- Provide assistance, if possible, with installation, software, and training; and work with community organizations to help determine what systems are needed and ensure that donated equipment is used effectively.

Educators

Educators—especially principals and teachers—have perhaps the most important role of all stakeholders. Because they are often the most visible personae when students, parents, administrators, and members of the community are introduced to the Information Superhighway and make their assessment of its importance and power, these stakeholders are critical to the national connectivity goal. The role of educators is, therefore, to:

- Speak to, educate, and lobby legislative bodies on the need for school connectivity;
- Harness information technologies to empower students to be lifelong learners and problemsolvers;
- Help all preschool and school-age children to learn to use the new technologies, especially children whose families cannot afford the technologies at home;
- Build partnerships with the private sector, libraries and other cultural institutions, government agencies, and the community to provide true lifelong learning;
- Develop access and acceptable use policies;
- Encourage and assist students to create content that can be shared over the networks;
- Enhance technology training in professional education programs;
- Prepare students to enter the emerging networked environment as seekers of employment and cultural enrichment; and
- Develop guidelines and educational programs that address the issues of intellectual property, privacy, and security.

Librarians and Other Cultural Heritage Professionals

Many adults will enter the Information Superhighway for the first time using computers at public libraries and other facilities within their communities. Thus, as stakeholders librarians and other cultural heritage professionals have an important role in creating environments where Americans who have completed their formal education learn firsthand about technologies that they might fear, but that their children are beginning to take for granted. These stakeholders can further connectivity to the Information Superhighway if they:

- Work with community groups to create, host, and provide public access to electronic community information;
- Become a "local evangelizer" on the importance of connectivity;
- Use qualified volunteers for training;

- Develop the skills and training needed to employ technology to traditional tasks such as organizing, searching for, and retrieving information;
- Speak to, educate, and lobby legislative bodies on the need for library/museum/archives connectivity;
- Develop access and acceptable use policies;
- Develop programs to prepare patrons with the information literacy skills they will need to effectively find and use information (navigation, quality filtering, etc.);
- Develop electronic resource subject area expertise to complement existing print subject area expertise;
- Build partnerships with the private sector, educational institutions, government agencies, and the community to provide true lifelong learning; and
- Develop guidelines and educational programs that address the issues of intellectual property, privacy, and security.

"Parents who are professionals in the area of technology, like myself, who work with state-of-the-art technology day in and day out, are a valuable source of untapped information. USE US PLEASE!" —*Roger C. Wildersten, parent and director, Castro Valley Educational Foundation, Castro Valley, California*

Parents

Parents are critical members of the educational team, together with their children and with principals and teachers. Parents help when they:

- Support elected officials and school boards in developing and implementing policies supporting connectivity of schools;
- Encourage their children to learn about use of communications technology hardware and software in order to take advantage of learning and career opportunities;
- Join parent-teacher and other organizations that generate an environment of support for the Information Superhighway;
- Share technical expertise with teachers and staff;
- Help write strategic plans for technology; and
- Raise funds, especially with private partnerships.

Foundations

Foundations have played critical roles in some of the most important medical, public policy, and technological developments in this century. Moreover, private, community, and corporate foundations and corporate giving programs are key funders for many innovative programs to improve education and educational opportunities throughout the country. As in so many areas, foundations have, and are continuing to have, sometimes critical roles in the implementation of the Information Superhighway. Foundations help when they:

- Act as convenors of community stakeholders to consider the KickStart Initiative;
- Provide startup seed money in the form of connectivity grants;

- Shift from a "bricks and mortar" orientation to committing resources to connectivity projects that have less tangible outputs;
- Insist that grant applications include a connectivity requirement, and give priority to good, cooperative projects;
- Fund projects that propose creative applications of new information technologies;
- Enter into collaborations with existing projects to determine where their resources can be appropriately deployed within the community; and
- Collaborate with other foundations and other private and public sector partners to pool and package resources for connectivity projects.

The Public

Hundreds of thousands of Americans plug in to the Information Superhighway every day. They serve others in their community, while furthering the national goal of connectivity, when they:

- Volunteer technology and training skills to community connectivity projects;
- Become local evangelists;
- Work with schools, libraries, and community centers; and
- Influence local leaders.

Other Local Community Groups and Users

Individuals and organizations that represent special interest, special needs, and other sectors of the population—such as the elderly—know best the kinds of information their audience needs and can benefit from. They help their constituents when they:

- Contribute funding, technology, and human resources to local connectivity projects; and
- Create and make institutional and organizational content available to community networks.

STAKEHOLDER SYNERGY: LESSONS LEARNED

Part of the excitement surrounding the Information Superhighway stems from reports about highly successful cooperative ventures—local successes that were achieved because individual stakeholders chose to involve the whole community.

A commitment to cooperation, hard work, patience, and informed strategies is the best route for entering the networked Information Age—an era that is characterized by user-driven, interactive, and multimedia applications, and information resources that can be accessed remotely across a distributed environment.

An essential lesson from every success story is that an average citizen, with a dedication to making the Information Superhighway a reality in his or her community, can succeed. Visible results accrue in localities that are able to combine the talents and resources of local stakeholders creatively and realistically.

Among the most salient lessons learned from stakeholder ventures are:

- Don't wait for a "better" time—the time to act is now.
- Start small now. It is better than waiting for more resources. Great things can be accomplished with limited resources, and, to coin a phrase, success breeds success. Institute a pilot project rather than attempting to solve every contingency before starting.
- Embrace the notion of collaborative efforts with other community stakeholders. Don't feel that you have to go it alone.
- Pool and share resources and expertise to overcome knowledge and resource gaps.
- Educate other potential stakeholders in the community on the benefits they can reap.
- Develop a common vision with other stakeholders.
- Disseminate announcements calling for project volunteers—communitywide.
- Retain a "sense of adventure" about connectivity projects and tie in employee reward systems to desired outcomes.
- Create and provide in-house content to community projects.
- Recognize that frank and honest discussions and a willingness to compromise and listen to other stakeholders' points of view are essential.
- Recognize that because of the new networked environment, institutions and organizations will need to change if they are to remain relevant to the local community, and that part of that change will necessitate broad, intelligent use of information technology.
- Develop training programs, technical assistance capabilities, and maintenance programs. All are key components of a successful project.
- Institutionalize the mechanisms for sustaining projects independently.

part 2
Identifying Costs and Sources of Funding

The curriculum adviser rallied administrators, teachers, students, and parents to support reallocation of funds for connecting a Portsmouth, Rhode Island, public middle school to the Information Superhighway. Then the coalition obtained additional funds from local businesses, received free equipment from a high-technology firm, bought used equipment at salvage prices in a sale of U.S. Navy surplus materials, and completed connectivity.

"We search. We search for resources. We never give up, and we make things happen in spite of the challenges."—*Kathy Popp, technology coordinator, Chestnut Ridge School District, Fishertown, Pennsylvania*

In Fishertown, Pennsylvania (a small rural community), public school teachers used a GTE Pioneering Partner Award for free Internet access time to instruct their students.

The private Dalton School, New York City, with more than 250 computers and much more equipment, has received grants from foundations, business, and the Federal Government to expand curriculum and teaching methods using high technology. The school is sharing the results at no charge with public school systems around the country.

These examples bear on two basic questions that community leaders will ask: How much will connecting to the Information Superhighway cost and where will the money come from?

Funding sources must be identified for purchasing and installing equipment, training teachers and other instructors, and operating the network.

