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TELECOMMUNICATIONS

Initiatives Taken by Three States to Promote Increased Access and Investment

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The Honorable Richard G. Lugar
Chairman
The Honorable Patrick J. Leahy
Ranking Minority Member
Committee on Agriculture, Nutrition,
and Forestry
United States Senate

As you know, the Congress recently enacted landmark telecommunications legislation that is expected to reduce regulations and give consumers access to a greater variety of telecommunications services at lower prices. Recognizing the benefits an advanced telecommunications system can provide to their constituents, several states with large rural populations have undertaken projects to make advanced telecommunications more widely available.

This report responds to your request that we provide information on (a) how selected states have encouraged private investment in advanced telecommunications, (b) how these states have encouraged widespread access, and (c) what lessons their experiences could provide for others.

We are sending copies of this report to the Chairman, Federal Communications Commission, and the Administrator, National Telecommunications and Information Administration. We will also make copies available to others upon request.

Please call me at (202) 512-2834 if you have any questions. Major contributors to this report are listed in appendix II.

John H. Anderson, Jr.
Director, Transportation and
Telecommunications Issues

Executive Summary

Purpose

Advances in telecommunications can improve people's access to a wide range of services no matter where they live. For example, using two-way video communications, high school students can participate in advanced science classes taught in other school districts and patients at rural clinics can be diagnosed by medical specialists at distant urban hospitals. Some states have already taken steps to make these types of services more widely available. Their experiences can assist officials in other states and federal policymakers who are seeking to encourage widespread access to these services.

The Chairman and Ranking Minority Member of the Senate Committee on Agriculture, Nutrition, and Forestry asked GAO to provide information on selected states that have started developing their telecommunications infrastructure. Specifically, GAO is reporting on (1) how these states encouraged private investment in improving their telecommunications infrastructure, (2) how they provided for increased and affordable access to advanced telecommunications services,[1] and (3) what lessons their experiences could provide for others.

Background

Historically, private investors have financed the building of the nation's telephone system, the form of telecommunications that reaches the most customers. Today, in order to provide advanced telecommunications services like two-way video communications and high-speed data connections, telephone companies would need to invest billions of dollars in improving their infrastructure by, for example, replacing copper wire with fiber optic cables and installing advanced computerized switches. The telephone companies have already begun making these investments, mainly in business districts and high-density residential areas where there are opportunities to make a profit. In rural areas, where there are fewer businesses and the cost of delivering service is usually higher, the current profit incentives are generally not high enough for companies to invest in providing such services.

State and federal policymakers are looking for ways to promote the widespread deployment of advanced telecommunications in order to make the delivery of these services more cost-effective and promote economic development. GAO reviewed the experiences of three states that experts in the field consider to be leaders in the development of statewide advanced telecommunications: Iowa, whose network provides two-way video

[1]In this report, the term "advanced telecommunications services" describes any service not available over a standard telephone line.

communications; Nebraska, which uses less advanced technology to provide high-speed data connections and video conferencing; and North Carolina, which provides two-way video communications to several sites simultaneously using the most advanced technology available. Officials in these states have worked with the private sector and with potential users to encourage private investment and ensure the availability of services in less densely populated rural areas.

Results in Brief

Iowa, Nebraska, and North Carolina encouraged private investment in advanced telecommunications infrastructure by offering to become major customers of these services from the telephone companies. In Iowa, the telephone companies were reluctant in 1987 to make the investment needed to provide these services because of doubts about the profitability of such a system, so the state financed and built its own network. However, by the time Nebraska and North Carolina began their projects in the early 1990s, the telephone companies had already begun upgrading their systems and were more willing to make the investment the states wanted. They also decided that they would rather have the states as customers than as competitors. As a result of these states' efforts, the telephone companies made improvements faster than they would have on their own.

To provide affordable access to a large segment of their populations, all three states are making advanced telecommunications services available through sites located in local public buildings, rather than in individual homes. State and federal agencies are assisting local organizations by paying some of the costs for the equipment and connections needed to use these services. Two states—Iowa and North Carolina—are making the services more affordable by charging the same price for using the network at every location, even at remote locations that are more expensive to serve. Nebraska has arranged for local schools to get discounts on service from the telephone companies. Each state has made advanced services available to between about 100 and about 400 sites, but each is in the early stages of its efforts and plans to connect many more sites in the next several years. However, even though the three states have focused on connecting high schools to the network, more than half of the high schools remain unconnected. Rural counties contain more high schools than urban counties, and more rural high schools have yet to be connected.

The three states' experiences illustrate the importance of building and maintaining consensus among the parties that will be involved in

constructing, financing, and using an advanced telecommunications network—the telecommunications companies, anticipated users, state legislators, and state executive branch officials. Addressing the concerns of these parties can help prevent the construction delays that can result from design changes and funding shortfalls. Identifying a stable source of funding for advanced telecommunications programs can also help promote widespread use by local organizations.

Principal Findings

States Encouraged Private Companies to Build Network Infrastructure

While each of the three states wanted to use advanced telecommunications to improve its residents' access to services, each also wanted to avoid, if possible, the large-scale public expenditures required to build the needed infrastructure. To convince the telephone companies to make the upgrades needed to provide the advanced services, the states offered to be long-term customers.

When Iowa, the first state to undertake such an effort, began its project in 1987, uncertainties about the profitability of the advanced services discouraged the telephone companies from accepting the risks of investing in upgrading the system, despite the state's offer to be a long-term customer. As a result, Iowa used state funds to build a network that reaches all 99 of the state's counties. To connect additional local sites to the state network, Iowa has begun contracting with private companies.

By 1990, when Nebraska and North Carolina began their projects, the telephone companies had already begun some system upgrades and had tested or offered advanced services in limited areas. They were thus more willing to invest in the infrastructure needed to offer advanced services. The companies also realized that long-term arrangements in which the states were customers could reduce the risk of investment by providing a steady income. Finally, the companies did not want to compete with a state-owned system like the one Iowa built. As a result, the states were able to accelerate the deployment of improved infrastructure.

Services Are Available Through Some Public Organizations

Although all of the states wanted to accelerate the pace at which the advanced services could be made widely available, they considered delivering these services to homes unfeasible. Instead, they concentrated

on providing services in public buildings such as schools, libraries, and hospitals, where the equipment could be used by many people.

In each state, the local sites are responsible for purchasing the equipment needed to gain access to advanced telecommunications services, as well as paying the ongoing usage costs. The cost of purchasing equipment, such as video monitors, has ranged from $3,000 to $120,000 per site. To use the video system, users paid $20 per hour in Nebraska, between $5 and $40 per hour in Iowa, and $2,992 per month plus $23 per hour in North Carolina. To make using these services more affordable, the states have helped local sites pay for some equipment. Local sites have also received federal grants to pay some of the connection costs. In addition, Iowa and North Carolina have established uniform rates at affordable levels so that sites in distant rural areas do not pay more than those in more urban areas, and Nebraska has used its buying power to help schools negotiate favorable rates from the telephone companies.

Although the states are still in the early stages of their efforts, each has made advanced telecommunications services more widely available to its citizens through local organizations. Iowa has completed two of the three parts of its project. As of October 1995, it had connected 157 sites, and it plans to connect 474 more sites by 2000. Nebraska had connected over 400 elementary and secondary schools as of February 1996 and is working with communities to help them develop new applications. North Carolina is in the third year of its project; as of February 1996, it had connected over 100 sites.

Officials in all three states believe that providing advanced telecommunications services to rural residents is of great importance. However, much remains to be done to provide access to such services in rural areas. GAO's review of the number of high schools that are currently connected indicates that despite their emphasis on improving education, more than half of the high schools in each state do not yet have access to advanced telecommunications. Rural counties contain more high schools than urban counties, and more rural high schools have yet to be connected.

States' Experiences Offer Lessons

Reaching consensus about how advanced telecommunications services will be provided and used among all interested parties has proved important to implementing a project successfully. Participants said that telecommunications companies can be convinced to provide advanced

services to public organizations if the proposal makes "business sense." Long-term customer agreements with the states, prior favorable experience working with public agencies, and the ability to sell advanced services to commercial customers can encourage the companies' acceptance of this type of proposal.

State and private-sector officials indicated that reaching agreement with potential users on how to use an advanced telecommunications system can help ensure that the system will provide the services they want at a price they are willing to pay. Identifying a stable source of financial support to assist users in paying the costs of connection is also important so that future users have access to some assistance.

Obtaining and maintaining legislative support for financing a project can help prevent the delays that can result from reductions in funding. And while officials of a state's executive branch can serve as advocates that keep the project on track, care must be taken to ensure that the administrative responsibilities for implementing the project are clearly defined.

Recommendations

This report makes no recommendations.

Agency Comments

GAO provided copies of a draft of this report to senior officials in the three states we visited, including the Chief Operating Officer, Iowa Communications Network, and the Education Policy Advisor, Office of the Governor of Iowa; the Director, Division of Communications, State of Nebraska; and the Advisor to the Governor for Policy, Budget, and Technology and the State Controller in North Carolina for their review and comment. They generally agreed with the facts presented in the draft and provided updated information and technical corrections, which GAO incorporated where appropriate. A detailed discussion of their comments and GAO's responses is included at the end of chapter 4. GAO also asked responsible officials with the Department of Commerce's National Telecommunications and Information Administration (NTIA), including the Director, Public Broadcasting Division, Office of Telecommunications and Information Applications, to review the draft. They commented that the draft accurately portrayed NTIA and its programs.

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Abbreviations

ARPA	Advanced Research Projects Agency (Department of Defense)
ATM	asynchronous transfer mode
GAO	General Accounting Office
NTIA	National Telecommunications and Information Administration (Department of Commerce)
SONET	synchronous optical network
USDA	U.S. Department of Agriculture

Introduction

Advances in telecommunications technology have the potential to provide new and improved services to people no matter where they live. For example, students in rural areas of Iowa are being taught Russian, music, and calculus by teachers in distant urban centers through two-way video communications. North Carolina has begun to link rural and urban hospitals to provide rural sites with access to medical specialists via video. A telephone company in Nebraska has created jobs in a small rural town by establishing a nationwide telemarketing business. Modern telecommunications can thus be used both to improve the delivery of services and to promote economic development.

In figure 1.1, a technician at a hospital in Des Moines is transmitting an echocardiogram to be read by a specialist at the University of Iowa hospitals in Iowa City, Iowa—100 miles away. Using advanced telecommunications instead of sending a tape by a 2-hour courier trip results in a quicker diagnosis and more timely treatment for the patient.

Figure 1.1: Remote Diagnosis Using Advanced Telecommunications in Iowa

(Figure notes on next page)

Source: Iowa Health System Telemedicine Program.

While services such as two-way video are offered in some places in the United States today, they are not widely available because the current telecommunications infrastructure, notably the telephone system, was not designed to provide them.[1] Billions of dollars worth of infrastructure improvements would be needed in order to quickly transmit data and high-quality video images throughout the nation. Some state governments are currently looking for ways to accelerate this investment and ensure that services will be affordable and widely available to their residents. The experiences of the states that have begun this process can provide critical information to federal policymakers and to other states as they revise their telecommunications policies and seek to develop a modern telecommunications infrastructure.

Competition Is Expected to Encourage Private Investment and Development of Modern Infrastructure

Historically, private investors have financed the building of the United States' telephone system, the most widely available form of telecommunications infrastructure. This system now provides services to over 93 million American households. As of 1994, about 94 percent of American households had access to basic telephone services.

Telephone companies are already improving their infrastructure to be able to provide advanced telecommunications services. This investment is occurring mainly in business districts and more densely populated residential areas. Profit incentives are not high for companies to provide such service in rural areas, where there are fewer businesses and the cost of delivering services is usually higher, unless financial support is available or cost averaging is applied. It is likely that private investment in advanced telecommunications will be slower in rural areas as well. Recent studies by the Department of Commerce and Office of Technology Assessment found that the use of telecommunications can be particularly beneficial to rural areas, where the population density is low.[2] However, the distances between people in rural areas also increase the cost of providing these

[1]See, for example, School Facilities: America's Schools Not Designed or Equipped for 21st Century (GAO/HEHS-95-96, Apr. 4, 1995).

