initiative. Via Satellite, Feb. 1994. p. 50.

Communications Commission (FCC) has begun issuing licenses for systems nicknamed "Little LEOs" (data-only systems for paging and messaging services), "Big LEOs" (that offer mobile telephone and FAX services as well), and one dubbed a "Mega LEO" because of its magnitude (in terms of cost and number of satellites) that would also provide two-way video.<sup>19</sup> Other companies are proposing satellite systems using other orbits (such as geostationary orbit). How many of these systems actually will be built is an open question, dependent primarily on market demand, financing, and spectrum availability.

### **Pilot Projects and Emerging Applications**

The diversity of information services expected to capture the fancy of the average consumer, government institutions, and business in the next few years has received widespread media attention.<sup>20</sup> Some new services are being tested in pilot projects now.

**Interactive Links.** Many consider extensive access to interactive technology the real promise of the Superhighway, particularly in the lucrative entertainment market. Interactive links are being tested in pilot projects, though many years will elapse before the Nation has widespread access to this technology, and still more before it is available worldwide.

Among the pilot projects of interactive systems planned, underway or completed are those by NYNEX in New York, Time Warner in Orlando, Bell Atlantic in the Virginia suburbs of Washington, D.C., GTE in Cerritos (CA), Viacom/AT&T in Castro Valley (CA), U.S. West in Omaha, and TCI, U.S. West, and AT&T in Denver's suburbs. Most of these tests focus on "video-on-demand" services that allow customers to request, through special devices on their television sets, a showing of certain movies at any time. Often cited as the quintessential Superhighway application, some of these pilot projects have been criticized for testing groups that are too small and not representative of American society at large.<sup>21</sup> Interactive television encompasses other services, too, such as interactive home shopping networks, televised classes, and games, but skeptics point out that many television viewers simply do not want to interact with anything or anyone during their viewing time -- their whole point in turning on the set is to passively "tune out" and relax.

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<sup>19</sup> Called Teledesic, the proposal involves an investment of \$9 billion and maintaining a system of 840 satellites (plus 84 spares) in space. The largest of the other LEO systems is the 66-satellite Iridium system, expected to cost \$3.4 billion.

<sup>20</sup> For example, *Fortune* (July 11, 1994), *Business Week* (Special 1994 Bonus Issue, *The Information Revolution*, Summer 1994), *Congressional Quarterly* (May 14, 1994), and the U.S. Dept. of Commerce report cited earlier (*Putting the Information Infrastructure to Work*).

<sup>21</sup> Cauley, Leslie. *Interactive Trials are Trials Indeed -- Tough to Start and Tough to Judge*. *Wall Street Journal*, May 18, 1994. p. B1, B3.

Other pilot projects are in the public service realm rather than entertainment. These include telemedicine in which medical data can be transmitted among physicians in various locations and patients can talk with doctors hundreds or thousands of miles away. Projects have been underway since 1986 with the Mayo Clinic in Rochester, Minnesota and clinics in Jacksonville, Florida and Scottsdale, Arizona for providing consultation services. Several other States, including Texas, West Virginia, and Georgia, also have initiated two-way video telemedicine projects. North Carolina, using telemedicine to treat prisoners at Central Prison in Raleigh, since 1990, has saved \$211,000 on logistical costs for treatment while spending \$100,000 on the network.<sup>22</sup> Telemedicine is not restricted to the United States, either. The National Aeronautics and Space Administration (NASA) created a "Spacebridge" to Armenia following the earthquake there in 1988 to provide interactive medical consultations via satellite, and currently links several U.S. medical centers with a hospital in Moscow.

Other health care uses of the Superhighway include cost-efficient handling of patient records and other administrative tasks. Kaiser Permanente Health Plan has established teleconferencing links among 15 of its medical centers in northern California (for telemedicine, training and staff meetings), reportedly saving \$1.5 million a year in operating costs.<sup>23</sup>

**Telephones, PCS, and Home Appliances.** Cellular telephones and pagers already are commonplace accessories, but today these services are available primarily in analog form. Soon, digital versions using satellite systems, terrestrial networks, or both are expected to be widely available. Quality will improve along with capacity. One constraint on the development of these so-called Personal Communication Services (PCS) is spectrum availability. The FCC began auctioning radio frequencies to companies interested in providing digital PCS in 1994.<sup>24</sup>

The newest trend in portable telecommunications accessories is the Personal Digital Assistant (PDA). Though the exact form that PDAs ultimately will take is still evolving, at a minimum they combine a notepad, FAX machine,

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<sup>22</sup> The States Swing into I-Way Construction. *Business Week*, Aug. 22, 1994. p. 73.