One of the more important findings of the Council is that the budgetary increases required to connect all schools, libraries, and community centers to the Information Superhighway are not as high as most people think and, in many instances, can be achieved with some careful reexamination of existing budgetary paradigms. This is not to suggest that the cost will be insignificant or that such an ambitious goal will be easy to achieve. Rather, what it says is that the goal is attainable, and is a reality already in a number of communities throughout the United States. Besides, the costs should be viewed as a community investment that will bring many short- and long-term benefits to everyone.

In a study conducted for the Council, McKinsey & Company* found that connecting every K-12 school computer laboratory to the Superhighway by the year 2000 would require between 1 and 2 percent of the projected K-12 education budget. Connecting every classroom by the year 2005 (with a ratio of five

*The models and cost estimates presented here for K-12 schools are derived from the study McKinsey & Company, Inc., conducted for the Council. Please refer to their publication, *Connecting K-12 Schools to the Information Superhighway, 1995*, for a more detailed discussion of this information.

students per computer) would require between 4 and 5 percent of the total K-12 education budget. By comparison, about 1.3 percent of public K-12 spending is now devoted to technology.

In every community, the costs for infrastructure development—whether for schools, libraries, government offices, health care, museums, community centers, or the like—will vary depending on the technology selected and benefits desired. The number of possible approaches to infrastructure deployment is infinite. For instance, deploying technology in every classroom in a school district would likely provide strong educational benefits but would be far more costly than deployment at the computer lab level, which would be easier to fund but perhaps less beneficial for students.

SCHOOLS

With assistance from McKinsey & Company, Inc., and based on information provided by numerous educational institutions and bodies, government officials, and private industry participants, the *key insights* about deployment costs for K-12 schools are as follows:

- **Costs for Hardware.** The purchase and installation of hardware constitutes the largest upfront cost. Approximately 55 percent of this cost is for computer hardware and software; and 25 percent is for printers, scanners, security, and furniture stations.

  Twenty percent of the costs for hardware are for retrofitting—electrical and heating, venting, and air conditioning (HVAC) upgrades. This cost could be much lower or higher as a percentage of the total for an individual school, depending on its current infrastructure and the age and condition of its facility. Alternative technologies (wireless local area network, for example) should also be considered, especially in cases where retrofitting costs are prohibitive because of the state of the facilities.

- **Costs for Teacher Training.** Teacher training and support constitute the largest ongoing cost during the 5- to 10-year period of deployment. This training would include formal programs, on-the-job support from curriculum specialists, and use of the technology on the teacher's own time (although this latter category is not included in the total). The overall cost should decline over time as teachers enter the system with higher levels of skill and as existing teachers gain more experience with the technology. For the near term, however, it is essential that resources be devoted to this category.

- **Costs for Connection.** The cost of connection per se is a relatively small portion of overall expenditures. Connecting to a school that is installing a computer laboratory is only 8 percent for initial deployment and 15 percent for ongoing costs; connecting within the framework of deployment throughout classrooms is only 4 percent for initial deployment and 7 percent for ongoing costs. Over time, however, increased levels of usage could drive up the relative cost of connection. Depending on the amount of upfront costs, the usage charges thereafter, and the potential

need to upgrade for higher capacity at a later date, schools should consider installing connections that have greater capacity (for supporting multiple users and carrying large amounts of data) than they need today or even project they will need in a few years.

A complete analysis of the costs of the Information Superhighway must take into account ongoing maintenance and support costs as well as initial purchase and installation costs; the costs of the human elements of infrastructure deployment, especially teacher training; the value of the existing technology infrastructure (e.g., the number, status, and distribution of computers already in the public schools); and the hardware necessary to make the networks fully functional (such as file servers or printers). The costs should also include the costs for hardware and software that may be required to adapt to the needs of users with disabilities. Incorporating those needs into the planning stage is typically less expensive than retrofitting. In addition, the analysis should amortize hardware costs over time and include factors in future cost curves that affect technology installation and upgrades.

The costing models presented here are a starting point. These models focus on an array of computer networking technologies found in an ever-increasing spectrum of information and communication technologies. Although these models are useful for understanding costs of selected computer-based infrastructures, they represent only a few of the many options available to schools, libraries, and community centers. For example, these models may offer direction for addressing broader information infrastructure goals requiring greater flexibility and interactivity through integrated video, voice and data applications, and integrated platforms—computer multimedia networks, wide-bandwidth connections (digital wire or fiber), television, VCR recorder/player, wireless transmitter/receiver, digital satellite transceiver, etc.

Individual schools and districts might choose alternative options and make other tradeoffs between costs and potential benefits. For example, purchasing lower cost computers could have a substantial impact on initial deployment costs, but computer capabilities will dictate the range of applications students and teachers can use. Reductions in teacher training could substantially reduce the largest source of ongoing costs during the deployment timeframe, and yet teacher training is one of the most essential elements to ensuring effective implementation. Finally, tradeoffs can be made with respect to exploiting current technology versus experimenting with or waiting for more advanced technology.

The models for technology deployment were selected based primarily on fundamental economic breakpoints between different options—costs rise significantly at certain decision points, such as deciding between connecting at the lab level versus the classroom level.

The major cost drivers and the economic breakpoints between different deployment options depend on the levels of infrastructure, timing, and cost. The models take currently existing infrastructure into account. Although the Council knows that deployment will take place at varying speeds in different schools and districts, it has made the simplifying assumption here that each model is imple-

mented evenly over either a 5- or 10-year period (i.e., by 2000 or 2005). In each case, costs are evaluated in detail across six infrastructure elements:

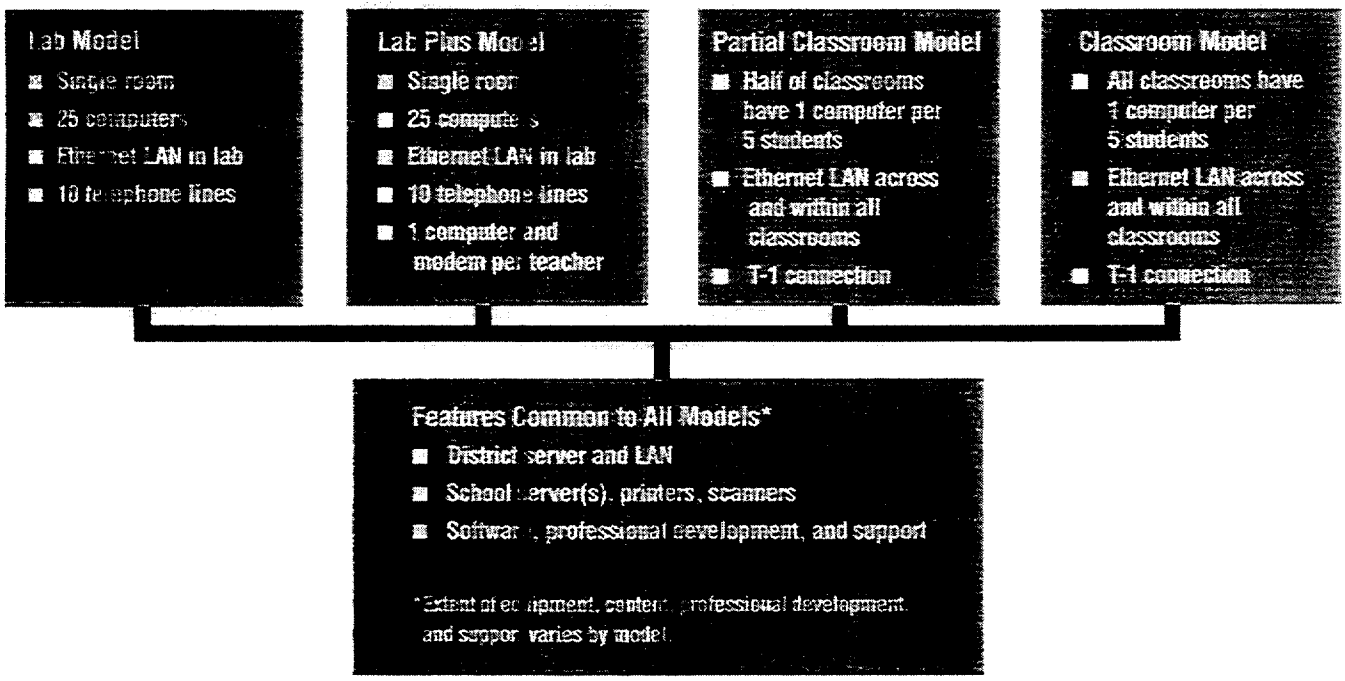
1. The external connection—the wide area networks that will connect schools to each other and to the Information Superhighway;
2. The internal connection—local area networks that link computers within the given school;
3. The computer, video, and related hardware (including the file servers, printers, scanners, and other equipment needed for full functioning of the technology);
4. Software and online service subscription charges;
5. Teacher training; and
6. Ongoing operational support.