[2]Rural America at the Crossroads: Networking for the Future, Office of Technology Assessment (May 25, 1994) and Survey of Rural Infrastructure Technologies, U.S. Department of Commerce, NTIA Special Publication 95-33 (Sept. 1995).

services.[3] Some industry observers expect increased competition to lead to lower prices and more choices in telephone service.[4] Others point out, however, that competition is less likely to develop in rural areas and that customers in these areas may be faced with higher prices because without subsidies or cost averaging, the prices for telecommunications services will likely reflect the higher cost of providing service there.[5]

Infrastructure Upgrades Can Allow the Delivery of Advanced Services

Advanced telecommunications services can be provided, in part, by upgrading the current telephone system's infrastructure to increase the capacity, or "bandwidth" of the telephone lines and switches.[6] These upgrades include powerful new computer switches, complex software, and fiber optic cables that combine to form a high capacity, "broadband" telecommunications infrastructure. The technologies that can be used for upgrades are diverse. For instance, replacing existing copper telephone lines with new fiber optic lines can dramatically increase capacity, enabling the lines to carry many thousands of times more data. In addition to telephone lines, other kinds of technologies—including satellites, cellular telephones, and cable television systems—can transmit information as part of the telecommunications infrastructure.

Besides the infrastructure needed to move information over distances, advanced telecommunications depend on two other elements—on-site equipment and switches that have been upgraded to handle larger amounts of information. Figure 1.2 illustrates these components of a network. The equipment at the originating site turns the information generated by the user, such as sounds, words, and pictures, into a form that can be transmitted. The switches route the transmission to its destination through cables or some other transmission channel. Once the transmission arrives at its destination, other types of on-site equipment convert the transmission back into the same usable form of sounds, words, or pictures.

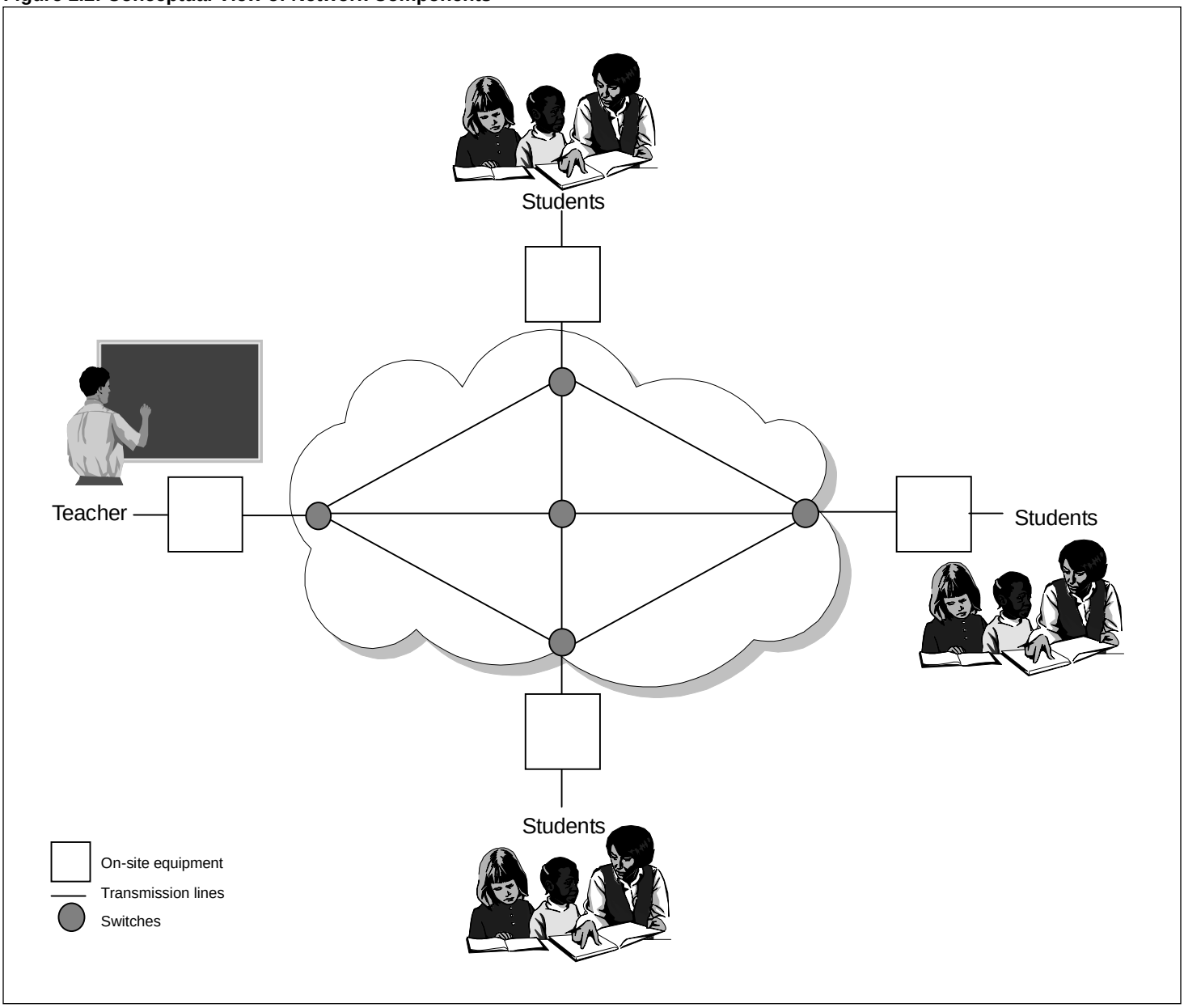
[3]And, while the costs of serving geographically dispersed customers are higher, telecommunications costs are also higher in rural areas than in urban areas because the equipment costs are generally spread over fewer customers.

[4]The Telecom Revolution—An American Opportunity, Progress and Freedom Foundation (May 1995).

[5]Keeping Rural America Connected: Costs and Rates in the Competitive Era, Organization for the Protection and Advancement of Small Telephone Companies (1994).

[6]Information Superhighway: Issues Affecting Development (GAO/RCED-94-285, Sept. 30, 1994).

Figure 1.2: Conceptual View of Network Components



Recently Enacted Federal Legislation Is Expected to Increase Competition

The President recently signed legislation reforming federal telecommunications law.[7] This new law envisions a telecommunications industry in which a variety of companies—local telephone, long-distance,

[7]P.L. 104-104, enacted Feb. 8, 1996.

cable television, and wireless—can offer similar services and compete with one another. For example, the new law allows competition for local telephone services.

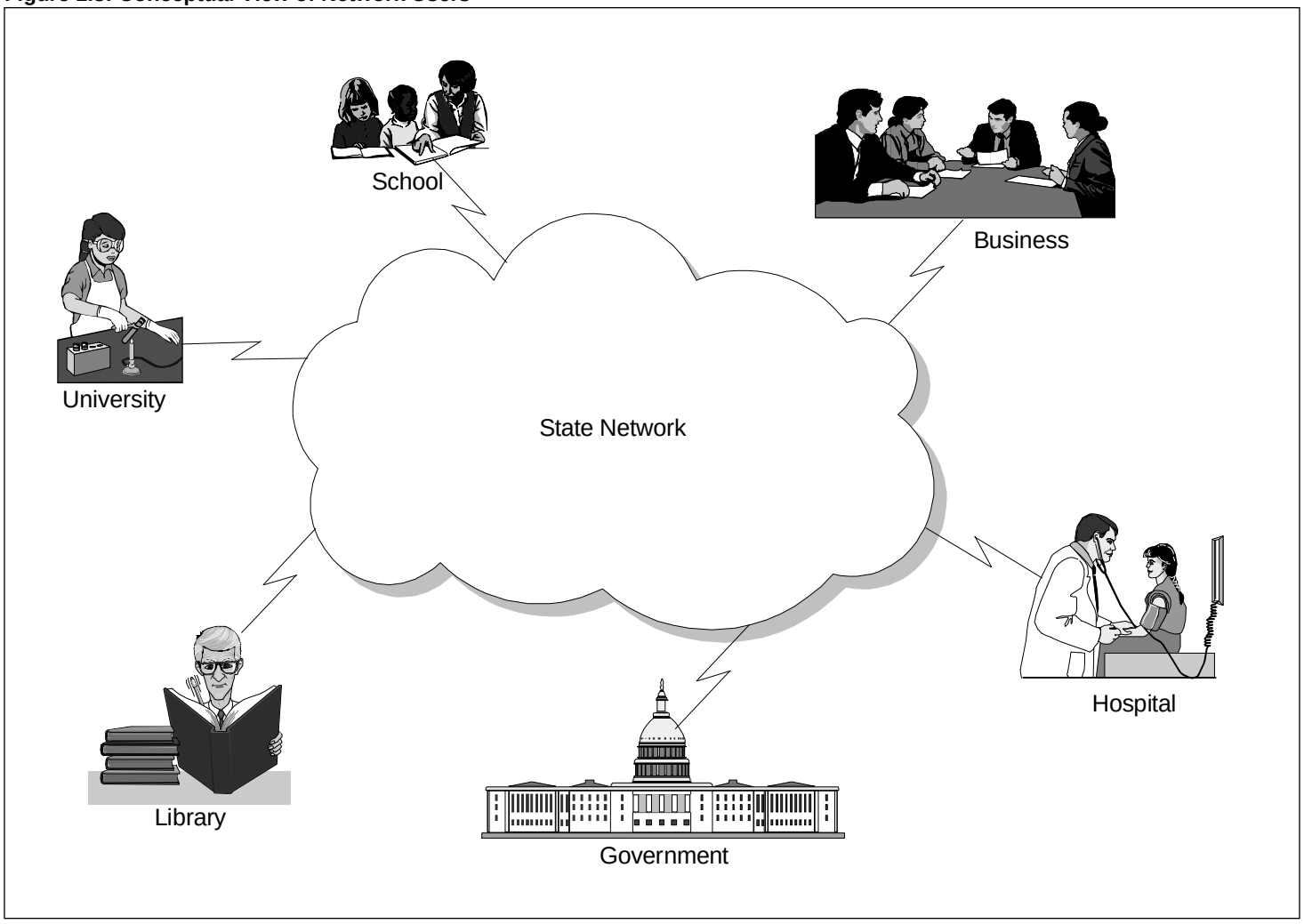
While promoting deregulation, this law seeks to preserve and advance the concept of "universal service"—affordable and widely available telephone service. Universal service has been a federal goal since the enactment of the Communications Act of 1934, and federal and state governments have supported this goal through a series of subsidies and other types of assistance. The effect of this policy has been to make telephone service more affordable for residential customers and rural users. The new law provides for the establishment of a joint federal-state board to make recommendations to the Federal Communications Commission on the steps necessary to preserve and advance the goal of universal service.[8]

States View Advanced Telecommunications as Contributing to More Effective Services and Economic Development

At the state level, officials have discussed the value of advanced telecommunications services in national forums such as the National Governors' Association and the National Conference of State Legislators. They envision using advanced telecommunications to provide education, health care, and other public services more effectively and more equitably (see fig. 1.3). They also believe these services will make their states more attractive to new and expanding businesses and allow their rural residents to participate more fully in state government. As a result, leaders in state governments are looking for ways to accelerate the development of the telecommunications infrastructure.

[8]Under the legislation, universal service is an evolving level of services to be established periodically, taking into account advances in telecommunication and information technologies and services. Among the principles to be taken into account in preserving and advancing universal service are access in rural and high-cost areas, and access to advanced telecommunication services for schools, health care facilities, and libraries.

