Report to the 77th Texas Legislature

Availability of Advanced Services in Rural and High Cost Areas

Public Utility Commission of Texas
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EXECUTIVE SUMMARY

> It is the policy of this state to ensure that customers in all regions of this state, including low-income customers and customers in rural and high cost areas, have access to telecommunications and information services, including interexchange services, cable services, wireless services, and advanced telecommunications and information services, that are reasonably comparable to those services provided in urban areas and that are available at prices that are reasonably comparable to prices charged for similar services in urban areas. Not later than November 1, 1999, the commission shall begin a review and evaluation of the availability and the pricing of telecommunications and information services, including interexchange services, cable services, wireless services, and advanced telecommunications and information services, in rural and high cost areas, as well as the convergence of telecommunications services. The commission shall file a report with the legislature not later than January 1, 2001. The report must include the commission's recommendations on the issues reviewed and evaluated.[1]

The Internet has changed our lives in ways only a few could have imagined. Ready access to unprecedented amounts of information has transformed the way that businesses operate, people are educated, and the world communicates. In sum, the Internet has made more information, of higher quality, available faster to more people than ever before.

High-speed access to the Internet is increasingly seen as critical to Texas' economic development, especially in rural Texas. While some rural areas may be well connected, most still lack access to the same telecommunications infrastructure or technologies enjoyed by those living in urban areas.

This *Report to the 77th Legislature on the Availability of Advanced Services in Rural and High Cost Areas* provides an in-depth discussion of why advanced services are important to the state's economic development. This executive summary will discuss the major issues associated with advanced services deployment, as well as policy recommendations the Legislature may wish to consider.

[1] Public Utility Regulatory Act, TEX. UTIL. CODE ANN. § 51.001(g) (Vernon 1998 and Supp. 2000) (PURA). Added by Act of May 30, 1999, 76th Leg. R. S., S.B. 560, Ch. 1212, 1999 Tex. Sess. Law 4210.

Role and Development of Advanced and Information Services

The majority of small rural communities face the twin challenges of attracting businesses and stemming the outflow of their residents to urban areas. Advanced telecommunications services may play an important role in addressing these challenges.

Today, e-commerce, telemedicine, and telecommuting are already improving the quality of life for rural Texans. Over the last five years, the state's Telecommunications Infrastructure Fund (TIF) has had a major impact in providing access to essential community services, such as health care, education, and library resources in rural Texas. The TIF's recent Community Network Implementation Grant program, for example, awarded 36 grants to help several small Texas communities, such as Commerce and La Grange, work collaboratively to obtain access to telecommunications resources. These communities and others across Texas and the rest of the nation have been especially pro-active in investing in broadband infrastructure and provisioning advanced services to their citizens. This civic activism has been a powerful tool to help connect small towns.

Tomorrow's challenge is how to best use advanced services to further the state's economic development, particularly in rural areas. Already, those involved with economic development believe that access to advanced telecommunications services is a necessary component for economic development and for participating in the emerging Internet economy.

Advanced Services Deployment and Community Perceptions

This Report utilizes the results from two state surveys to paint a comprehensive picture of computer and Internet usage in Texas.

The first survey, conducted by the Telecommunications and Information Policy Institute (TIPI), at the University of Texas, examines the demographic and behavioral aspects of Internet use.

The TIPI report illustrates that computer and Internet usage among Texans exceeds national levels and that usage does not differ significantly between rural and non-rural Texas residents. The TIPI results are also consistent with national studies showing that older people, poorer people, and certain portions of minority groups generally have lower computer and Internet usage levels.

Further, the TIPI study shows that some rural residents report that they do not have easy Internet access. It also shows that rural Internet users are adopting broadband technologies at a slower rate than urban users, although interest in high speed Internet access is as high in rural as in urban areas.

The second survey, developed by the Texas Rural Development Council (TRDC) and the Texas Economic Development Council (TEDC), collects views from community leaders regarding the importance of advanced services to rural economic development. The TRDC/TEDC study reveals that rural communities have a strong desire for high-speed Internet access and view high quality telecommunications infrastructure as essential to economic development.