Although it is difficult to assess the actual distribution of costs around the average, the major sources of variation have been identified. Assumptions have also been made concerning required technology upgrades and cost reductions over time. Finally, both the onetime purchase and installation costs as well as the ongoing operations and maintenance costs have been quantified.

Given this approach, the models are defined as follows:

- **Lab Model.** The basic "Lab" model envisions connectivity at the lab (or multimedia room) level for each school. It includes 25 networked computers with 10 analog telephone lines per school (although 5 ISDN lines can easily substitute, and double the performance capability at little extra cost, depending on the tariff structures of the particular State). This option gives scheduled access only to teachers and students—for example, a given class of students might be able to use the lab for an hour a day. This intermittent usage requires a higher level of commitment by all involved parties to ensure an effective level of integration into the curriculum. This type of setup may be most appropriate for schools that are just beginning to experiment with technology and connectivity or where building basic computer and networking skills is the main focus.
- **Lab Plus Model.** In addition to all the technology assumed by the basic "Lab" model, the intermediate "Lab Plus" model adds one networked computer for each teacher (i.e., a LAN connects all classrooms). The rationale is to give teachers adequate exposure and access to the technology to expedite teacher skill building, providing them with the opportunity to master and adapt the technology to their specific teaching needs. Ideally, this model might also facilitate migration from access in the lab to access in the classrooms over time.
- **Partial Classroom Model.** The "Partial Classroom" model assumes that only half of each school's classrooms are connected with networked computers. The ratio is the same as with the "Classroom" model—five students per computer with a T-1 (1.5 Mbps) connection (or a substitute if T-1 is not available). The model is designed to illustrate a less costly

Figure 1. Features of Models for a Computer-based Infrastructure



Source: McKinsey & Company.

variant—and possible step on the path—to the classroom model. It also presupposes that some classes or teachers are more logical starting points for deployment than others. For example, a school may choose to begin deployment in specific-subject classrooms or with teachers who appear particularly open to experimentation and change.

- **Classroom Model.** The "Classroom" model connects every classroom of every public K-12 school to the Information Superhighway. Classrooms are connected with networked computers at a ratio of five students per computer with a T-1 long-distance, point-to-point communications channel that transmits data, video, and voice at 1.5 Mbps (or a substitute if T-1 is not available). In this setup, students can work in groups of three to five around a computer and have convenient and relatively quick access to a broad range of potential courseware, online services, and video-based materials. By placing the computers directly in the classroom, the technology can be more closely integrated with the curriculum. Teachers will be able to incorporate computers and connectivity in teaching the full range of subjects throughout the course of the classroom day, and students will have regular, almost constant access to the technology.

Features of these models are summarized in Figure 1.

All models include the local area networks, file servers, printers, and other equipment necessary for full functioning of the technology, as well as needed upgrades over time. The models also include appropriate levels of courseware, teacher training, and technical support.

Although a "Desktop" model, which puts a networked computer on every student's desk, was also considered, this model involved substantially greater expenditures. It entailed more than 2-1/2 times the cost of the "Classroom" model in the final year of deployment even when deployed over a longer timeframe, and more than 3-1/2 times the cost of the classroom model for initial installation costs. For this reason, the desktop model is not examined in depth, although that model might be desirable from an educational standpoint for certain schools or at some future date.

Costs for dedicated video (i.e., video screen and camera) and dedicated voice (i.e., telephones and voicemail) were calculated separately. Although the technologies may converge in the future, these computer, video, and voice platforms are discussed as separate technologies here. Many computers are currently capable of full-motion video and should be able to handle voice transmission before long.

Summary of Costs for Each Model

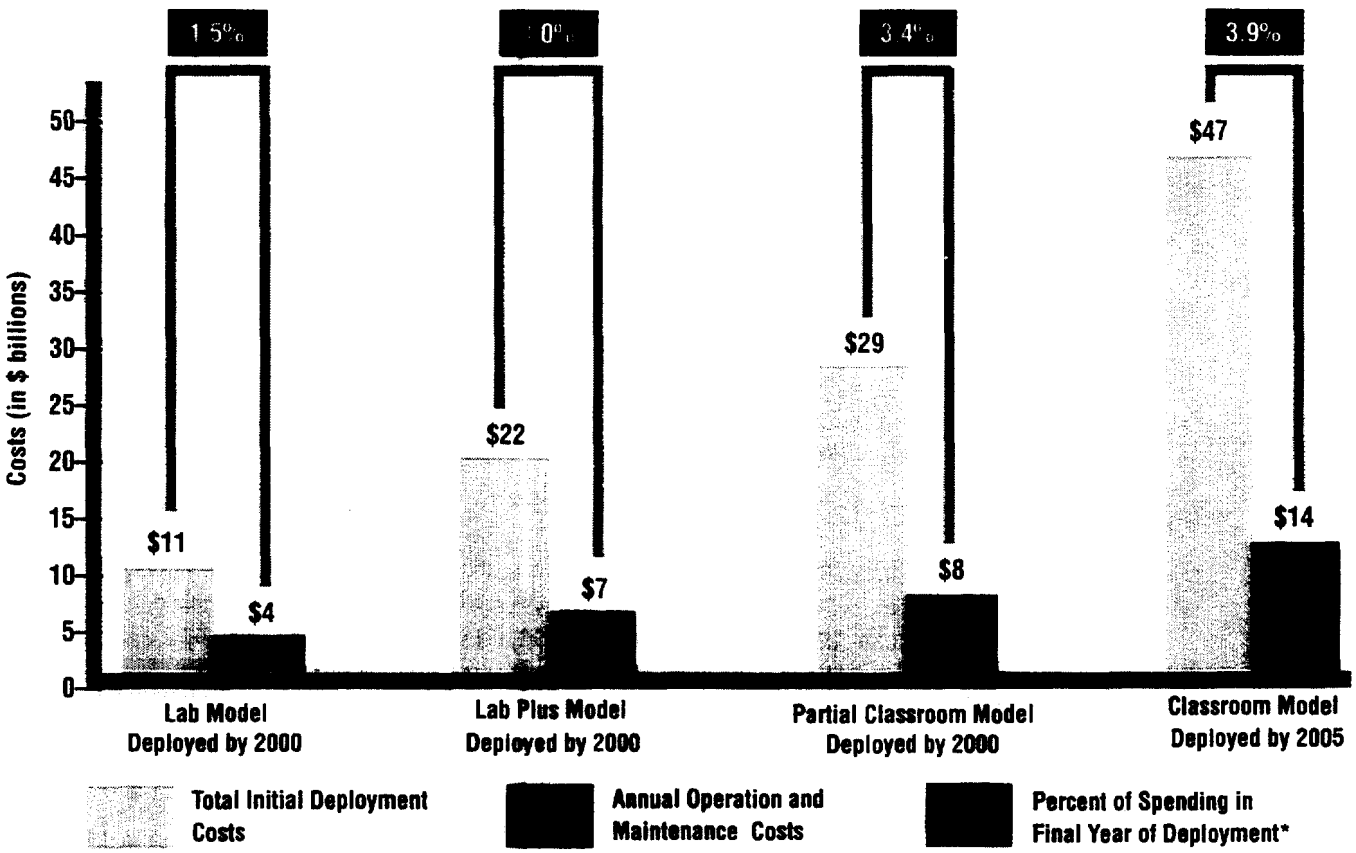
To implement the "Classroom" model across the Nation by the year 2005, onetime purchase and installation expenditures would total approximately $47 billion or $965 per student, while ongoing operations and maintenance expenditures would be about $14 billion per year over the 10-year deployment period or $275 per student. In the "Partial Classroom" model, onetime purchase and installation expenditures total approximately $29 billion over the course of a 5-year deployment or $610 per student. Ongoing operations and maintenance expenditures would be about $8 billion per year or $155 per student. In the "Lab Plus" model, onetime purchase and installation expenditures total approximately $22 billion over the course of a 5-year deployment or $460 per student. Ongoing operations and maintenance expenditures would be about $7 billion per year or $150 per student. In the "Lab" model, onetime purchase and installation expenditures total approximately $11 billion over the course of a 5-year deployment or $225 per student. Ongoing operations and maintenance expenditures would be about $4 billion per year or $80 per student.