Figure 1.3: Conceptual View of Network Users



Iowa, Nebraska, and North Carolina Were Among the First to Begin Network Development

Three states with significant rural populations—Iowa, Nebraska and North Carolina—have been cited as leaders in the development of statewide advanced telecommunications services. Recognizing that decisions about private investment for improving the telecommunications infrastructure are driven by market circumstances, officials in these states have worked with the private sector and with potential users to encourage private investment and ensure the availability of service in less densely populated rural areas. Table 1.1 shows the demographics of these three states relative to the nation as a whole.

Table 1.1: Demographic and Economic Characteristics of the Three States

	United States	Iowa	Nebraska	North Carolina
Population (1994)[a]	260,341,000	2,829,000	1,623,000	7,070,000
Area (square miles)	3,717,522	56,276	77,359	52,672
Number of counties	3,043	99	93	100
Percentage of population that is rural (1990)[b]	24.8	39.4	33.9	49.6
Number of rural counties[c]	2,383	88	88	75
Percentage of population living in rural counties (1994)	20	56	49	33
Number of farms (1995)[d]	2,073,320	100,000	56,000	58,000

[a]Data from the U.S. Bureau of the Census, Statistical Abstract of the United States (1995).

[b]Data from the U.S. Bureau of the Census, 1990 Census of Population, General Population Characteristics, United States.

[c]Unless otherwise specified, we have used the U.S. Department of Agriculture (USDA) Rural-Urban Continuum Codes for Metro and Nonmetro Counties to distinguish between urban and rural counties. USDA defines counties coded 0-3 as metro, or urban counties, and counties coded 4-9 as nonmetro, or rural, counties. For a further discussion of urban/rural definitions, see Rural Development: Profile of Rural Areas (GAO/RCED-93-40FS, Apr. 20, 1993).

[d]Data from USDA, Agricultural Statistics Board, National Agricultural Statistics Service.

Iowa's Primary Goal Was Equalizing Access to Education

Iowa is a midsized agricultural state with a population of about 2.8 million. The state has a large number of midsized towns—ranging from 8,000 to 10,000 people—which are fairly equally distributed in the eastern two-thirds of the state. The state also has about 100,000 farms. Of Iowa's 99 counties, 88 are considered rural.

Iowa's primary goals for a statewide telecommunications network were improving educational services and equalizing educational resources, such as the course offerings available at urban and rural educational facilities. Iowa selected a system based on high-capacity fiber optic technology and SONET[9] software that was capable of transmitting voice, data, and two-way interactive video. This technology provides high-quality pictures that let students and teachers see each other clearly.

[9]SONET—synchronous optical network—is an international standard for transmitting information over optical fiber cable at high speeds.

Nebraska's First Priority Was Affordable Technology

Nebraska is a predominantly agricultural state with a scattered population. Sixty percent of the state's 1.6 million residents are located in four major cities; the rest live in small and midsized communities that are often distant from each other. The western parts of the state are sparsely populated. Of the state's 93 counties, 88 are considered rural, and 10 of the 25 counties with the smallest populations in the nation are located in Nebraska.

Nebraska's first priority for its network was providing high-speed data services, such as Internet connections, at prices that the state's small, rural schools and organizations could afford. The frame-relay[10] technology that the state selected, streamlines data transmissions and allows data to travel more quickly and cost-effectively than other alternatives. The state has also created a video network that community organizations can use for meetings, hearings, and training sessions, using leased T-1 lines.[11] The "compressed" video technology selected for the network reduces the bandwidth needed to send pictures and the cost of transmission. However, the resulting video images are often seen as jerky or blurred.

North Carolina's Primary Goal Was Improving Education and Making Business More Competitive

About half of North Carolina's 7 million residents live in midsized towns found along a central corridor stretching east from the state's largest city, Charlotte, to the Atlantic coastline. This area includes the generally affluent Raleigh-Durham metropolitan area and Research Triangle Park, one of the nation's leading centers for medical, electronic, and industrial research. The western part of the state is mountainous and forested, and many of the state's least populated counties are found in this area. The coastal region also includes isolated towns. Of North Carolina's 100 counties, 75 are considered rural.

The primary objectives for North Carolina's network were improving education and making North Carolina's businesses more competitive. The state selected state-of-the-art technology: a high-capacity fiber optic network and advanced ATM[12] switches that can connect a very large number of users and support very fast interactive video transmission to multiple users simultaneously. The costs of this advanced system were

[10]Frame relay is a type of technology in which large amounts of data are broken into smaller, variable-length pieces called "frames."

[11]T-1 lines combine the capacity of 24 transmission channels into a single, high-speed channel. With some enhancements, standard copper telephone lines can carry T-1 signals.

[12]ATM—asynchronous transfer mode—is a technology that transfers large amounts of data in smaller, fixed-length pieces. ATM is able to mix types of data, such as voice, images, and full-motion video.

considered acceptable because state and private-sector officials believed that it would have a longer useful life than a system built with older technologies.

Objectives, Scope, and Methodology

The Chairman and Ranking Minority Member of the Senate Committee on Agriculture, Nutrition, and Forestry asked us to provide information on selected states that have started developing their telecommunications infrastructure, specifically (1) how these states encouraged private investment in improving their telecommunications infrastructure, (2) how they provided for increased and affordable access to advanced telecommunications services, and (3) what lessons their experiences could provide for others.

To respond to this request, we conducted case studies of three states—Iowa, Nebraska, and North Carolina—that (1) include rural populations that constitute at least one-third of the state's total population and (2) have made significant progress in deploying statewide advanced telecommunications systems. To answer the first two objectives, we used a case-study approach that included interviews with state and private-sector officials and reviews of state planning documents, audit reports, and network operation figures, as well as pertinent economic and demographic data for the states and the nation. To answer the second objective, we also examined the extent to which high schools in rural and urban areas have access to the states' networks. We chose high schools because providing service to them was a goal in all three states. We relied on USDA for a determination of urban and rural counties and on the states' data for a listing of connected and unconnected schools. To answer the third objective, we asked project participants in the three states what factors had helped or hindered their efforts; we combined this information with our observations and analysis to identify the lessons.

We performed our work from June 1995 through February 1996 in accordance with generally accepted government auditing standards. We discussed a draft of this report with senior officials with responsibility for the networks in the three states we visited, as well as with NTIA officials. These officials generally agreed with the information presented and provided some information to clarify and update the report. A detailed discussion of their comments and our responses is included at the end of chapter 4.

States Encouraged Private Companies to Build the Network Infrastructure

While all three states wanted to use advanced telecommunications to make services more accessible to their residents, each also wanted to avoid, if possible, the large-scale public expenditures that could be required to build the needed infrastructure. As a result, all three states encouraged the telephone companies operating in their states to invest in upgrading the existing networks more quickly so that the companies could make advanced telecommunications services available within the states' time frames.

Each of the states tried to encourage private investment through the use of long-term agreements whereby the state would purchase advanced telecommunications services from the telephone companies. At the time Iowa tried this strategy, uncertainties about the profitability of providing advanced services discouraged the telephone companies from accepting the risks of investing in the statewide network needed to provide these services. However, by the time Nebraska and North Carolina began their projects, the telephone companies had already begun to upgrade their facilities, by, for example, using more fiber optic lines. Also, having the states as long-term customers provided an income stream and reduced the risk of investment. Finally, by investing in their own infrastructure, companies could avoid competing with a state-owned facility.

Iowa Faced Early Difficulties in Attracting Private-Sector Involvement

In 1987, Iowa began efforts to become the first state to create a fiber optic telecommunications network that would deliver services to classrooms throughout the state. The Iowa Public Broadcasting Board was directed to develop a design for a video network, and a formal request for private-sector proposals to construct the network was issued in 1988. According to state officials, the request had several technical flaws in it, and telephone company representatives were uncertain whether they would be able to recover the costs of building the system. Despite these uncertainties, the state received three bids to build the network. After reviewing these, the state announced its intent to award the contract to one of the companies. However, a challenge was filed and the intended award was overturned in March 1989.

State officials ascribe the state telephone companies' lack of interest in the project to several factors. These include doubts about the profitability of the network, a belief that it would be too expensive, and hesitancy to make investments in a long-term project that might not allow them to recover their investment in an acceptable time frame. These officials also told us that they believe that the state's telephone companies were not

prepared to make the internal policy decisions needed to make long-term lease agreements or ready to make infrastructure improvements as quickly as the state required. One telephone company cited as an inhibiting factor the cost and complications of assembling proposals for such an uncertain outcome. Another saw the level of investment, lack of a known customer base, and high technology required as substantial risks.

In May of 1989, the state legislature passed a law providing the initial funding to build the Iowa Communications Network. This state-owned, statewide network was to be designed to provide video, voice, and data service to the state government and educational system. The proposal was not debated by the full legislature and was adopted on the last day of the legislative session. The staff responsible for the design of the network later told Iowa's state auditor that they were not involved in the drafting of the provision until the final days of the legislative session and did not have sufficient time to analyze the proposed network or its costs.[1] According to state officials, telephone company representatives were also excluded from this process. In December 1989, the state asked for proposals to build the network. Two companies bid on the project, but both bids were rejected as too costly, and the proposal was withdrawn.

In October 1990, Iowa issued a third, more limited proposal intended to reduce the cost of building the network by, for example, including fewer sites. This proposal did not provide for the equipment or modifications necessary to fully carry the state government's voice and data service. A contract to begin construction was awarded in April 1991, and $96 million in bonds were issued to finance the system. However, it was later determined that the state government's telephone service needed to be included in order to generate sufficient cash flow for operations. To fund the resulting design modifications, the state was forced to issue a second set of bonds in 1993 for $18.5 million.

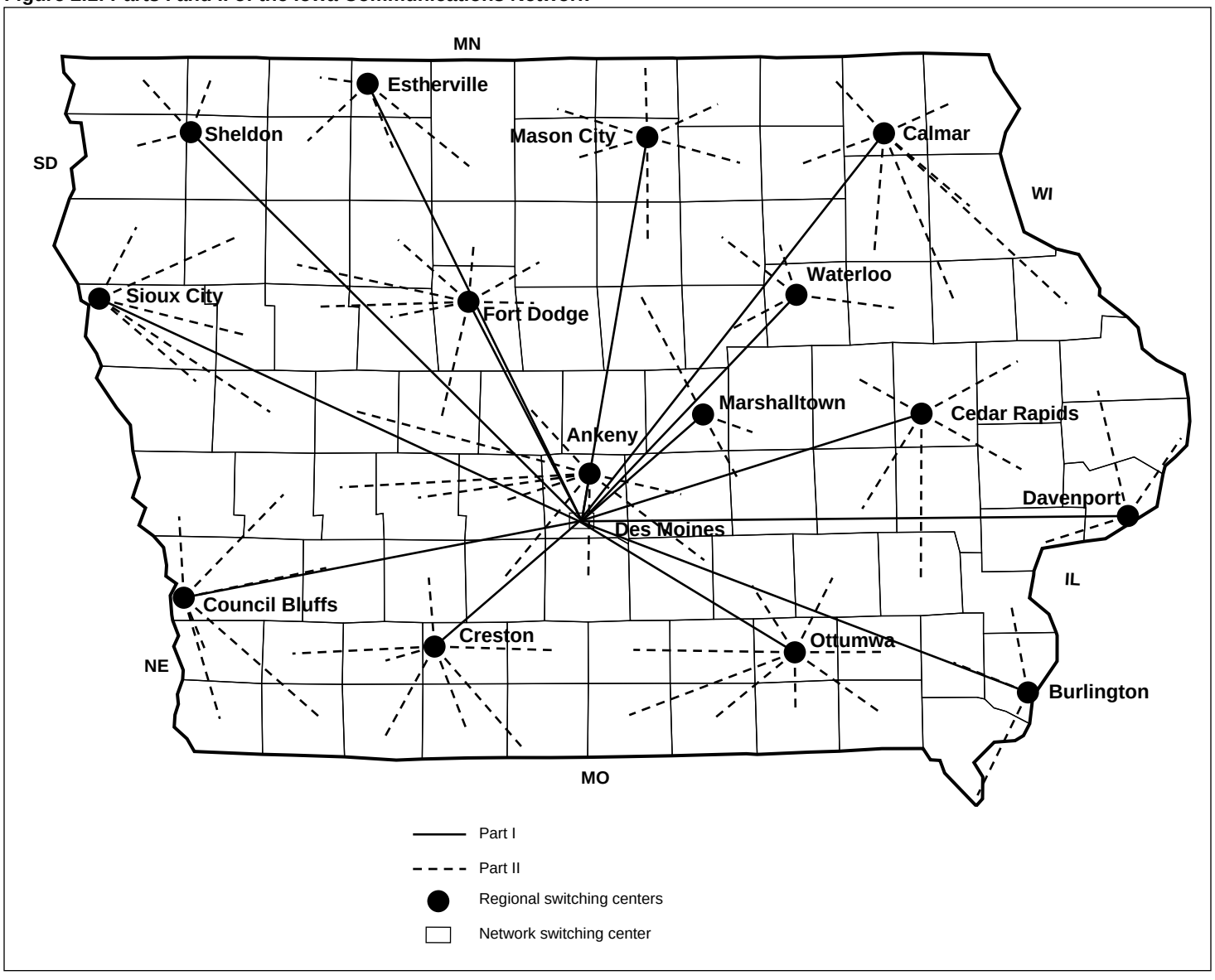
First Parts of Iowa's Network Were Completed With State Financing