Advanced Services Technologies Overview

While traditional dial-up modem access remains for most Texans the principal means of accessing the Internet, new high-speed technology alternatives are rapidly becoming available. Preeminent among these new technologies are digital subscriber line, cable modems, wireless technologies, and satellite access.

These technologies will all play a role in advanced services deployment. Telecommunications and cable infrastructure can be upgraded to provide high bandwidth, but may not be suitable for all parts of the state because low population density and longer distances increase deployment costs. In some rural areas, a fixed wireless network or satellites may cost substantially less than wireline or cable offerings.

Status of Advanced Services Deployment in Texas

There are many encouraging signs that competition and technology are driving broadband deployment, particularly in urban parts of the State. Telecommunications carriers, cable companies, wireless providers, and satellite companies are all making large investments across the state to provide access to advanced telecommunications capabilities. At the same time, the state is at an early stage of technology adoption, with current penetration levels for advanced services remaining relatively low.

Several emerging issues indicate that some regions of the state and certain customers may be not be receiving "reasonably comparable" access to advanced telecommunications services:

- "Middle mile" infrastructure, which provides high-speed data transport from a telephone company central office to the Internet backbone, is generally available, but the lack of transport infrastructure and the cost of connecting to the Internet backbone may contribute to some rural areas not having access to advanced telecommunications infrastructure.

- Deployment of "last mile" broadband infrasturcture, which provide connections from a central office to a home or business, is still at a relatively early stage. Deployment appears to be occurring at a faster pace in urban areas than in rural communities.

Issues and Prospects for Broadband Deployment

Competition is rapidly driving carriers to deploy advanced telecommunications services. Deployment of these services appears to be following a standard technology adoption curve. Despite the aggressive effort by carriers to roll out advanced services, most competitive and innovative services are available only in densely populated areas. Rural areas face challenges in gaining access to advanced telecommunications services, given the disparities between rural and urban areas in demographic characteristics such as income, population, and density.

Potential Policy Solutions

Both Congress and the Legislature have established policy objectives recognizing the importance of "reasonably comparable" access to advanced telecommunications services.

Some jurisdictions have begun to establish a date certain for achieving universal broadband access. Similarly, Texas could consider establishing a goal that all Texans have access to affordable advanced services within a reasonable time. The goal could specify that service should be reliable, easy to use, robust, and scaleable to growing needs and uses. Any goal must remain flexible enough to adapt to technological advances.

If the Legislature believes that certain communities and individuals are being left behind in achieving the state's goal for advanced services deployment, then the state could adopt public policies to address these issues.

Any program for promoting advanced services deployment should meet several public policy objectives. Programs should be technology neutral, avoid excessive regulation, encourage local solutions, and avoid "one size fits all" solutions. Developing a "tool kit" approach that allows communities to select the program that best fits their need may be the most effective policy solution.

A "tool kit" could include specific programs that have worked well in other states, such as demand aggregation or anchor tenancy. Demand aggregation and anchor tenancy are programs that use a community's existing demand for telecommunications services to develop market-based solutions. Similarly, community Internet access and training has successfully addressed the technology training needs of "at risk" populations in other states.

The state could also leverage current programs and telecommunications investments, such as the Telecommunications Infrastructure Fund, existing economic development programs, the TEX-AN 2000 network, and the state's highway rights of way. The legislature may also want to use government resources to provide a "backstop" to market-based solutions.

Report to the 77th Legislature on Advanced Services in

Rural and High Cost Areas

> "These advanced broadband networks are the most important networks of our time. They have the power to make or break communities."
>
> —William Kennard, FCC Chairman[2]

INTRODUCTION

The Internet has reshaped the need for, and the use of, the telecommunications infrastructure in ways that seemed impossible only a few years ago. Data services have transformed the way that businesses operate, people are educated, and the world communicates. Currently, most residential users access the Internet through low speed, dial-up analog modems over existing telephone lines.

As Internet usage becomes more widespread and as new uses and applications emerge, the demand for higher speed Internet access is exploding. With broadband Internet access, Texans can create and access new Internet content, such as music, quickly exchange data, communicate through video links, and create interactive multimedia learning environments. High-speed Internet access will also become critical to Texas' continued economic development and quality of life.