Again, as a reference point, current expenditures on equivalent technology are running at about 1.3 percent of the education budget. Figures 2 and 3 break down deployment costs by model and component costs.

PUBLIC LIBRARIES

As with schools, public libraries have a range of options for deploying infrastructure. Libraries have fundamental choices to make both about the level of functionality (what services to provide) and the choice of technology (how to provide services most efficiently). In addition, as with schools, libraries need to plan for the soft infrastructure (training, content—including subscriptions and site licenses to access content—and system operation/support) just as much as the hard infrastructure (external connection, a LAN, computers, and related equipment).

Figure 2. Estimated Cost of Deploying and Operating Infrastructure in Public K-12 Schools with the Four Models



*Reflects the Department of Education's forecast of an average increase in the education budget of 5.6 percent per year (including inflation) through the year 2005.

Source: McKinsey & Company.

Figure 3. Cost Components for Deploying, Operating, and Maintaining Classroom and Lab Models in Public K-12 Schools

	Initial Deployment Costs		Annual Operation and Maintenance Costs	
	Classroom Model	**Lab Model**	**Classroom Model**	**Lab Model**
Hardware	51%	34%	14%	17%
Professional Development	14	19	41	31
Content	14	20	21	26
Connection within School	13	12	4	5
Connection to School	4	7	7	15
Systems Operation	4	8	13	6
	100%	100%	100%	100%
Total Cost (in $ billions)	$47	$11	$14	$4

Source: McKinsey & Company.

Figure 4. Cost Components for Deploying, Operating, and Maintaining Online Services in Libraries

	Initial Deployment Costs	Ongoing Costs
Application Hardware	24%	12%
Application Software	8	3
Training and Support	27	32
Content/Resource Development	—	23
Connection within Library	17	3
Connection to Library	4	9
System Integration and Support	20	18
	100%	100%
Total Cost (in $ billions)	$1.6	$1.3

Source: NIIAC Analysis, Department of Commerce.

Public libraries should be connected to the Information Superhighway by the year 2000. The Council estimates that the initial deployment costs to connect public libraries to the Information Superhighway should be about $1.6 billion, and that ongoing costs will be more than $1.3 billion per year.

The cost model, as shown in Figure 4, is intended to serve only as a starting point for determining the cost of connecting all public libraries in the United States to the Information Superhighway. Existing raw data for determining levels of technology in public libraries is nowhere near as robust as the data available for public schools. Additional research is required for a more accurate estimation of costs.

The Council realizes that public libraries face access and service provision problems that differ from those faced by schools. Bandwidth capacity and other connectivity issues can result in substantial differences in the costs of connecting urban and rural libraries to the Information Superhighway.

Another factor to consider is that public libraries have already made some progress toward providing Internet and other Information Superhighway-related services to the public. *The New York Times*, citing library sources estimated that 9 percent of America's libraries offer Internet access. A much higher proportion offered other electronic services, such as CD-ROMs, online public access catalogs, commercial databases, and electronic texts. Public libraries in several rural regions throughout the United States do have sophisticated broadband networks available to them. Iowa, Nebraska, North Carolina, and other "rural" States have deployed high-capacity, broadband networks that can supply rural subscribers with access to a wide variety of broadband services. Therefore, the overall costs presented in the model may be overestimated, because, to a certain extent, the infrastructure needed to connect public libraries to the Information Superhighway is already being deployed, and to a greater extent than it has been among public schools.

Furthermore, using the lab model to determine costs may be overkill— some public libraries may not need that capacity to satisfy patron demand. A simpler model, say 10 computers with 4 simultaneous users, for example, may be more applicable in determining costs for public libraries where the service area is relatively small. Applying such a model would reduce the overall cost presented in the cost model.

As with schools, the connection charges faced by libraries will differ significantly. The Council's model has attempted to compensate for this difference by dividing public libraries into two segments: libraries with a service-area population of 25,000 or more; and libraries with a service-area population of less than 25,000. Libraries serving a population of more than 25,000 are assumed to have access to T-1 lines (1.5 Mbps), while 60 percent of libraries serving a population of less than 25,000 are assumed to have access to ISDN lines (56 to 128 Kbps) and 40 percent are assumed to have plain old telephone service (POTS—14.4 to 34 Kbps). The model does not take into consideration the bandwidth capabilities of States such as Iowa, Nebraska, or North Carolina, for example, which may be considered rural but have very sophisticated broadband networks in place throughout the State.

Additionally, although software applications for public schools can be relatively uniform across the Nation, the same cannot be said for public libraries. Because customer demand for certain applications varies from library to library, a uniform average for the ongoing costs of software applications could not be developed for this model. The Council used an average ongoing cost of $2,000 per library for the purpose of the cost model, however, the ongoing costs of software applications for public libraries will vary significantly from region to region, depending on what applications patrons demand from their local public libraries.

In addition to information taken from the McKinsey lab model, the Council also employed information from a report issued by the U.S. National Commission on Libraries and Information Science (NCLIS) on the costs of providing Internet access in public libraries to develop its projections of library costs. Although the NCLIS work addressed the costs of Internet provision only, it illustrated the order-of-magnitude costs libraries might expect to incur in providing Information Superhighway access. The study also provided examples of cost considerations public libraries must take into account as they connect to the Information Superhighway.

Categories of Costs for Connecting Libraries

Initial Deployment Costs. The onetime cost for supplying a given number of public libraries with the necessary hardware and software to operate and maintain a lab model (i.e., 25 networked computers with 10 simultaneous users).

Ongoing Operation/Maintenance. The annual costs necessary to maintain a lab model for a given number of public libraries. These costs are primarily for service charges, user and maintenance fees, etc., which must be paid to maintain the network.

Connect to Library. The cost of connecting the public library to the existing communications infrastructure via POTS, ISDN, or T-1 lines. The figure includes the cost of necessary customer premises equipment (CPE) and usage fees (where applicable).