<sup>23</sup> See: U.S. Library of Congress. Congressional Research Service. Health Care Reform and the National Information Infrastructure. CRS Report 94-770 SPR, by Stephen Gould. Washington, Sept. 21, 1994. p. 8.

<sup>24</sup> When it first came into usage, PCS referred to any telecommunications service provided directly to individuals via small, portable handsets, like cellular telephony. More recently, it has come to mean new, digital technologies for these purposes, as opposed to the existing analog versions. For more on PCS, see: U.S. Library of Congress. Congressional Research Service. Auctions of PCS Frequencies. CRS Report 94-444 SPR, by Richard Nunno. Washington, May 20, 1994.

and rolodex. PDAs already have hit the market (including one that allows the user to handwrite a note on the screen which is then translated into binary bits and faxed or stored), but with mixed success so far. One problem, for example, is that the unit that translates handwriting into binary bits takes a bit too long for most users.

As telephone and cable television services merge, so may the appliances to utilize them. Single units that act as compact disc players, television sets, FAX machines, telephones and answering machines already are being offered by some of the leading computer companies.<sup>25</sup> The time also may be near when telephone numbers will be assigned to a person rather than a place (like a home or office). MCI and Alltel Mobile Communications (in Charlotte, N.C.) and Bell Atlantic Mobile (in Pittsburgh) already are conducting one-number "anytime, anywhere" tests using cellular phones.

### **What More is Needed**

The applications described above barely scratch the surface of what many believe is the full potential of the Superhighway. Achieving it will require time, money, and a lot of work on the part of industry and government. In exploring what it will take to make the NII reality, the IITF commented that:

There is no ineluctable force pulling these advanced applications of the NII into being. Nor can the simple statement of desirable future characteristics of the NII make it so. Success in each applications arena requires the identification of intermediate goals and objectives and the successful negotiation of outcomes involving a multitude of different parties. Only conscious, willful, and well informed public decisions will result in an NII that meets America's needs.<sup>26</sup>

Major investments in technology and infrastructure will be needed to build both the NII and GII, as well as the programming, information, and services to be carried. As a portent of how much money is involved, six companies (Ameritech, Bell Atlantic, MCI, Pacific Telesis, SNET, and Time Warner) say they will spend a total of \$107 billion to "wire" America with fiber optic cables, only a small piece of the Superhighway pie.<sup>27</sup>

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<sup>25</sup> Sugawara, Sandra. Enter the "Digital Chameleons." Washington Post, Oct. 5, 1994. p. F1, 2.

<sup>26</sup> U.S. Dept. of Commerce, op. cit., p. 5.

<sup>27</sup> Keller, John J. They'll Spend Lots But Lots Less Than They Say. Wall Street Journal, May 18, 1994. p. B1, B5. Ameritech, Bell Atlantic, and Pacific Telesis are three of the seven Regional Bell Operating Companies (RBOCs, or Baby Bells) created after the court-ordered break-up of AT&T. The other four are NYNEX, BellSouth, SBC Corporation (formerly Southwestern Bell Corp.), and U S West.

Satellite systems are often viewed as the answer to enabling countries without established telecommunications systems to be part of the GII. The companies proposing LEO and other satellite systems are optimistic that connecting all the countries in the world will be a profitable endeavor despite the billions of dollars needed to create the satellite networks. In June 1994, it was announced that the Organisation for Economic Cooperation and Development (OECD) would begin work on creating an international high-speed communications network.<sup>28</sup> The G-7 countries (plus Russia) also discussed the GII at the July 1994 summit in Naples and agreed to convene a conference in February 1995 to develop plans for creating it. At an ITU-sponsored meeting in Kyoto, Japan in September 1994, developing countries complained that they were being excluded from the Superhighway and that their primary need now is just for local communications within their countries.<sup>29</sup>

Software advances undoubtedly will be needed, particularly for navigating the Superhighway. A frequent complaint about Internet is that although there is a flood of information available, finding it can be exasperating and ultimately fruitless. Software tools like MOSAIC are available, but even they have their limitations. As interactive networks become widespread, the need for efficient navigation tools will rise in importance.