Despite these difficulties, Iowa has now completed parts I and II of its network. The first part entailed installing a network control center at an armory in central Iowa and linking it to the state's 15 community colleges, 3 state universities, and more than 25 private colleges; Iowa Public Television; and the state capital complex. The second part involved extending the network so that it was available in each of the state's 99 counties. These two parts were completed by late in 1993. State officials

[1]See Special Report on the Iowa Communications Network, State of Iowa, Office of the Auditor of State (Nov. 30, 1993).

estimated that Iowa had spent more than $100 million to build the network as of the end of 1993. Figure 2.1 shows the network Iowa built during these first two parts.

Figure 2.1: Parts I and II of the Iowa Communications Network



Source: GAO's illustration based on information from the Iowa Communications Network.

Iowa Is Attempting to Share Future Costs With Private Sector

Iowa began Part III of its network in early 1995. In this final part, Iowa will connect an additional 474 sites by 1999, including more than 350 schools and 87 libraries, at an estimated additional cost of about $95 million. Under Part III, Iowa is required by statute to lease fiber optic cable facilities from qualified private telecommunications providers. Thus, to connect the remaining sites, the state is contracting with private companies to provide the local connections. The state will pay the construction cost of installing the fiber circuit, then lease the circuit from the private provider for 7 years. State officials expect this arrangement to be especially beneficial to the smaller telephone companies. This arrangement also reduces the initial amount of capital that private companies need to participate in network development.

Because of some legislators' concerns about whether the state should own and operate a network, the legislature requested a study to examine alternatives, which ranged from retaining state ownership of the network to selling the network. On the basis of the study, the Iowa Telecommunications and Technology Commission, which manages the network, unanimously recommended retaining state ownership because it was the most practical option at the time. The legislature accepted this recommendation and, according to state officials, the legislature will restudy this issue in the year 2000.

Nebraska and North Carolina Accelerated Private Investment

By the early 1990s, when Nebraska and North Carolina were beginning to seek private-sector assistance in providing advanced telecommunications services, the telephone companies were more receptive to cooperative arrangements because of changes that had occurred since Iowa began its project. According to private-sector officials we spoke with in both Nebraska and North Carolina, the telephone companies had already begun efforts to upgrade their facilities and were more willing to finance network development.

To provide the services the states wanted, the companies had to, for example, replace copper wires with fiber optic lines and upgrade their switches. According to telephone company representatives in both Nebraska and North Carolina, the companies were already planning to make some of these improvements. For example, telephone company officials we spoke with said that their companies were increasing the use of fiber optic cable in their systems because it is more cost-effective and reliable than copper lines. Officials also told us that they had already

begun to test and offer some advanced services, such as fast data service and video communications for education, in limited areas.

Iowa's experience also served as a motivating factor. By demonstrating that a state could build its own network, Iowa reduced some of the earlier uncertainties about cost and demand. However, according to telephone company officials in Nebraska and North Carolina, the telephone companies did not want the states to build networks that could compete with them for business, as Iowa had done.

Participants in North Carolina identified prior experience with advanced telecommunications pilot projects involving public- and private-sector participants as a factor that helped convince companies to work with the state on its advanced network. There, the telephone companies had conducted several projects testing advanced telecommunications applications for schools and hospitals. These tests helped convince the companies that it was technically feasible to offer advanced telecommunications services on a larger scale. Participants also identified the positive working relationship developed during an upgrade of the state's telephone system as a factor that built trust between the companies and the state government.

According to participants in Nebraska, the reduction of state regulations on telephone service prompted the telephone companies to experiment by offering new services. The companies were more willing to offer such services in Nebraska, officials said, in order to demonstrate the benefits of deregulation to other states.[2]

In this environment, the long-term leases that Nebraska and North Carolina offered—called an "anchor-tenant" arrangement—helped convince the telephone companies that responding to their states' proposals was in their best business interests. For example, as a result of a meeting with several state telephone companies, Nebraska's Division of Communications has entered into 5-year agreements to buy frame-relay services at wholesale prices. At the same time, costs are reduced for the telephone companies because the state is performing functions, such as billing, that the company performs for other customers.

[2]A court-imposed legal restriction was cited as a barrier to building statewide networks, but recently enacted legislation seeks to loosen this restriction. Certain local telephone companies, such as US West and Bell South, were previously prohibited from offering services outside of specific geographic areas. Under the new law, they can offer service outside of those areas if they meet certain requirements.

North Carolina used a similar anchor-tenant arrangement to attract private investment. After deciding it wanted to make advanced telecommunications services available statewide, the State Controller's Office asked the local telephone companies to help develop the technical specifications required for this network. It then struck formal agreements with three major local telephone companies and a long-distance company to build the infrastructure needed for its applications. In return, the state agreed to pay rates based on estimates of a certain level of use, which were derived from the original projections of the number of sites to be connected and their levels of connection time. These rates are reviewed every 2 years and can be adjusted to reflect the actual usage if the state and the companies agree. By basing their rates on projected usage and allowing for changes based on actual usage, the telephone companies could plan to recover their costs in a time period they thought was reasonable.

According to participants in the projects in Nebraska and North Carolina, these long-term agreements between the states and the telephone companies benefited the companies in the following ways:

- Investment risk was reduced by ensuring a stream of revenues to help recover the costs of installing the hardware.
- The infrastructure that was upgraded is owned by the companies, and any capacity not committed to the state could be sold to other customers. (In North Carolina, officials estimate that 75 percent of the capacity of the upgraded network will be available for lease to private customers.)
- The presence of an advanced telecommunications infrastructure can serve as an economic development tool to help states attract new business and retain existing jobs—which means the companies will have more customers to sell their services to in the future.

Although the telephone companies had begun to make some improvements to their systems, company representatives agreed that the states' efforts encouraged them to make improvements faster than they would have on their own, especially in rural areas. Representatives of one of the Nebraska companies we interviewed estimated that they had invested $7.5 million in the state system by October 1995. The company expects its investment to rise to $14 million in the near term. Officials with the three telephone companies we spoke with in North Carolina estimated that they had invested about $43 million through August 1995 to upgrade their facilities. Two of the three North Carolina companies could not,

however, estimate how much investment was due solely to the state's efforts.

States Have Provided Access to Many Local Organizations and Plan to Do More

The three states we visited agreed that making advanced telecommunications services available to public organizations was more practical than providing services to individual homes. They made services more affordable for users by providing funding for some local equipment and establishing lower prices for users than these users could obtain on their own. These policies were designed in part to address the concerns of rural residents, who could face higher prices because of the distances between rural communities and the smaller number of people living in them. While all three states have made progress in providing advanced telecommunications services to communities, they are still in the early stages of deploying their networks and plan to connect many more sites over the next several years. A review of the number of rural high schools connected in each state indicates that many are still waiting for connections.

States Have Given Priority to Connecting Public Organizations

Although all of the states wanted to accelerate the pace at which services could be made widely available, they considered delivering advanced services to homes unfeasible and unnecessary. Instead, the three states decided to provide for increased and affordable advanced telecommunication services by locating access points in public buildings—such as schools, libraries, and hospitals—where the equipment could be used by many people. Each state has begun connecting sites at these locations. Table 3.1 illustrates the type and number of organizations that have been connected to the states' networks.

Table 3.1: Examples of Sites Located in Public Organizations With Access to Advanced Telecommunications

Type of site	Iowa (as of 10/95)	Nebraska (as of 2/96)	North Carolina (as of 2/96)
Schools (K-12)	57	420[a]	53
Community colleges	50	5	24
Universities	16	3	11
Medical sites	13	1	19
Libraries	1	5	1
Other	20 (including 3 area education agencies, 2 National Guard sites, 12 state agencies, and 3 federal agencies)	9 (state agencies)[b]	10 (including 9 state and special agencies and 1 local government site)

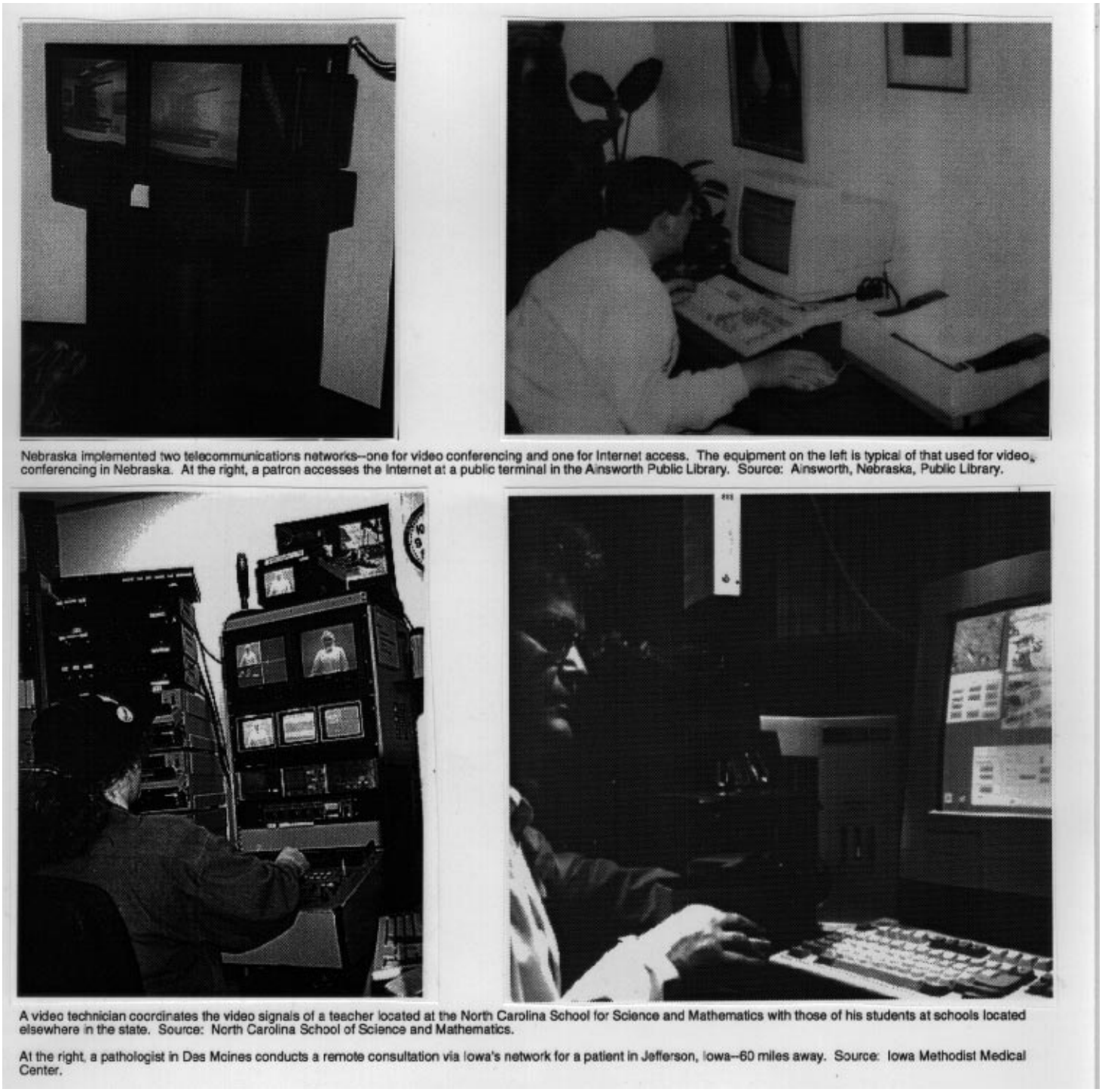
[a]Of these sites, six provide video communications.