Connect within Library. The cost of networking the computers within a particular public library. The figure includes installation, purchase, retrofitting, and replacement costs for the LAN.

Application Hardware. The cost of computer equipment, including terminals, printers, and scanners.

Application Software. The cost of necessary software needed to gain access to the Internet and other electronic services (e.g., online public access (OPAC) Gateway, commercial Internet navigation software). Average ongoing cost of $2,000 per library assumed.

Content/Resource Development. The cost of software and online services necessary for a public library to be both a consumer and producer of information over the Information Superhighway. In this case, the cost model includes the cost of two services: *Bowker's Books in Print* and *Carl UnCover*. The *Carl UnCover* estimate includes $5,000 for standard access via the Internet and 500 articles downloaded at a cost of $6.50 each. There may be additional software and service required by individual public libraries, each adding an additional cost to this category.

Training and Support. The costs of staff training, public training, and Internet training positions and document development necessary for a public library to support active connection to the Information Superhighway.

System Integration and Support. Consulting costs and the cost of keeping one-half to one trained professional on staff to maintain support of the lab model.

COMMUNITY CENTERS

Community centers represent an excellent supplement to schools and public libraries in terms of meeting the lifelong learning needs of a community and providing public access to the Information Superhighway. Connecting community centers to the Superhighway may also serve to fill in the gaps left by schools and public libraries. Connecting community centers can fulfill the access needs of the nonschool population of a community; can extend the hours that access to the Information Superhighway is available to the community; can bring the community closer together; and can create a point of access for special interest groups within a community—e.g., senior citizens, veterans, Native Americans, etc.—who might not otherwise access the Superhighway.

The Council has defined a community center as a physical location where community members go to meet others, learn, play, or access information resources. This definition encompasses a broad range of locations, such as: centers for "at-risk" populations—e.g., public housing projects or Boys/Girls

clubs; cultural or religious centers—e.g., churches or ethnic centers; public institutions—e.g., municipal recreation departments or post offices; and government offices—e.g., city or town halls. Even privately owned shopping malls, banks, museums, and grocery stores can be regarded as centers where communities meet and, in fact, have been targeted as test sites for several community networking efforts. In addition, electronic community centers have been established in the form of online community bulletin boards, chatlines for selected communities-of-interest—e.g., LatinoNet, SeniorNet, Alzheimer's Disease Network, and World Wide Web pages. In the broadest sense, a community could seek to be "wired" by connecting a range of physical community centers as well as creating electronic communities that connect individuals or groups to each other and to community resources.

Given the diversity of locations for community centers, the Council has used "surrogates" to estimate the number of community center locations across the Nation. As a short-term goal, each of the 11,097 "places" (communities with a population of 2,500 or more as defined by the U.S. Bureau of the Census) throughout the United States should have at least one connected "community center" by the year 2000. As a long-term goal, the Council has expanded the number of community centers connected to the Information Superhighway to about 40,000 locations throughout the United States by the year 2005 (the number 40,000 was chosen because it approximates the number of neighborhoods represented by the current number of 39,372 post offices throughout the Nation). The number of Census-designated places and post offices cited above is used as a scale of magnitude. The Council recognizes the need for more than one community center access point in larger population areas for the community to be effectively connected to the Information Superhighway.

Defining the role the community center should play helps define and limit the number of appropriate locations. If the goal is to provide convenient, affordable access to the Information Superhighway for the general populace of a particular community, centers to consider include: libraries where people currently access printed resources; city or town halls that serve as gathering spots or data repositories; post offices, which have historically handled correspondence; and even shopping malls that teenagers frequent. Other roles could include: providing targeted, programmed learning and access to the Superhighway for at-risk groups—e.g., high school dropouts, the homeless, underprivileged children, and ex-offenders; serving as a substitute for K-12 school or public library access for selected communities—e.g., certain Native American communities; making community resources available in electronic form; and providing afterhours access to the Information Superhighway for K-12 students.

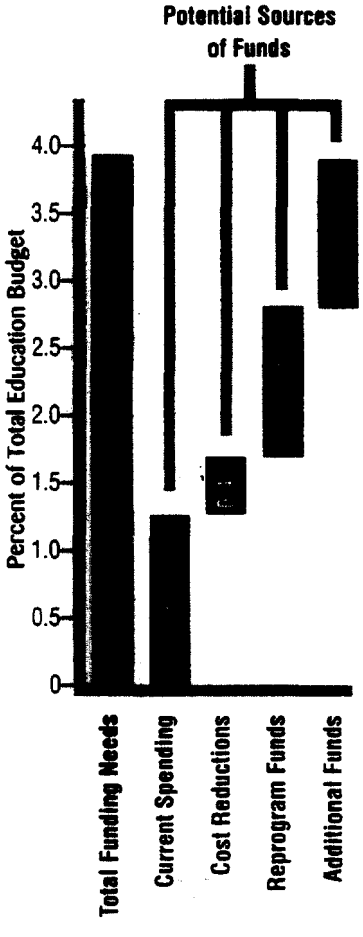
If the role for a community center (or for a community network) is to provide basic public access to the Information Superhighway, the applications might be limited to e-mail, access to selected online databases or community bulletin boards, and emergency services. As the role extends into providing programmed learning modules for students and adults, the possible application set becomes enormous. In Native American communities, for example, tribal centers that end up supplementing schools will need to provide a suite of applications similar to that needed for deploying technology in public K-12 schools. Another possible

role is that of the "electronic community," in which community members create some of the content transmitted over the local electronic network rather than simply providing access to preexisting information and services. In such electronic communities, community bulletin boards could include public and private industry job listings, city permit applications, vehicle registration information, resources for starting up and growing small businesses, mechanisms for conducting transactions online, and announcements for emergency procedures.

SOURCES OF FUNDING

Although the costs associated with implementing the Information Superhighway within schools, libraries, and community centers appear to be within reach, they present a significant cash outlay to local communities, many of which are already operating under tight budgets. The Council has identified a number of funding options that community leaders might want to explore as they search for funds to connect facilities to the Information Superhighway. Figure 5 illustrates options for sources of funding. These options fall into three categories: alternative funding mechanisms, reprogramming of existing sources of funding, and cost-saving measures.

Figure 5. Potential Sources of Funds for Connecting Classrooms



Source: McKinsey & Company.

The array of possible funding alternatives to equip schools, libraries, and community centers with the necessary technology is vast. The majority of the funding alternatives listed in Figures 6 through 8 are real alternatives that have been used effectively in funding K-12 school initiatives throughout the United States.

Some States have also begun developing competitively neutral universal service programs that improve the opportunities for schools, libraries, and community centers, as well as individuals, to participate in the Information Superhighway. For example, the Wisconsin Public Utilities Commission recently proposed a revision to its universal service rules that would establish a fixed budget to allow for rate discounts for the first 3 years to institutions, including schools and libraries, that obtain new advanced services or Internet access from their telecommunications providers.

Cost-Saving Measures

In addition to generating funds to connect communities to the Information Superhighway, State and local governments can realize savings from the existing technology infrastructure costs and apply the cost savings toward accelerating the deployment of the local technology infrastructure. Figures 7 and 8 give good examples of potential cost-saving measures.