But the real hurdle is getting everyone connected. More capacity is needed already. Fundamentally, it is a matter of putting the physical infrastructure in place and the investment dollars and number of years required. How fast the Superhighway develops will depend primarily on consumer demand for the services it can offer, and hence the profit potential anticipated by the companies that will build it. If killer applications materialize and drive demand up steeply, the Superhighway will be here sooner rather than later; if consumers recoil from the prospect of having to surf through 500 or more television channels to find something to watch, or really don't mind stopping by the video rental store while out running errands, this may take longer than proponents expect.

**"Killer Apps."** Superhighway promoters are looking for applications that will convincingly demonstrate why these investments are worthwhile -- called "killer applications" or simply "killer apps." Video-on-demand, discussed earlier, is an oft-cited example of a killer app. Home shopping is another. Though available today, in the interactive future, consumers would not have to pick up the telephone and call an 800-number to order merchandise, but simply "click" on the item on the screen with a pointing device (like a computer mouse) and order the item automatically. Some on-line computer services offer such home shopping already, with mixed success.

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<sup>28</sup> Mainichi Shimbun (Japan), 27 June 94. Translated and printed in Foreign Broadcast Information Service Daily Report (East Asia), 29 June 1994, p. 6-7.

<sup>29</sup> Williams, Brian. Bumps Appear on Information Highway. Reuters, Sept. 22, 1994. 07:22 AET.



Keys to the success of these killer apps will be their cost and how easy they are to utilize. Consumers who complain that they cannot program their VCRs may not be willing to invest the time and patience to learn complicated procedures, even if it means being able to watch *Casablanca* or *Terminator II* on a moment's notice. Cost will be another factor. Complaints about cable television rates caused the FCC to roll back rates twice, in late 1993 and early 1994. Today's bills may pale in comparison to what homes will have to pay to drive on the Superhighway.<sup>30</sup> Another ingredient is whether people actually want these services. Shopping is as much a social activity as a means to an end, for example, and home shopping simply may not be a satisfactory substitute to a large segment of consumers.

**Education and Public Service Applications.** Entertainment and personal services may be the killer apps that get consumers onto the Superhighway in the first place, but public service applications are equally important. Some, such as telemedicine, already have been discussed. Others include increasing the public's role in political decision-making through electronic "town hall" meetings over the Superhighway with interactive links allowing voters to participate from home as though they were present at the meeting itself.

Education is often cited as a major beneficiary of the I-way. Vice President Gore has called for all schools in America to be linked to the I-way by the year 2000. While a laudable goal, it raises many issues, chiefly the question of who will pay to connect the schools, purchase the computers and other equipment, and train school personnel on how to use it. Federal and State initiatives already have begun to bring schools into the Superhighway era. The Iowa Communications Network has 2,600 miles of fiber optic cable linking 15 regional centers, three regent universities, and Iowa Public Television. In Ohio, the Ohio Educational Computer Network is developing K-12 links, while the Ohio Academic Resources Network links colleges and universities. But these examples only serve to demonstrate how far there is to go in reaching all schools in America.

**Private Sector and Government Roles.** The private sector and the Government both have roles to play in creating the Superhighway. The private sector already has created much of the highway that exists today and has a critical role in the evolution of the NII. Reports from the Council on Competitiveness and the Information Technology Association of America (ITAA)<sup>31</sup> outline the private sector's view. ITAA, for example, delineates

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<sup>30</sup> One semi-humorous look at the costs involved in a unified telecom system put the total monthly bill for the average consumer at \$86 (Schrage, Michael. For Whom the Data Highway Tolls. Washington Post, Apr. 8, 1994. p. D3).

<sup>31</sup> (1) Council on Competitiveness. Vision for a 21st Century Information Infrastructure. Washington, May 1993. 25 p.; (2) Council on Competitiveness. Competition Policy: Unlocking the National Information Infrastructure. Washington, Dec. 1993. 31 p.; and (3) Information Technology Association of

between the Federal and private sector roles by stating that the Government should facilitate, not duplicate, industry efforts; industry should be responsible for developing, planning, designing, and implementing the NII in the marketplace; industry should be responsible for developing standards; the Government should facilitate pre-competitive technology development; the Government should adopt industry standards; and Government should create a conducive legal and regulatory environment. The Government's role in creating policy is discussed below.