[b]The number of other public and municipal users in Nebraska is unknown.

Source: Based on information from state officials and state documents.

Figure 3.1 shows some ways in which advanced telecommunications are being used in each state.

Figure 3.1: Examples of How Advanced Telecommunications Are Used in Three States



Nebraska implemented two telecommunications networks--one for video conferencing and one for Internet access. The equipment on the left is typical of that used for video conferencing in Nebraska. At the right, a patron accesses the Internet at a public terminal in the Ainsworth Public Library. Source: Ainsworth, Nebraska, Public Library.

A video technician coordinates the video signals of a teacher located at the North Carolina School for Science and Mathematics with those of his students at schools located elsewhere in the state. Source: North Carolina School of Science and Mathematics.

At the right, a pathologist in Des Moines conducts a remote consultation via Iowa's network for a patient in Jefferson, Iowa--60 miles away. Source: Iowa Methodist Medical Center.

All of the states are giving special priority to improving education, and more than 500 schools in these states now have access to instructional resources located beyond their classrooms and buildings. All three states see the use of technology as a way to equalize educational opportunities between rural and urban areas. North Carolina, like several other states, is being sued over alleged inequities in the amount of funding available to school districts in different parts of the state. The state hopes that use of the network will help alleviate these concerns and that, once connected, smaller, poorer schools will have access to specialized educational service regardless of their resource base.

All the states expect other types of users to benefit from access to the network. Iowa provides services to federal agencies, such as the U.S. Postal Service and Department of Veterans Affairs. Nebraska's video network is open to community groups such as churches and chambers of commerce. Iowa and North Carolina are using their systems to conduct judicial hearings from remote locations. In addition, Iowa and Nebraska expect to use the availability of modern telecommunications as an economic development tool. Similarly, North Carolina hopes that making advanced services available to businesses will help the state attract and retain companies.

States Have Provided Financial Support to Make Equipment and Usage More Affordable

In each of the states we studied, network users were expected to purchase and install the equipment needed to use the state networks. For example, in schools this equipment includes users' equipment—cameras, monitors, and computers—and the network connection equipment that converts information, sounds, and pictures into a form that can be transmitted.

In Iowa, local users are expected to pay for classroom equipment, but the state pays for network connection equipment for state and educational users, while federal government and medical users pay for their own connection equipment. North Carolina expects its sites to meet both costs. Nebraska expects sites to purchase the equipment needed to connect to the frame-relay system, but the state purchased the equipment for the video conferencing sites. In all three states, the sites use funds from a variety of sources to pay these costs, including capital budgets, grants, and private donations. Table 3.2 shows examples of the connection expenses that schools in each state must meet.

Table 3.2: Examples of Network Connection Costs

State	Type of network	Key uses	Estimated cost of on-site equipment
Iowa	SONET	Full-motion video	$90,000-$100,000
Nebraska	T-1	Compressed video	$50,000
	Frame-relay	Data (Internet)	$3,000
North Carolina	ATM/SONET	Full-motion video	$80,000- $120,000
	ATM/SONET	High-speed data	$40,000

Source: Based on information from state officials and documents.

Nebraska's video costs are lower than Iowa's and North Carolina's, reflecting the state's decision to use less-expensive technology. North Carolina's State Controller believes that the communities' expenses will decline as the state's network technology matures and becomes more generally available.

All three states found that some local sites needed assistance in paying for on-site equipment and offered such assistance using a variety of techniques. Iowa is using appropriated funds to help schools pay for local connection equipment. Nebraska has funded some educational connections through several sources. For example, it has created a School Technology Fund from funds available from a planned program to winterize the schools and proceeds from the state lottery. Grants from this fund will be used to help schools with small budgets pay to prepare rooms and connect with the frame-relay network. Also, the state's Public Service Commission allowed telephone companies to use a tax windfall to help schools connect to the Internet instead of returning these funds directly to consumers. The North Carolina legislature created grants that can help local sites meet the cost of preparing rooms and connecting equipment. Of the first 132 sites planned to be connected in North Carolina, 115 received some form of state funding.

States and communities have also used funds from federal programs to pay for users' equipment and network connection equipment.[1] For example, the Iowa National Guard used funds from the Department of Defense's Advanced Research Projects Agency (ARPA) to link its 60 armories. North Carolina's sites have also received grants from federal agencies, including ARPA, NTIA, and USDA. Table 3.3 lists examples of the use of federal assistance by states and localities for network development.

[1]We plan to issue a report on federal programs available to assist rural communities with telecommunications later in 1996.

Table 3.3: Examples of Federal Grants Used for State Telecommunications Projects

	Iowa		Nebraska	North Carolina	
Location of site	Iowa National Guard	Iowa Methodist Medical Center	Nebraska Department of Administrative Services	Public Library of Charlotte and Mecklenburg	Office of the Governor
Amount	$9.5 million	$700,000	$212,455	$450,000	$550,000
Source	ARPA	Health Care Financing Administration	NTIA	NTIA	NTIA
Purpose	Connect 60 armories	Link rural hospitals to the Des Moines Medical Center	Plan for statewide integrated telecommunications infrastructure	Provide for 114 public computer terminals for gaining access to information resources	Connect emergency departments at four teaching hospitals to those in four rural hospitals and a military base for remote consultations

Source: Based on information from Department of Commerce and state officials.

According to an Iowa education official, federal funds have been key to Iowa's ability to connect schools in a wide range of communities. A North Carolina official indicated that federal funds used for earlier state projects, such as a medical project partially funded by the National Science Foundation, contributed to their ability to plan and implement a statewide network.

Two states—Iowa and North Carolina—are making the services more affordable by charging the same price for using the network at every location, even at remote locations that are more expensive to serve. According to the North Carolina Governor's Office, North Carolina is committed to ensuring that those who need service most, including residents in remote rural areas, will not have to pay more for services than those in other regions. Iowa shares this commitment, stating that there will be no regional price penalties. As a result, residents in rural counties in Iowa and North Carolina can obtain services at the same rate as users in urban counties like those where Dubuque and Raleigh are located. Nebraska has not averaged rates for all of its users but has averaged costs for state agency users.

The prices that local organizations pay for network services vary by state. Users in Nebraska pay lower fees than users in the other two states because Nebraska's technology is less advanced. All of the states charge

users by the hour to use their systems, but North Carolina also charges a fixed monthly fee. Table 3.4 illustrates the networks' rates for services and how they are applied.

Table 3.4: Examples of Rates for Using the Video Network

State	Type of network	Price of network use
Iowa	SONET	$5/hour for educational users, $10/hour for state government users, $40/hour for other users
Nebraska	T-1	$20/hr
North Carolina	ATM/SONET	$2,992/month plus $23/hour[a]

[a]The rate that North Carolina charges its users is readjusted every fiscal year. Before November 1995, North Carolina charged $4,000 per month for up to 64 hours of network use, plus $75 per hour for additional hours.

Source: Based on information from state officials and state documents.

In North Carolina, the state government is the telecommunication industry's largest customer, and the state has used this position to purchase network services on behalf of other eligible network users. This strategy makes network use more affordable for local sites, allowing them to purchase network time at prices 25-30 percent lower than those available on the open market. The Nebraska state government is also purchasing large amounts of capacity and reselling it to regional educational facilities at prices that state officials said were lower than the facilities could negotiate by themselves. As a large customer, the state has also obtained discounts of approximately 50 percent from telephone companies for schools that are using the network.

All three states have also used direct subsidies to make the services more affordable. Iowa currently subsidizes school sites, paying $35 of the $40 an hour that schools are charged for using the network. A raise in this rate resulted in a dramatic decrease in video usage, and the $5 rate was reinstated after school officials indicated that they were unwilling or unable to pay more. In order to encourage participation in the frame-relay network, Nebraska paid the usage charges for all of the regional educational facilities connected to this system during the first year of the network's operation. In North Carolina, the legislature originally allowed state funds to be used for either site equipment or network costs. For the current fiscal year, the legislature approved funds averaging $2,800 per

month for each site to subsidize network costs for those sites already connected to the network.

Many Sites Are Connected Already, but Even More Remain Unconnected

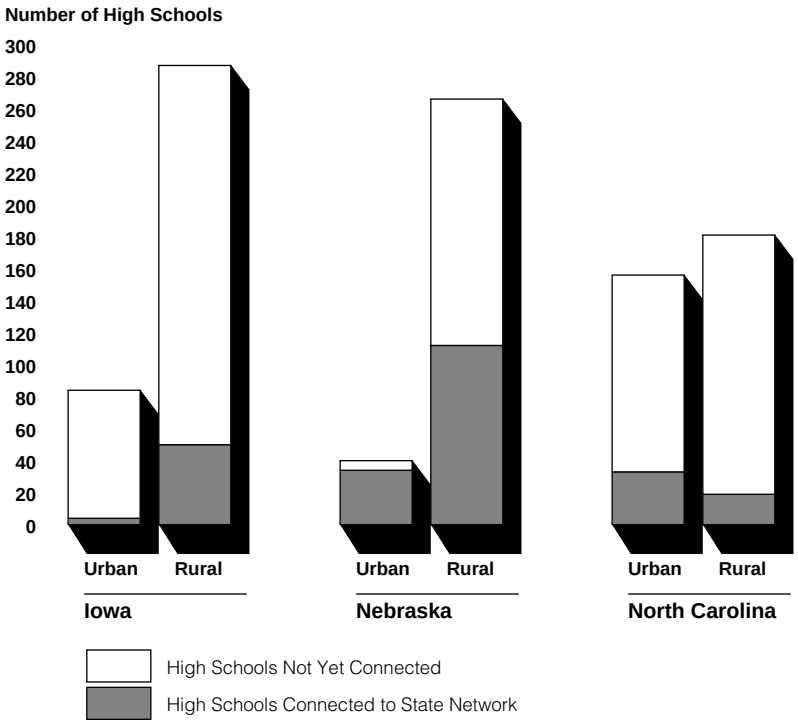
Although the three states are still in the early stages of developing their networks, each has made progress in making advanced telecommunications services widely available to its citizens through organizations such as schools, hospitals, and government agencies. Iowa has completed two of the three parts of its project. As of October 31, 1995, it had connected 157 sites, and it plans to connect 474 more sites by 2000. Nebraska had connected over 400 schools (kindergarten through 12th grade) as of February 1996 and is working with a number of communities to help them develop demand for new applications. North Carolina has connected over 100 sites of the 800 sites the Governor's Office estimated that the state would connect by the end of 1999.[2] However, in 1995 the legislature prohibited the use of state funds to connect additional sites without further legislative approval.