For example, State and local agencies could aggregate demand (school district as a whole, school district plus city, hospitals and libraries, education departments, and other government agencies) to obtain volume discounts and bulk contracts for hardware and software. For example, Cooperative Library Agency for Systems and Services (CLASS) offers discounts to libraries on many Superhigh-

Figure 6. Potential Sources of Additional Funding

Source of Funds	Mechanism	Examples
Federal Government	■ Regulation ■ Categorical Funds/Grants	■ FCC or Federal legislation ■ Special Federal funds allocated to education, e.g., DOE Technology Learning Challenge grants ($9.5 million in FY 95); Library Services and Technology Act; Department of Commerce/NTIA's TIIAP funding ($24.4 million in matching funds in FY 94, of which the largest percentage of requests were for education and community information networks)
State	■ Direct ■ Bond issuance ■ Regulation ■ Lottery	■ Allocation of funds by legislature, e.g., Florida—$128 million in 1995; Ohio—$9.5 million; Utah—$5 million ■ Bonds issued for technology infrastructure, e.g., New York—$700 million for 5-year technology program; Iowa—$18 million to expand the number of schools connected to ICN in 1995 ■ PUC-approved programs for reduced rates and/or free service, e.g., California, Indiana, Georgia ■ Nebraska lottery sets aside a portion of proceeds for its Education Innovation Fund and for use in technology projects
District/County	■ Tax increase ■ Entrepreneurial ventures ■ Bond issuance	■ County in Louisiana added 0.5% to its sales tax for a period of 3 years and then 1% for 10 years to pay for education ■ Selling educational software—Port Hueneme, CA; charging for access to file servers or computer systems—Charleston, GA, and Mendocino Unified School District, CA ■ Bethel School District, Oregon—$16.4 million education bond issue with $3 million for technology
Private Sector	■ Donations	■ Donation programs of money, equipment, time, and other resources, e.g., Apple/Classrooms of Tomorrow; PacBell/CalREN—$25 million program to stimulate development of applications for high-speed data communications services; Bell Atlantic—Union City Schools, NJ. ■ Numerous college and university contributions of software, training, etc.
All levels	■ Grants	■ Available from Federal and State agencies as well as foundations and private industry.

***Source:** McKinsey & Company, Inc; information from NIIAC members and staff.

way-related items, including hardware, software, Internet services, and furniture. CLASS is a self-supporting public agency and a buying consortium for its cooperative members. Another example is the Educational and Institutional Cooperative Service, Inc., which is a not-for-profit buying cooperative open to tax-exempt colleges, universities, private schools, hospitals, medical research institutions, and hospital purchasing organizations.

If Federal or State legislation allows for educational discounts or community access set-asides, State and local governments can take advantage of such measures in budgeting for services. For example, Louisiana requires that schools be charged residential rather than business rates; in Texas, telecommunications

Figure 7. Current Proposals/Actions to Reduce Infrastructure Costs

Element	Method	Examples
Hardware	■ Purchasing cooperatives at county/State or regional levels can significantly reduce the biggest cost element. ■ Used computers donated from businesses.	Nation Christin Foundation Detweiler Foundation
Software	■ Negotiate discounts in purchase price and alternative licensing agreements. ■ Develop cooperative ventures with courseware developers and/or in-house curriculum developers.	Microsoft, Apple, PacBell (California) NSF CoVis project (Learning through Collaborative Visualization) with Northwestern University, NASA
Professional development	■ Extensive peer training and support could produce significant cost savings because training/development represent 30-40% of ongoing costs. ■ Develop private sector training/support partnerships.	Virtual School Network, Tennessee AT&T Foundation/Nat'l Council for Accred. of Teacher Education (NCATE), US West/Teacher Network
Systems operation	Make use of: ■ Wide availability of best practices and "how-to" materials and resources. ■ Onetime repair contracts. ■ Vendor-provided integration/operation.	See NTIA listing of online sources

Source: McKinsey & Company, Inc.; information from NIIAC members and staff.

services related to distance learning must be provided at rates 35 percent below normal charges; and most of Hawaii's K-12 public schools are connected via an Institutional Network (I-NET) based on SONET, ethernet-over-CATV, and other fiber technology, and funded through cable franchise fee agreements.

Use of older equipment, or least-cost technology where feasible, is another means of reducing costs in deploying hardware throughout K-12 public schools. New York's "BET Initiative" (Business for Equity in Telecomputing), and California's Computer Recycling Center are examples of organizations that recycle used equipment from businesses and individuals. Gifts in Kind America connects companies willing to donate computers to needy school districts and nonprofit organizations. In 1994, Gifts in Kind America reported $118 million in donations—total donations from this organization had reached $100 million by the end of the first 6 months of 1995.

Considerable savings can also be generated through collaborative educational courseware development and teacher training projects such as CoVis (Learning through Collaborative Visualization), a cooperative venture funded by a National Science Foundation $3.5 million grant that partners Northwestern University, the University of Illinois, the Exploratorium in San Francisco, and Bellcore with networks of more than 7,000 students and teachers throughout the United States. CoVis approaches to teaching science employ a broad range of communications

Figure 8. Current Proposals/Actions to Reduce Connection Costs

Method	Publicly Considered Proposals or Actions Taken	Examples
Special rates/ Subsidies to schools	■ Charging schools residential or other discounted rates can save more than 50% of connection charges for the lab or classroom models. ■ Providing free connection to the network by telephone and cable companies during broadband deployment would save installation costs. ■ Lease/purchase plans that reduce financing costs can be obtained. ■ Free upgrade of present cable connections to two-way would save 74% on installation costs.	■ Louisiana (PUC/1994) ■ Texas (Act 231, 1995) ■ California (PUC/1994) ■ Hawaii (CATV franchise agreements/1988) ■ Carrollton, Georgia ■ Alabama
Direct negotiation with provider	■ Individual negotiations or pricing of lower specification connection can lead to savings of 90% on ongoing connection costs. ■ Negotiating purchase discounts for high-volume and educational use with CPE manufacturers would save money.	■ Pittsburgh School District ■ Pittsburgh School District
Volume purchasing by States	■ Aggregated demand could generate up to 60% in savings for connections to schools.	■ Public Technology, Inc.
Extend connection to other government agencies	■ Cost savings would be achieved in telephone bills, administrative costs, personnel costs, etc., by spreading the cost of the network among a number of government agencies.	■ North Carolina
Donations/partnerships with communications carriers and others	■ Pilot projects that involve telecommunications carriers and other information technology businesses would save money.	■ Mendocino Unified School District, CA (Autodesk, NASA, PacBell, MCI, Apple)
Connections within schools	■ Using volunteers/technical support to pull cable can save 10% or more of internal wiring costs. ■ Using volume discounts can save money.	■ California (NetDay '96)

Source: McKinsey & Company Inc.; information from NIIAC members and staff.

technologies such as desktop videoconferencing, shared software for real-time collaboration, a multimedia scientists' "notebook," and scientific visualization software that place students in a realistic scientific environment.

Impressive savings in costs for teacher training have been achieved through projects such as Tennessee's Virtual School network. More than 11,000 of this State's teachers have been fully trained to use computer networks as the result of funding and staff contributions from Oak Ridge National Laboratories, Vanderbilt University, the University of Memphis, Pellissippi State Technical College, the Tennessee Chamber of Commerce and State of Tennessee, the Eisenhower Foundation, the Appalachian Regional Education Lab, and BellSouth Corporation.

Sometimes the costs associated with ensuring access to computers and network-based services for users with disabilities can be higher than the cost of the basic individual terminal or workstation—some types of adaptive technology can be

expensive and difficult to find. These costs can be eliminated, in some instances, by ensuring that the off-the-shelf equipment purchased is as usable for persons with disabilities as possible, with built-in features such as text or screen enlargers, keyboard alternatives to the mouse, single-keystroke command features, onscreen substitutes for auditory cues, screen readers, and other features that allow the user to customize the interface.