Several States are moving forward in building elements of the Superhighway within their borders. They are confronting the same issues as the Federal Government as to how to stimulate the private sector to install Superhighway infrastructure. An analysis by Congressional Quarterly<sup>32</sup> contrasts the approaches of two States, North Carolina and California, as two different models of bringing the Superhighway to fruition. The North Carolina government "favors public institutions," offering itself as a major customer for the telephone companies to spur them to invest in Superhighway infrastructure. The State wants the telephone companies to establish interactive video and computer links to schools, libraries, medical facilities and other public institutions. The telephone companies will create the infrastructure and the State will pay to use it. California "favors commercial interests," focusing on reducing regulatory barriers to encourage the private sector to build the infrastructure, with consumers as the customer for services such as home shopping and video-on-demand. Under either model, eventually all users would have access to the same services, the question is which uses (public service or commercial) would be available first. This is important in terms of whether profits earned by telephone companies from State-regulated local phone service should be used to finance infrastructure that would be used for profit-making activities such as video-on-demand, or whether the phone companies and their shareholders should have to finance these for-profit ventures.

One aspect of private sector involvement is creating business relationships that take advantage of the opportunities presented by the arrival of the Superhighway era. Over the past year, many proposed and planned mergers of business and entertainment companies have made headlines, though several of the highest profile subsequently fell apart. The tempestuous nature of business mergers and acquisitions makes forecasting alliances fraught with risk, but despite the demise of deals like Bell Atlantic-TCI and CBS-QVC, many alliances

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America. National Information Infrastructure: Industry and Government Roles. Arlington, VA, July 1993. 23 p.

<sup>32</sup> Contrasting Models: Two States Blaze Trails on High-Tech Frontier. Congressional Quarterly: The Information Arena, v. 52, May 14, 1994. Supplement to No. 19. p. 19-22.

have been forged<sup>33</sup> and others are expected. Some companies are moving ahead on their own. MCI, one of the long-distance telephone companies, not only has announced plans to offer local telephone service, but also plans to provide access to Internet for consumers and businesses, including e-mail, home shopping and other electronic services. Microsoft, a leading software manufacturer, plans to enter the on-line computer network business in mid-1995, competing with companies like CompuServe, Prodigy and America On-Line, and offering an array of Microsoft services in addition to traditional on-line services such as e-mail, games, and news.

## **SOCIOLOGICAL IMPACTS**

How businesses do business, how workers work, how people use their leisure time, and how elected leaders govern are all likely to be affected by the emergence of the Superhighway. Just as automobiles changed American society, so may the new telecommunications paradigm. Telecommuting is practiced by relatively few people today, but as more homes and offices are linked by the Superhighway in the future, it may become as common as hour-long commutes are today. Resulting changes in work patterns and family routines (such as child care) could have profound effects. Some wonder whether Superhighway town meetings will change the way representative democracy is practiced, bringing the "voice of the people" directly into the decision-making process and, some would argue, reducing the need for elected representatives.

There are negative aspects of all this access to information and each other, too. One is the "Infobog," where people are so overwhelmed by information and e-mail messages that they lose their productivity.<sup>34</sup> When workers and managers spend hours a day answering hundreds of e-mail messages, productivity can be seriously impacted. The prospect of never being away from the telephone because numbers are assigned to people rather than places can be a benefit in business, but an intrusion during personal time.

Striking a balance between using these new capabilities to make life easier rather than more difficult will be as much a part of Superhighway evolution as the technology and policy that enables it.

## **ISSUES FOR CONGRESSIONAL CONSIDERATION**

Attaining the full vision of the Superhighway will be a lengthy and expensive proposition that involves many policy questions. Congress already is

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<sup>33</sup> A 5-page list of "alliances, business agreements and shared financial interests" of companies involved in the interactive television/interactive services industry was published by Digital Media in its June 23, 1994 issue.