Despite this progress, much remains to be done to make affordable advanced telecommunications services widely available. For example, despite each state's emphasis on improving and equalizing education, none of the three states had succeeded in connecting half of its high schools by November 1995. Nebraska had made the most progress, connecting 140 of its 300 high schools. More of the states' unconnected schools are located in rural counties, where students may be distant from urban centers.[3] These counties also contain more of the states' high schools (see fig. 3.2).

[2]The state also identified more than 3,400 sites as the maximum potential number that could be connected.

[3]According to North Carolina officials, one additional high school was connected after November 1995. The high school is located in rural Hyde county.

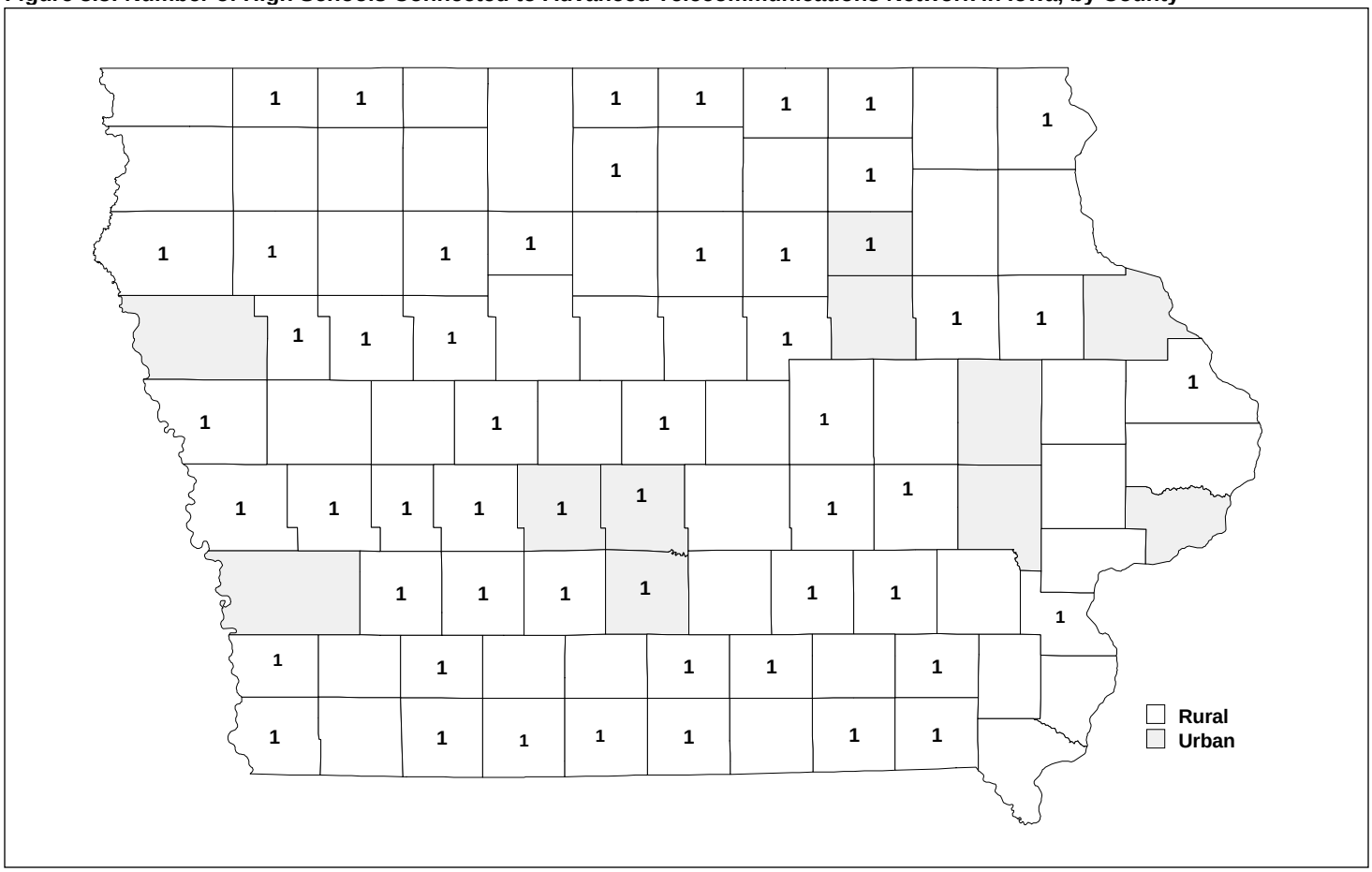
Figure 3.2: Number of Connected and Unconnected High Schools in Urban and Rural Counties in Three States



Source: Based on information from state officials and documents.

In Iowa and Nebraska, the connected high schools are spread fairly evenly throughout the states. In North Carolina, however, a larger number of counties do not have even one high school with access to its advanced telecommunications network. Figures 3.3, 3.4, and 3.5 show the geographic distribution of the connected high schools in each state by county. For all three states, maps showing the connected high schools relative to the total number of high schools in each county are presented in appendix I.

Figure 3.3: Number of High Schools Connected to Advanced Telecommunications Network in Iowa, by County



Sfigure 3.4: Number of High Schools Connected to Advanced Telecommunications Network in Nebraska, by County

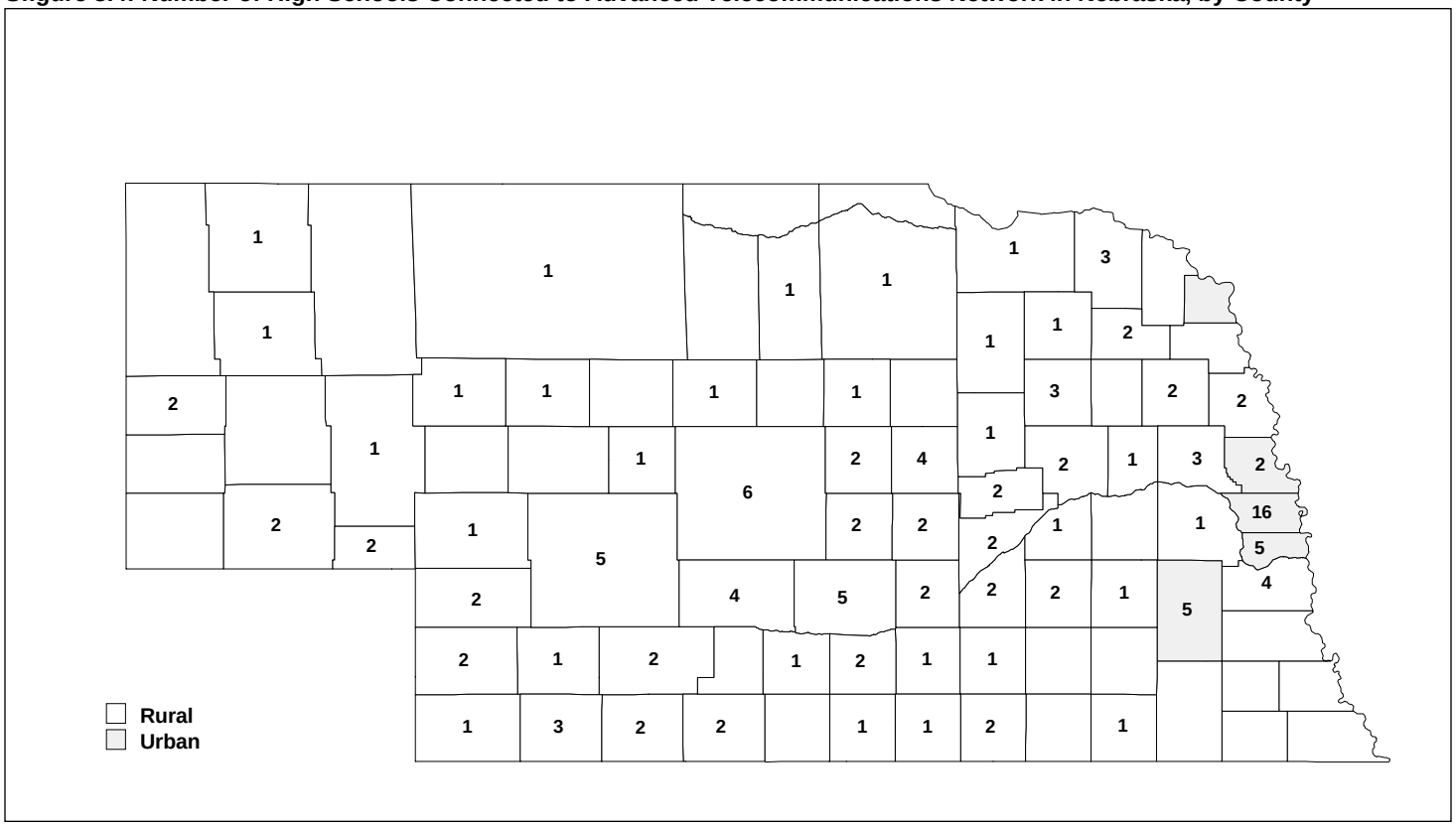
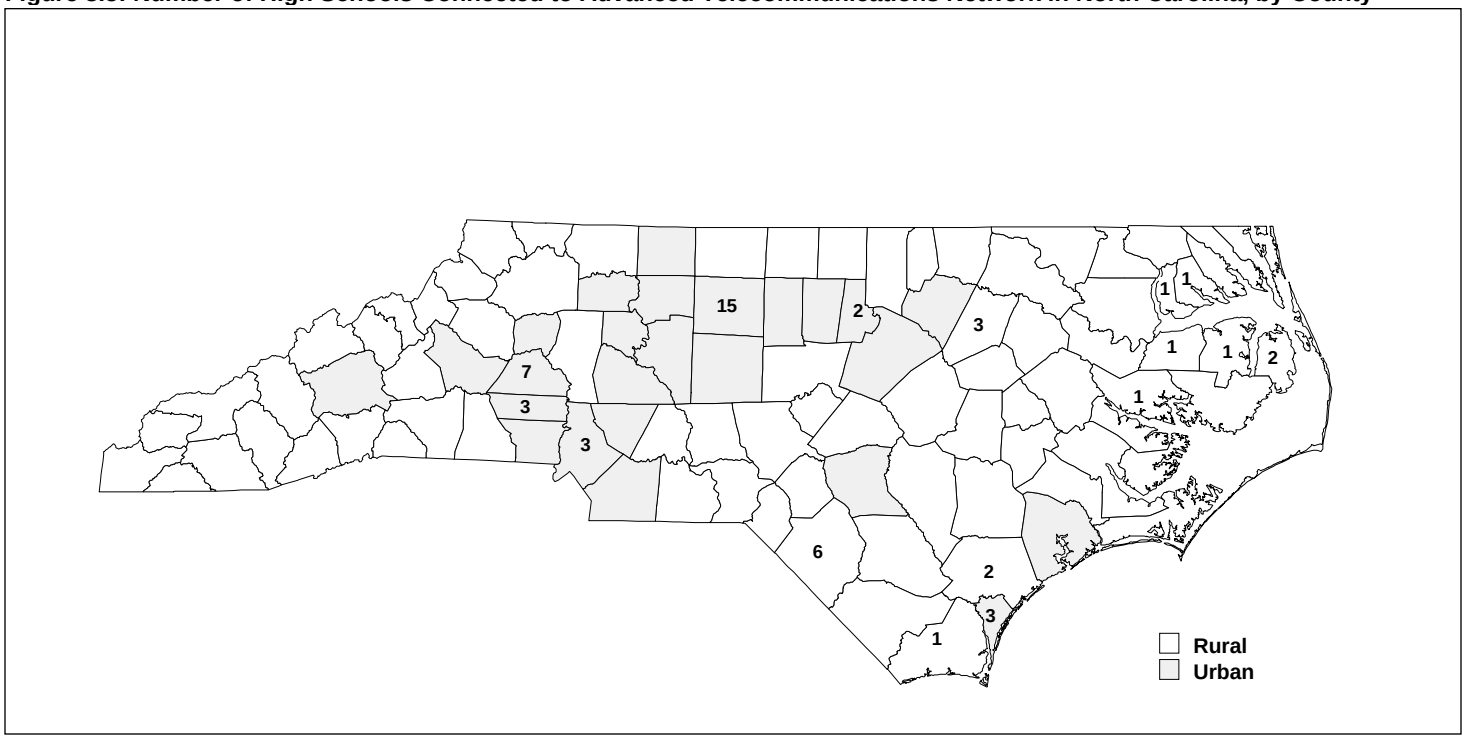


Figure 3.5: Number of High Schools Connected to Advanced Telecommunications Network in North Carolina, by County



Lessons Offered by the Experiences of Three States

The three states we studied recognized that planning and building an effective statewide advanced telecommunications network is an expensive undertaking that can require years to complete. Their experiences illustrate the importance of building and maintaining consensus among those parties that will be involved in constructing, financing, and using the network—the telecommunications companies, anticipated users, state legislators, and state executive branch officials. Addressing the concerns of these parties can help prevent the construction delays and increased costs that result from disagreements and financial constraints. These lessons can be used by other state policymakers as they begin or expand their own advanced telecommunications projects, as well as by federal policymakers who are considering what role the federal government should play in developing a national information infrastructure.