Reprogram Existing Funds

A second set of actions focuses on shifting existing educational funds to new uses. Textbooks account for about 50 percent of schools' expenditures on instructional materials, supplies, and services, or about 2 percent of total school spending. Some of these funds could instead be used for multimedia courseware and online instructional materials, supplementing (or replacing) traditional textbook purchases. Another 8 percent of school spending is currently devoted to "instructional support," such as instructional supervisors—e.g., the head of the math department. Some of these resources could be redeployed to address teacher training and support needs. For example, instructional supervisors could focus on helping teachers integrate technology-based tools into the curriculum.

Reprogramming funds within these natural categories could contribute 1 to 2 percent to the technology budget. In addition to the 1 to 2 percent from natural candidates, some general funding categories can also be reprogrammed. In Carrollton, Georgia, for instance, the district cut administrative staff by 20 to 30 percent, releasing funds for technology and connection within their schools, and some schools, such as those in the Hueneme District, California, have chosen to fund technology rather than teachers' aides.

Funds for technology can come from reallocating money in existing budgets in addition to increasing these budgets. Reallocation of increasing amounts of local school district budgets, of grant funds awarded for lower-priority programs, of the existing State education budget or existing State funds becomes more likely when the benefit from deployment can be measured in the form of higher skill levels, greater productivity and communications, and so on.

Alternative Funding Mechanisms

The third, and perhaps most difficult, funding option is to seek additional funds. Currently, State and local government funds cover 84 percent of the Nation's public K-12 education budget, but directly account for only 60 percent of technology spending. Some State and local governments have issued special educational bonds, increased taxes, and/or allocated lottery funds to cover investments in education technology. A range of other funding sources are currently providing support for technology, including Federal Chapter 1 and Chapter 2 funds. Local leaders need to be aware of the range of possibilities for funding and determine which alternatives are appropriate, based on the unique needs of their community institutions.

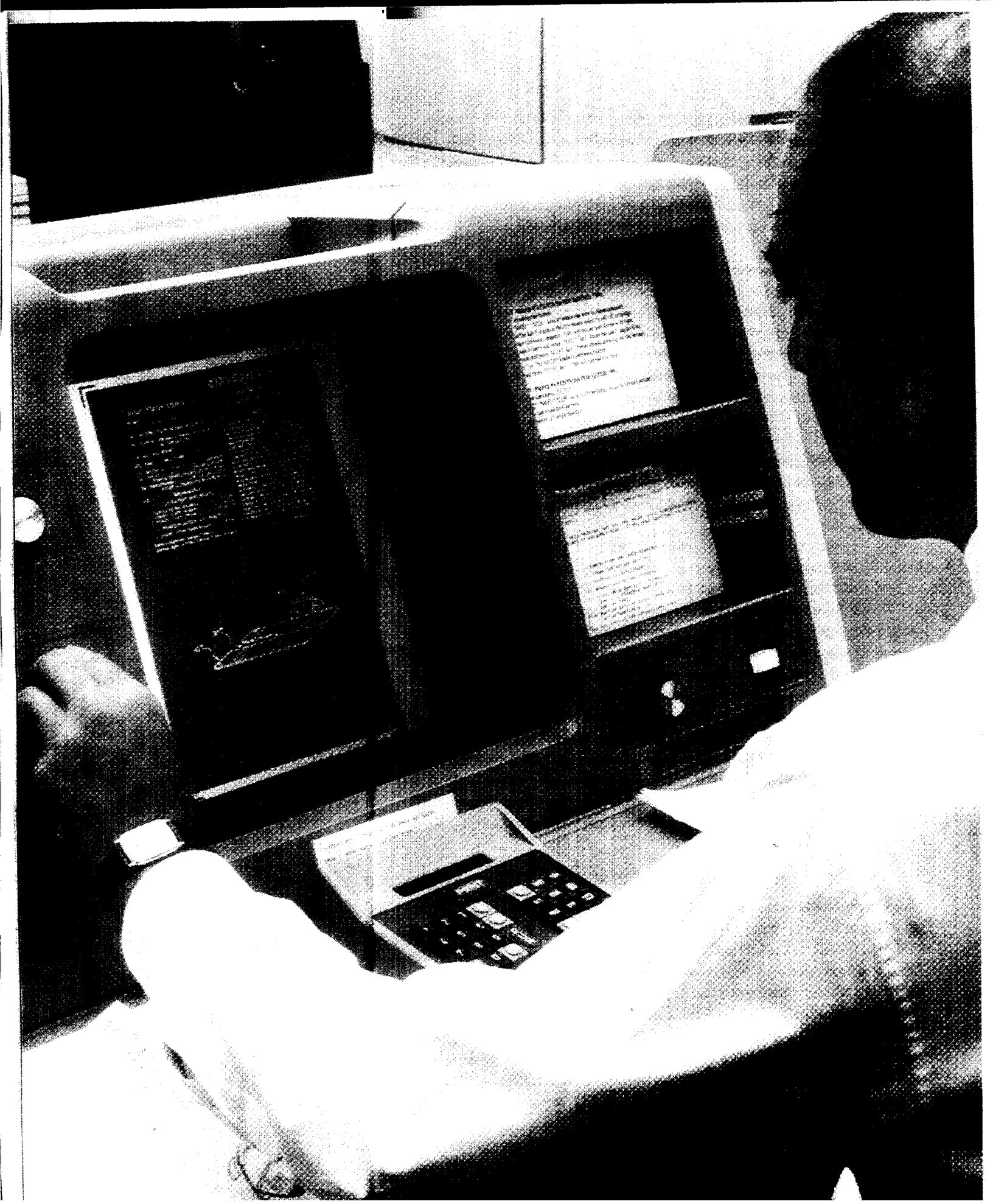
States can appropriate new general funds to increase their education technology through a number of means. Recently, increased levels of funding for school

technology were passed in Florida (from $36 million in 1993 to $135 million in 1994), Kentucky ($63 million), Texas ($99 million), and Tennessee ($78 million), for example. As an alternative, other States are increasing State and local income taxes, general sales taxes, or adding a special sales tax—a county in Louisiana, for instance, recently increased sales taxes by 0.5 percent for 3 years and 1 percent for subsequent years for this purpose.

Some States and local governments such as New York, Iowa, Delaware, and School District 4J in Eugene, Oregon, are also issuing general obligation bonds or revenue bonds for educational technology and infrastructure. Others are providing tax credits or incentives to individuals or private companies that donate technology or assist their communities to connect to the Information Superhighway. And still others, such as Nebraska and Georgia, have used State lotteries for these purposes. Figure 6 provides examples of these sources of funding.

Schools, libraries, and communities also have leveraged Federal funding programs such as the Department of Education's Technology Learning Challenge grants and the Department of Commerce/NTIA's TIIAP grants, which require matching funds.

Finally, innovative schools and districts have also found a number of ways to raise money from local community groups, private industry, and foundations. Some have been fortunate to be chosen as model schools by businesses, others have received special grants from foundations or businesses, while others have set up entrepreneurial ventures such as reselling the instructional materials they develop. Private organizations across the country have developed a variety of programs to facilitate the use of technology and infrastructure development. These programs have ranged from school-level—for example, MCI's sponsorship of the Rosa Parks Elementary School, Baltimore, Maryland; and Bell Atlantic's sponsorship of the Christopher Columbus School, Union City, New Jersey—to national-level programs such as the AT&T Learning Network, a program under which AT&T is spending $150 million over the next 5 years to provide schools with Internet services and usage.



part 3
Meeting Responsibilities as Users and Creators

Schools, libraries, community centers, and other institutions have long played a role in empowering individuals through information and in encouraging them to use this information in responsible and lawful ways. This role continues on the Information Superhighway.