<sup>34</sup> Tetzeli, Rick. Surviving Information Overload. Fortune, July 11, 1994. p. 60-65.

debating a number of the policies needed to bring the Superhighway to fruition; the major issues are discussed below. (For information on particular bills and their legislative status, consult the CRS issue briefs listed in the appendix.)

## **Regulation**

Creating a regulatory environment that permits the NII to evolve to its fullest potential is a key aspect of White House and congressional efforts today. Since the 1930s, Congress has enacted legislation that treats the cable, broadcast and telephone industries separately. The advent of new technologies has blurred the distinction among these services, however. With technology outstripping the regulatory environment, Congress, the Administration, communications companies, and public interest groups have been working to develop legislation to supersede the "MFJ" restrictions (the 1982 Modified Final Judgment consent decree that implements the court-ordered break-up of AT&T) and revise the Communications Act of 1934. During 1994, the House passed legislation (H.R. 3626, incorporating another bill, H.R. 3636) to eliminate regulatory barriers between cable and telephone companies (called "cable/telco cross-ownership") and remove MFJ restrictions, among other things. The Senate did not pass its bill, S. 1822, though it was reported from the Senate Commerce, Science and Transportation Committee (S. Rept 103-367). The bills would have allowed each industry to provide similar services, and end business restrictions on the Regional Bell Operating Companies (RBOCs). Many other issues were addressed, too, such as establishing goals for serving the public interest (such as linking schools and libraries to the I-way) and establishing preferential rates for public institutions, but the bills did not provide Federal funding to achieve such goals. Among the issues that stymied the legislation was concern by State and local governments that the bills shifted responsibility for and authority over cable and telephone issues from them to the Federal Government.

## **Universal Access and Open Access: Avoiding "Haves and Have-Nots"**

One principle emphasized by the White House and Congress is "universal access" -- allowing everyone access to the Superhighway at affordable rates regardless of income, disability, or location. The 1934 Communications Act has been interpreted to require telephone companies to provide a dialtone to everyone at affordable rates. The question of whether the same concept should apply to video services<sup>35</sup> and other advanced telecommunications services is a matter of considerable debate.

More broadly, emphasis is being placed on ensuring that schools, libraries, hospitals, and clinics have access to the Superhighway by the year 2000. The Government has established a matching grants program administered by the National Telecommunications and Information Administration (NTIA) to

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<sup>35</sup> For a discussion of video dialtone issues, see U.S. Library of Congress. Congressional Research Service. Telecommunications Policy Reform: The Telephone/Cable Crossownership Debate, by Angele Gilroy. CRS Issue Brief 94021. Updated regularly.

connect public institutions to advanced networks such as the Internet, but advocates strong private sector commitment to this goal. Bell Atlantic has agreed to provide access for 26,000 schools, but left unanswered is the question of who will pay for other equipment and training needed by the schools to use the Superhighway.

Making these digital resources available to all communities and ensuring that this does not become a Nation of information "haves" and "have-nots" is a major concern. Rural communities are especially worried that they will be left out, or the cost will be too high for them to take advantage of new services. Even accessing Internet can be expensive for customers who must make a long distance call to reach the nearest local access point.<sup>36</sup> Several States are leading the way in establishing information infrastructures, but Maryland is the first to offer "free" access to Internet, except for the price of a local phone call, for all residents (services such as e-mail would incur charges, however).<sup>37</sup> Start-up funding came from the Federal Government (as has funding for initiatives in other States), but the project will have to be supported from State funds beginning in 1995. Whether other States will follow suit, and whether taxpayers will be amenable to continuing support for such efforts, remains to be seen.

Another issue is "open access." Today, the issue is one of requiring local telephone companies to interconnect their networks with the facilities of competing providers on a nondiscriminatory basis. The House and Senate addressed this topic in the legislation on cable/telco cross-ownership considered in the 103d Congress (H.R. 3626 and S. 1822) both in terms of requiring local telephone companies to allow access to any telecommunications provider, and providing preferential rates to enhance access for certain types of users such as educational institutions and libraries; the legislation did not clear Congress, however.