Telecommunications Companies Need to See Return on Investment

Securing the involvement of the telecommunications companies, whose existing telephone and cable television systems can form the basis of an advanced telecommunications network, is a key step, participants told us. Without cooperation from these companies, a state can build its own network, as Iowa did, but it will incur substantial construction and maintenance costs. Company representatives stressed that a company will only invest in upgrading its infrastructure if it expects to recover its investment in a reasonable amount of time. Such investment did not occur in Iowa, where, according to state and private-sector officials, the companies viewed the project as risky and had doubts about the profitability of building the network. Several factors contributed to this assessment, including the perceived technological risk and uncertainty about whether other customers would pay for such services.

Conversely, Nebraska and North Carolina were able to encourage private investment because they worked with the companies to ensure that their proposals made "business sense." Both states involved the companies in decisions about the network's design so they would know how much investment was needed to provide the anticipated services. In Nebraska, this process resulted in adopting a system using well-known technology, thus reducing both the initial investment and ongoing usage costs. In North Carolina, the companies agreed to provide the state with a system based on state-of-the-art technology that was more expensive to install and use but could have a longer useful life. In both cases, the states and the companies agreed on a system that they believed was technically feasible as well as cost-effective. Both also entered into long-term agreements with customers (namely, the state) to guarantee a stream of revenue that the

companies could use to repay their initial investments and thereby reduce their risks. Also, by working with the state, the companies could prevent the introduction of a potential competitor by heading off the construction of a state-owned network like the one built by Iowa. Finally, the companies recognized that they could benefit from the networks by selling advanced services to private customers and by using the network to attract new customers and retain existing ones.

Agreeing With Potential Users on What the System Will Be Used for Is Important

Involving the potential users, including local educators and medical professionals, state agencies, and businesses and trade organizations such as chambers of commerce, is also important to ensure general agreement about what services the network should provide. If the system does not meet the needs of the anticipated users, deployment can be slowed, thereby increasing costs for those who are using the system. For example, while North Carolina involved potential users during the planning for its network, the project has experienced slower-than-anticipated acceptance by some users because of the high cost of using the system. One reason for this lower acceptance is that the system was designed to carry two-way video to multiple sites. However, some of the schools that the state anticipated would use the network wanted to buy only access to the Internet at higher speeds than were available over conventional telephone lines, which is a less expensive service to provide.[1] As a result, some users were unwilling to pay for the capacity to send and receive video images, when they would rather have had less expensive data connections. Since the rates the state pays the telephone companies were based on estimates of use that have not been met, these rates, and ultimately the rates charged to users, could go up to allow the telephone companies to recover their investment, further discouraging use of the statewide network.

In Iowa, the development of the network was delayed by a disagreement over what services to offer. While the network was always intended to provide video communications for the state's schools, disagreement arose about whether it should carry telephone calls. Iowa's state auditor found that this lack of agreement caused several design changes, which slowed the progress of the network.

[1]Officials told us that the state also offers this type of service, but not over the ATM/SONET network.

Local User Connections Often Depend on Funds That May Not Be Available in the Future

As discussed in chapter 3, paying for equipment to connect to the network and paying the ongoing usage charges can represent a substantial investment by local users. The states expected local users to pay the costs associated with connecting to and using their networks. However, each state currently offers some type of financial assistance to help pay some of these costs. Only one of three states, though, has approved enough funding to connect all the users it planned for. In Nebraska, the state plans to connect all elementary and high schools to the Internet by 2000. The state legislature has approved $13 million for this purpose from a fund originally created to winterize the schools. According to a state education official, this amount should be sufficient to pay for connecting all of the state's schools to the Internet. Iowa enacted a plan to connect 474 sites to its network by 2000 but initially appropriated funds to pay for about 100 sites through fiscal year 1996. North Carolina has also approved state funds to assist users through 1996 but has not approved funds to assist current users in future years or to connect additional users. If the states do not commit additional funding, there is no guarantee that the sites that want to participate later will get the same assistance that the current sites are getting. As a result, some local sites may be less likely to connect to the networks if they have to pay more of the costs themselves.

Some local organizations have also used grants from federal agencies to help pay for connection equipment. However, under recent proposals, some of the programs that provided these funds may be eliminated. For example, there are proposals pending in the Congress to eliminate funds for the Department of Education's Star Schools program, which helped pay for classroom equipment in Iowa. In addition, NTIA's information infrastructure grant program, which serves mainly rural and disadvantaged urban areas and provided grants in Nebraska and North Carolina, has been proposed for elimination. Should these proposals be carried out, local users would have fewer funding sources available to help pay the costs associated with using the advanced communications technology.

Maintaining Legislative Support for Projects' Financing Can Help Prevent Delays

Each of the states planned to complete its advanced telecommunications project over a number of years. In Iowa and North Carolina, where state funding was planned as a major source of resources for the project, it was necessary to request funding approval from the state legislature several times. Since both projects based their plans on future appropriations, they experienced delays when they did not receive the level of funds they anticipated. In Iowa, the legislature originally approved about $50 million over 5 years to construct that state's network. However, a series of

reductions and redirections reduced that amount by over 50 percent to $23 million. In a report, the state auditor found that these shortfalls could impede the progress of the project. North Carolina's legislature approved $4.1 million for the project as requested in fiscal year 1993. In fiscal year 1994, the governor requested an additional $5.3 million for the project, but the legislature rescinded the original appropriation and approved $7 million. A report by the state auditor concluded that this uncertainty about funding left potential users in a quandary in trying to plan for participation in the network.[2] More recently the legislature appropriated $2.5 million for use through June 1996—again less than requested by the governor. In addition to providing less funding than requested, the legislature explicitly prohibited the use of state funds to connect additional sites to the network without further legislative approval. As a result, North Carolina has been able to connect far fewer sites than it had planned.

Although Nebraska also planned a multiyear project, it did not rely on appropriated state funds. Instead, it was able to identify funding for its project from other sources, such as lottery proceeds and a one-time tax refund to telephone companies.

States' Executive Branch Can Provide a Project Advocate and Coordinated Leadership

Each of the projects in the states we visited spanned a number of years—longer than the individual terms of office of any of the elected officials in those states. According to those we spoke with, having someone who could serve as an advocate for the program despite changes in political leadership was helpful to maintaining the government's support for the project. For example, in Nebraska, the director of the Division of Communications, has worked on the project from its inception, through the governor's two terms of office. Despite changes in legislative support, North Carolina's project kept progressing, in part because of the efforts of the governor's technology advisor, who had been involved in the design of the project since its inception. In Iowa, the governor has been in a position to advocate the state's program for nearly 10 years as a result of being reelected to several consecutive terms in office.

While an advocate can provide the vision that keeps the project on track, a lack of consistent and coordinated management can limit the effectiveness of the project. According to a report by Iowa's state auditor, the lack of a consistent management structure was one of the problems that hindered

[2]Performance Audit Report: North Carolina Information Highway, Office of the State Auditor, North Carolina (Mar. 1995).

the implementation of the state's project.[3] Responsibility for the project was initially split between the public television agency and the Division of General Services, which had three different administrators during the first 3 years of the project. It was not until 1994—3 years after network construction began—that the legislature enacted a formal management structure, the Iowa Telecommunications and Technology Commission, to oversee the network's operations.

Similarly, in North Carolina a 1992 performance audit report found that the state needed to restructure its governance of information technology and that it had not performed adequate planning for information technology.[4] In response, the state formed the Information Resources Management Commission, which is responsible for setting state policy on information technology projects, including the statewide network. However, a 1995 report by the state auditor found that while progress had been made, the number of agencies and other organizations involved with the network raised the potential for problems due to a lack of coordination. The report recommended that the state's technology-related functions be further consolidated.[5] The state controller, who provides the staff for the commission, did not concur with this recommendation on the grounds that the commission was formed to perform this function and that it was too early to evaluate its effectiveness.

Agency Comments

We discussed a draft of this report with senior officials in the three states we visited, including the Chief Operating Officer, Iowa Communications Network, and the Education Policy Advisor, Office of the Governor of Iowa; the Director, Division of Communications, State of Nebraska; and the Advisor to the Governor for Policy, Budget, and Technology and the State Controller in North Carolina. Each provided comments to clarify and update the draft, and we incorporated them where appropriate.

The Iowa officials commented that we had not included enough detail about the technical capabilities of their network or the applications it supported. Because our report is intended for a non-technical audience, we did not include the technical language they proposed. We did, however, add information in chapter 3 about how the network is used beyond the specific education and medical applications we identified. The officials

[3]Special Report on the Iowa Communications Network.

[4]Performance Audit of Information Technology and Telecommunications, North Carolina General Assembly Government Performance Audit Committee, Vol. I, Final Report (Dec. 1992).

[5]Performance Audit Report: North Carolina Information Highway.

also pointed out that the state legislature is currently considering a proposal to provide $150 million in educational technology funds. We did not include this information because the proposal had not been adopted as of February 23, 1996, and because the funds would not necessarily pay for costs related to the network.

The North Carolina officials told us that the 3,400 sites originally identified as potential connections to the network were meant to represent the maximum potential sites that could be connected and, as such, are not the project's current goal. They said that the only official recommendation for the number of sites to be connected is the 1993 Governor's Office estimate of 800 sites to be connected by 1999. We changed the draft to reflect this clarification. Officials with the State Controller's Office commented that there was no need to further consolidate state information technology management, as recommended by the state auditor. They said that reorganization was unnecessary because the recently created Information Resources Management Commission, which is housed in the Controller's Office, already performs that function. The state auditor, however, identified several other organizations that still have responsibility in this area. Officials with the Controller's Office confirmed that the responsibilities of the organizations identified in the state auditor's report have not changed. We clarified our discussion of this issue and noted that the controller did not concur with the auditor's recommendation.

The Nebraska official who reviewed the draft provided clarifying comments and updated data. Officials with NTIA, including the Director, Public Broadcasting Division, Office of Telecommunications and Information Application, also reviewed the draft. They told us that it accurately portrayed NTIA and its program.

Location of Connected and Total High Schools in Three States, by County

Each of the states we visited has begun efforts to make advanced telecommunications more widely available. Within this broader objective, each state has focused on providing its schools with access to advanced services, such as high-speed Internet access or two-way video communications. To date, more than 500 schools have access to these types of services. To further illustrate the status of the states' advanced telecommunications projects, the maps below show the number of high schools in each county that were participating in the project according to the most recently available data. For comparison, the total number of high schools in each county is also presented. The shaded counties are those classified as metro, or urban, by the U.S. Department of Agriculture.