Traditionally, schools, libraries, and community centers also play an important role in educating society. These institutions are uniquely situated to promote awareness about the legal issues involved in using the Information Superhighway and to demonstrate the importance of establishing and understanding clear policies and guidelines for participating in the Information Age. In developing flexible policies concerning browsing on and contributing to the Superhighway, it is useful to encourage schools, libraries, and community centers to keep abreast of what their users are doing on the Superhighway, at least when using their equipment, and to promote open discussion of network activities among users.

Moreover, individuals can learn how to be responsible Information Superhighway users by becoming aware of the issues involved when they create, access, receive, or transmit materials.

The Scenarios in Section 3 have been written to help illustrate some of the important issues schools, libraries, and community centers might want to explore as they enter the Information Superhighway.

"[Because the] kids are exposed to large quantities of information [on the Web and are also creators], they have a healthy respect for what it takes to make information. They have a much stronger sense of what is 'theirs' and what is somebody else's [in terms of ownership of information and ideas]."—*Paul Reese, computer and technology coordinator, Ralph Bunche School, Harlem, New York*

COPYRIGHT CONSIDERATIONS

Copyright law protects original works of authorship. The U.S. legal system grants copyrights not simply to reward the author for the act of creation, but to benefit the public as a whole by "spurring creativity in a free market economy while encouraging the interchange of ideas and information." Allowing authors to control the use of their works, and therefore profit financially, gives them an incentive to invest time and effort in creating new works. The more works that are created and disseminated by authors and their publishers, the richer the spectrum of material available to the public.

In the context of using and creating information on the Information Superhighway, the basic rule is simple: Copyright should be respected. If copyrights in these works are not respected, many copyright owners may be reluctant to make their works available online. Each user of the Information Superhighway is potentially also a creator, and thereby a copyright owner and a copyright user. While someone may choose to donate his or her work to the public domain or allow it to be freely used, the choice should be his or hers. Others may want to control who accesses their work and in what context, or they may have invested substantial time and money in the work's creation that they need to recover.

As a practical matter, most people, up to now, have been required to have only a passing acquaintance with the principles of copyright law. The new technologies involved in the Information Superhighway make it more important today for the general public to acquire a basic knowledge of copyright law. Even for those who are familiar with copyright law, the Information Superhighway context

raises new issues. For the first time, the average person sitting at a home computer can gain access to a wide range of every type of copyrighted material and can easily copy or communicate that material virtually instantaneously. With traditional technologies, such as photocopiers, it is easy to see that a work has been copied. However, when the digital form of a work is accessed and the results are communicated electronically from one computer to another, it is not obvious to the user whether and at what point in the process a copy has been made or a performance has occurred.

Fortunately, the advent of new technologies will help users to respect copyrights. A license may often cover the proposed uses of a copyrighted work, and may be easily available. If not, if the user exercises judgment in taking only the amount of a work that is necessary for reasonable, noncommercial purposes that do not interfere with the copyright owner's market, the use may well qualify as fair use or be covered by another exemption.

In some respects, the Information Superhighway will simplify the mechanics of the copyright system. The new technology will eventually make it easier not only to gain access to a wider variety of works, but also to identify legal claims and, where indicated, who should be contacted to obtain permissions and/or make payments. It is in everyone's interest, both copyright owners and users of copyrighted materials, to make these transactions as simple and painless as possible.

Understanding Your Rights and Responsibilities

Whenever someone uses the Information Superhighway, he or she may be using a copyrighted work and, at the same time, may be creating a copyrighted work. In both situations, he or she needs to understand what types of material are protected by copyright and what types of uses require permission. These copyright basics are an important part of the Information Superhighway's "rules of the road." The essential questions to be asked are the following: (1) Is the material protected by copyright? (2) Is the proposed use within the copyright owner's exclusive rights? (3) If so, is use permissible under an exception to those rights? (4) If not, is it covered by a license, either explicit or implied?

A more detailed explanation of these questions, and suggestions on how to answer them, is included in the "Basic Principles of Copyright" section of the Scenarios in Section 3. Also, a list of organizations and published materials that can serve as copyright resources is provided in the "Resources for Communities."

PRIVACY AND SECURITY CONSIDERATIONS

Infringements of laws and social norms occur in everyday life and will occur in the online world, probably with about the same regularity. Schools, libraries, and/or community centers will never be able to control online activities completely—the technology and the technical know-how move too rapidly. Instead, the focus may best be placed on sensible responses to protect privacy and security. In other words, as a basic operating principle for the Information Superhighway, everyone should do the right thing, exercising common sense.

It may be helpful to view the public-private nature of the Information Superhighway as a continuum. The area of private activity is actually quite narrow, including private e-mail, especially if the message is encrypted. A less private sphere of activity includes a variety of bulletin board–type services that require passwords. But in these spheres, messages may be further divulged by another member of the bulletin board.

Most other areas of the Information Superhighway are basically public. News groups and chatgroups are accessible to anyone who subscribes. Once again, messages may be further disseminated outside the group. In addition, the account information (name, e-mail address) for subscribers to public groups and bulletin board groups is often widely available.

A theme that recurs in many of the privacy and security scenarios found in Section 3 is that the rights of minors may be different from those of adults. In the school environment, parents—and to a certain extent teachers—have certain responsibilities for a child's education that enable them to get access to a student's records and communications. The scope and detail of online activities may represent a qualitative change from the world of face-to-face contacts and paper records, but it is unclear whether this change will alter parent/student/teacher rights and responsibilities.

Everyday examples of the importance of privacy and security awareness abound. Online systems for communication of financial or medical information, for example, would probably involve serious concerns about security and data integrity. In an educational environment, school authorities would need to determine whether retention of information was warranted given the kinds of communications that are likely to dominate the system.

Additionally, schools may want to consider whether records of online computer activities constitute school records. The question becomes whether records of online activities are more similar to records of educational actions or to a trail of browsing. If online activities are more similar to browsing in the library, then divulgence of online activities may have the effect of stifling student use of the Information Superhighway and their learning through it.

For a more indepth analysis and illustration of some of the issues to be dealt with on the Information Superhighway, see the Scenarios in Section 3.

THE IMPORTANCE OF POLICIES AND PROCEDURES

Schools, libraries, and community centers—as system operators of the online system within the institutions and as providers of access to other online systems on the Information Superhighway—need to establish policies and procedures. Educators and librarians are generally knowledgeable about the use of guidelines, as they have participated in the past development and implementation of copyright guidelines related to photocopying and off-air recording of broadcast programming. (see Copyright Office Circular 21, Reproduction of Copyrighted Works by Educators and Librarians (August 1993).) The scenarios in Section 3 are designed to illustrate where and how guidelines can be useful.

Organizations with plans to use the Information Superhighway, whether in educational or professional settings, or as a service to the public, should take the following steps:

- Publish guidelines for all who use the organization's computers and/or access online resources onsite.
- Ensure that all constituents are aware of established guidelines.
- Ask for outside advice when issues arise that go beyond the scope of the guidelines.

Simply put, develop guidelines, make them available, and take steps to ensure that users agree to and understand them before using the institution's facilities.

Addressing Concerns About Inappropriate Content

While many schools are looking for ways to prevent students from accessing inappropriate material on the Internet, two school districts in Eugene, Oregon, are taking action. The Bethel School District has purchased software that limits what students can access online. With this software, a small hand pops up a warning if a student attempts to surf in areas where they do not belong. The program costs about $30 per computer, and although it cannot block out every objectional site, it will screen out most.

The Eugene School District has taken a second tack. In their middle and high schools, students only receive e-mail accounts if they have parental permission. Students who misuse those accounts lose them as well as access to the district's computer network. Students are required to apply for their e-mail account on a yearly basis.