In a much broader context, the National Research Council's Computer Science and Telecommunications Board expands the "open" concept to what it calls the "Open Data Network" -- open to users, open to service providers, open to network providers, and open to change.<sup>38</sup> Noting that the success of Internet is directly tied to its openness, the Board argues that the NII should build on that experience and calls on the Government to embrace the Open Data

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<sup>36</sup> Chandrasekaran, Rajiv. On-Line Highway A Costly Toll Road for Rural Users. Washington Post, Nov. 7, 1994. p. A1, 14.

<sup>37</sup> Powledge, Tabitha. Information Highway Without Tollbooths: Maryland is First State to offer Free Access to Internode. Washington Post, June 23, 1994. p. A 1, 11.

<sup>38</sup> U.S. National Academy of Sciences. National Research Council. Computer Science and Telecommunications Board. Realizing the Information Future. Washington, National Academy Press, 1994. 285 p.

Network architecture as the technical framework for designing and deploying the NII.

### **Standards**

Setting technical standards for telecommunications systems to ensure that all the pieces can work together, and that U.S. products can compete globally, is another important issue. Typically the private sector sets such standards itself, not the Government. For example, standards for Internet were set by the Internet Standards Group, a voluntary effort run by the Internet Society.

In July 1994, 1,300 companies, including AT&T, IBM, and Eastman Kodak, formed the Information Infrastructure Standards Panel to review work underway on NII standards by professional societies and trade organizations that belong to the American National Standards Institute. Many see the Government's role as facilitating coordination among standards organizations, industry, and the Government so that voluntary standards can be utilized efficiently, and to ensure U.S. representation on regional and global standards-setting groups to ensure that foreign standards are not used to exclude U.S.-made products from global markets.

### **Privacy and Security**

Ensuring that confidential information (such as medical records or business data) traversing the Superhighway remains confidential, and that data on the viewing habits or buying practices of subscribers are not misused are clearly of tremendous importance to network users. The ability to link hospitals, banks, insurance companies and government agencies can provide great benefits, but also creates the technical capability for unprecedented intrusions into personal and corporate lives.

Ensuring the security of the system from unauthorized use is also a significant concern,<sup>39</sup> especially when coupled with the need to provide for the legitimate requirements of law enforcement officials to be able to detect criminal activity on the network versus privacy concerns of users. The U.S. Government wants to equip many of its telephones with a special computer chip designed by the National Security Agency, called the "Clipper chip."<sup>40</sup> The Clipper chip would enable law enforcement agencies to decode any communications over these lines. The Administration insists that the requirement to use two simultaneous keys, held by different Government agencies, would prevent abuse of this capability, but the computer industry and privacy advocates argue strongly against it. In August 1994, the White House signaled flexibility on this issue in a letter to Representative Maria Cantwell (D-Wash), though

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<sup>39</sup> Wallich, Paul. Wire Pirates. Scientific American, Mar. 1994. p. 90-105.

<sup>40</sup> See: U.S. Library of Congress. Congressional Research Service. The Clipper Chip Encryption System. CRS Report 94-298 SPR, by Stephen Gould. Washington, Apr. 6, 1994. 6 p.

interpretations of the letter vary. The Government's goal, to assure that criminals cannot use the Superhighway to their advantage, remains; the problem is how to accomplish it without trampling on individual rights or stifling commercial interests. "Digital wiretap" legislation requiring carriers to engineer networks so they are wiretap-ready and setting rules and privacy guidelines for the electronic surveillance of networks by law enforcement agencies was passed by Congress in October 1994 (P.L. 103-414).

### **Intellectual Property Rights**

Protecting intellectual property rights will be a challenge in an age of easily accessible digitized information. Calls for strengthening copyright laws and ensuring that the technical architecture of the Superhighway protects copyright owners and provides for their remuneration already have been heard. Libraries, scholars, and the public also have voiced concern that some form of "fair use" be established for digital materials. For video-on-demand, for example, residuals may have to be paid to those involved in the original making of the films. But as individual users and corporate lawyers are discovering, this is a murky legal area. Writers or actors who have assigned publishing or movie rights, may -- or may not -- have also assigned multimedia rights. Importing a scene from a television program or part of the score to a movie into a multimedia presentation for a business conference may be a violation of copyright laws, or may be a permissible "fair use."<sup>41</sup> The IITF Working Group on Intellectual Property Rights released a preliminary report concluding that only minor changes to the copyright laws are needed in July 1994,<sup>42</sup> but that conclusion is controversial. Public comments have been solicited, and a final report is scheduled to be released in January 1995.