Figure I.1: Connected High Schools and Total High Schools in Iowa, by County, as of November 1995

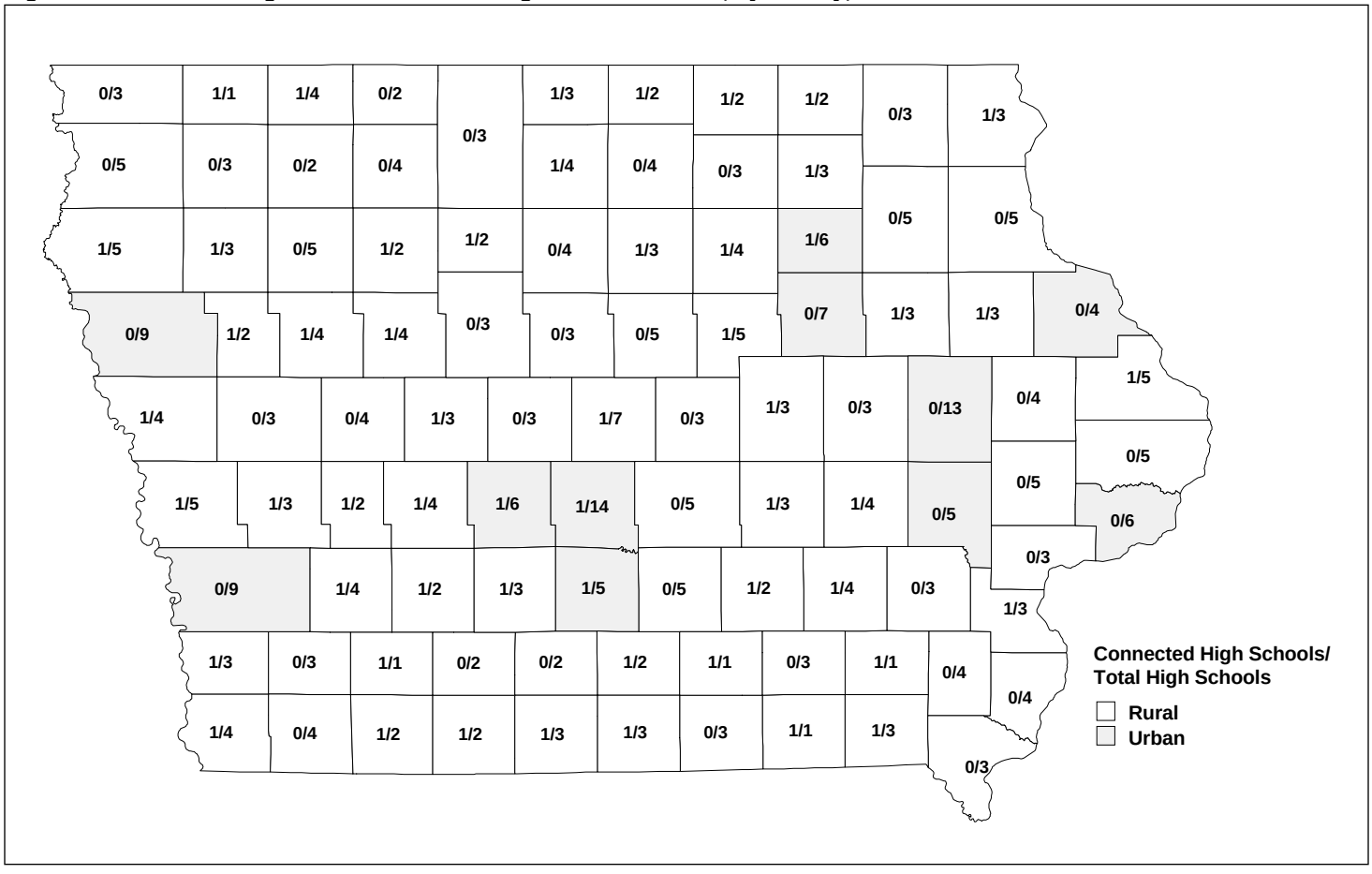


Figure I.2: Connected High Schools and Total High Schools in Nebraska, by County, as of November 1995

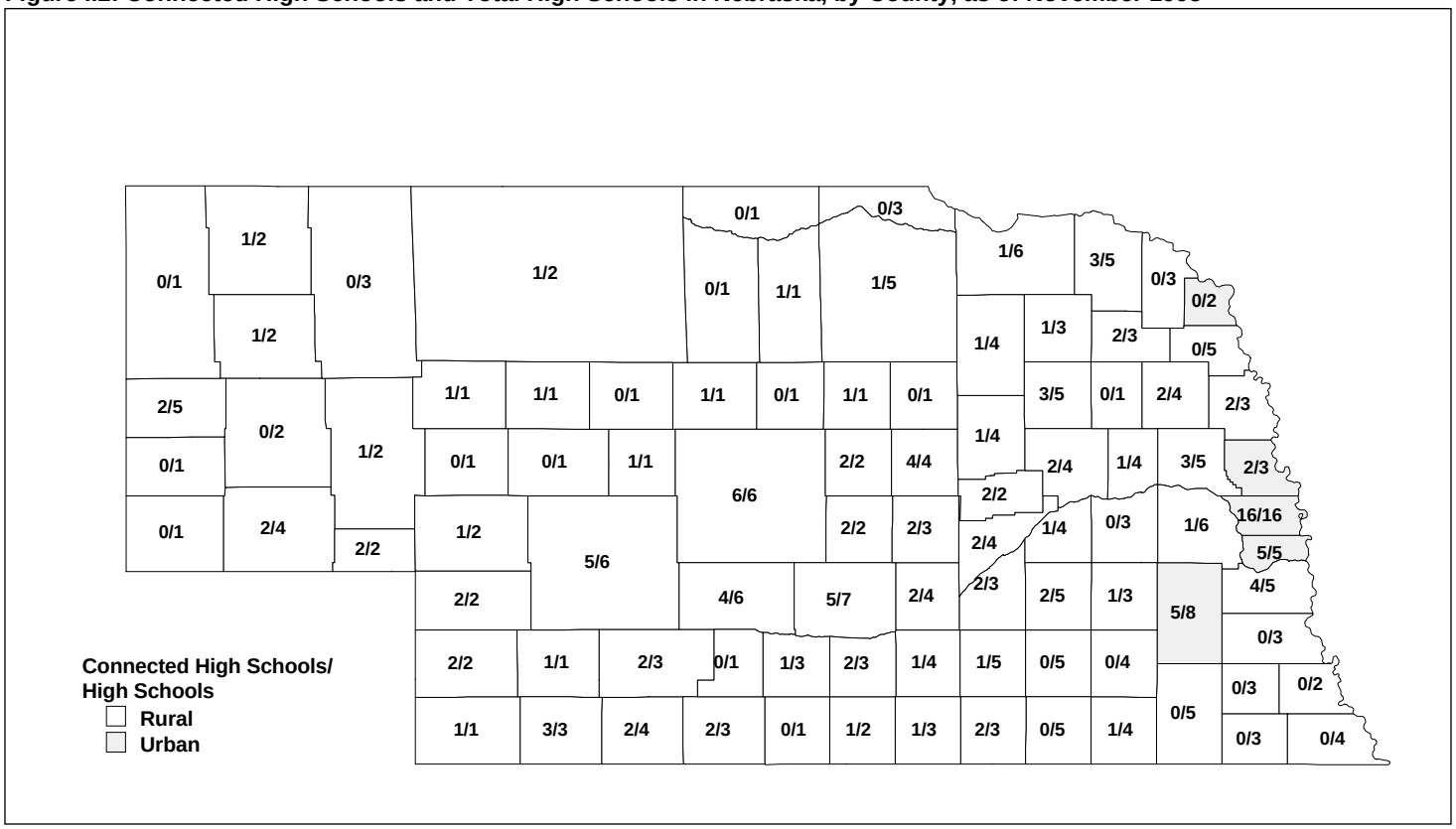
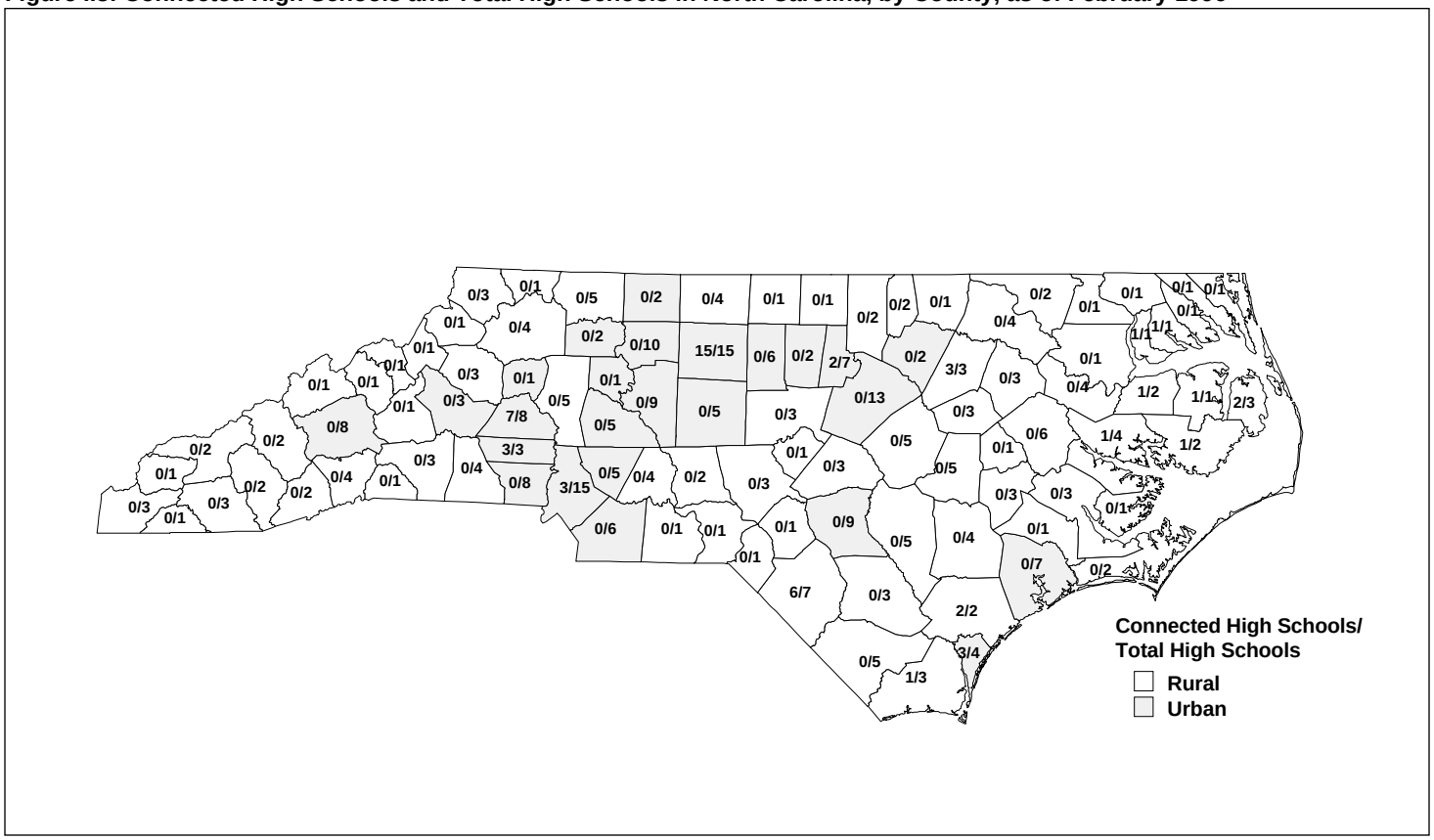


Figure I.3: Connected High Schools and Total High Schools in North Carolina, by County, as of February 1996



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