### **Federal Role in Applications and Research and Development**

The private sector, rather than Government, undoubtedly will spearhead most applications of the Superhighway, though the Government has a role in developing and supporting public service applications, such as those for schools and libraries, as well as research and development on information technologies generally.

The High Performance Computing Act of 1991 (P.L. 102-194) established the High Performance Computing and Communications (HPCC) program "to extend U.S. leadership in high performance computing and communications, disseminate the technology to speed innovation, and promote its use in

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<sup>41</sup> See, for example: Osteen, Kathleen. Rights Face Fuzzy Future. *Variety*, Mar. 28-Apr. 3, 1994. p. 1, 83; and Steinberg, Don. Hey! We're Being Sued for Copyright Infringement. *Infoworld*, Mar. 14, 1994. p. 54.

<sup>42</sup> NII Panel Recommends Minor Changes in Copyright Laws. *Communications Daily*, July 7, 1994. p. 4.

industry."<sup>43</sup> The original 5-year budget plan allocated \$4.67 billion through FY 1996 to seven Federal agencies. (The program does not have its own budget, but rather projects are supported through programs in the various agencies). The 103d Congress debated legislation (H.R. 1757 and H.R. 820) to amend the Act to stimulate Government development (or joint Government-private sector development) of applications of high-performance computing and networking technologies and reallocate some of the funding for supporting applications. Neither bill cleared Congress, however. The issue of how much Federal funding should be spent on the HPCC initiative is expected to be controversial in the 104th Congress since the "Contract with America" would reduce spending for the HPCC by \$1.23 billion over 5 years.

Regarding public service applications of the I-way, one question that remains to be answered is who will pay to digitize the vast collections of text, photographs and other media that are not currently in digital form so that they are, in fact, accessible over the Superhighway.<sup>44</sup> As already noted, who will pay for the equipment and training needed by schools is another unanswered question.

## CONCLUSION

It will be many years before the Information Superhighway exists in its broadest definition, but many of the building blocks are here already. While attention in Congress is focussed today primarily on regulatory issues, once those are resolved others, such as intellectual property rights, may become more visible. As the years pass and the Superhighway reaches maturity, consumers, government institutions, and businesses will shape, and be shaped by, this new information revolution.

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<sup>43</sup> U.S. Library of Congress. Congressional Research Service. The National Information Infrastructure: The Federal Role, by Virginia Huth and Stephen Gould. CRS Issue Brief 93101. Washington, Oct. 14, 1994. p. 3.

<sup>44</sup> For a discussion of the public policy issues involved in making digital information available, see: U.S. Library of Congress. Delivering Electronic Information in a Knowledge-Based Democracy. Summary of Conference Proceedings, July 14, 1993. Washington, 1993. 17 p.





## RELATED CRS PRODUCTS

### Info Packs

Cable TV. IP104C. Contains general articles plus the items below preceded by ★.

The Information Superhighway and the Internet. IP 490I. Contains general articles plus the items below preceded by ◆.

Telephone Industry Issues. IP 257T. Contains general articles plus the items below preceded by †.

### Issue Briefs

† Gilroy, Angele. Telecommunications Policy Reform: Modification of the 1982 AT&T Consent Decree. CRS Issue Brief IB94034 (Updated Regularly)

★† Gilroy, Angele. Telecommunications Policy Reform: The Telephone Cable/Crossownership Debate. CRS Issue Brief IB94021 (Updated Regularly)

◆ Huth, Virginia and Stephen Gould. The National Information Infrastructure: The Federal Role. CRS Issue Brief IB93101. Updated Regularly.

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### Reports

Gilroy, Angele. The American Telephone and Telegraph Company Divestiture: Background, Provisions, and Restructuring. CRS Report 94-510 E. Updated June 20, 1994. 32 p.

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◆ Riehl, James R. The Information Superhighway: An Annotated Glossary. CRS Report 94-468 C. June 2, 1994. 6 p.

◆ Tehan, Rita. Welcome to Cyberia: An Internet Guide. CRS Report 94-471 C. May 12, 1994. 9 p.

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★ in Info Pack 104C; ◆ In Info Pack 490I; † In Info Pack 257T