New high-speed Internet access technologies are being deployed by numerous providers, including telecommunications, cable, wireless, and satellite companies across the country. These new high-speed Internet access technologies will require highly capital intensive investments through upgrades to existing infrastructure or new infrastructure deployment.

Whether these new technologies are available to all consumers has become an issue of intense public debate, particularly in light of both Congress' and the Legislature's directive that all citizens have "reasonably comparable" access to telecommunications and information services.

In its recently issued report on broadband deployment, the Federal Communications Commission (FCC) found that advanced telecommunications capability is being deployed in a reasonable and timely fashion overall. The FCC also expressed concern that five groups could be in danger of not having reasonable and timely access to advanced services deployment. Those populations are rural consumers; inner city consumers; low-income consumers; minority consumers; and tribal areas.[3]

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[2] *Digital Exclusion* (NPR's Morning Edition radio broadcast, Apr. 6, 2000).

This Report reviews the availability and pricing of telecommunications and information services and examines whether Texas consumers have reasonably comparable advanced telecommunications and information services. This Report also provides information on the advanced service technologies available to Texans today, technologies of the future, and the convergence of telecommunications services. Lastly, this Report offers policy recommendations to address potential deployment gaps.

Definitions

Advanced services are services that allow users to send and receive large amounts of information. For purposes of this Report, the FCC's definition of "advanced telecommunications capability" will be used.[4] The FCC describes "advanced telecommunications capability" as "high-speed, switched, broadband telecommunications that enables users to originate and receive high-quality voice, data, graphics, and video using any technology."[5] In addition, for the purposes of this Report, a "rural area" is defined as any county with fewer than 100,000 persons.[6] Appendix A of this Report lists all Texas counties, associated populations, and classifications as either rural or urban.

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[3] *FCC Issues Report on the Availability of High-Speed and Advanced Telecommunications Services* (visited Oct. 23, 2000) <http://www.fcc.gov/Bureaus/Common_Carrier/News_Releases/2000/nrcc0040.html>.

[4] The definition further clarifies that advanced services infrastructure must be capable of delivering a speed of 200 kilobits per second (Kbps) in both directions. The FCC defines "high-speed" as those services with over 200 Kbps in at least one direction. FEDERAL COMMUNICATIONS COMMISSION, CC DOCKET NO. 98-146, DEPLOYMENT OF ADVANCED TELECOMMUNICATIONS CAPABILITY: SECOND REPORT at ¶ 10-11 (Aug. 2000) (*Second Advanced Services Report*). Additionally, the term "broadband" is often used when referring to advanced telecommunications capability or advanced services.

[5] *Id.*

[6] However, it should be noted that the term rural could be interpreted many ways. The Texas Department of Economic Development defines a "rural community" as "communities located in counties, not included within any Metropolitan Statistical Area (MSA) boundary, as defined by the United States Office of Management and Budget, and those communities within an MSA with a population of 20,000 or fewer, not adjacent to the primary MSA city." TEXAS DEPARTMENT OF ECONOMIC DEVELOPMENT, STRATEGIC PLAN FOR THE FISCAL YEARS 2001-2005 at 21 (Jul. 13, 2000); the National Telecommunications and Information Administration (NTIA) and the Rural Utilities Service (RUS) adopted the U.S. Census Bureau's definition that "rural means towns of fewer than 2,500 inhabitants as well as areas outside of towns, including farmland, ranchland, and wilderness." *Advanced Telecommunications in Rural America: The Challenge of Bringing Broadband Service to All Americans* at 4 (Apr. 2000). Additionally, the term "rural" is defined in multiple provisions of Texas statute and code.

CHAPTER 1: ROLE OF ADVANCED SERVICES AND INFORMATION SERVICES

"Like all the previous episodes of technical advance, the revolution in information technology already has improved living conditions in numerous ways and it will likely bring future benefits to rural communities that we now can only scarcely imagine."

--Alan Greenspan, Federal Reserve Chairman[7]

Rural and urban Texans alike can benefit from high-speed data connections and applications. However, many small rural communities face numerous challenges: attracting new business and stemming a population outflow as well as providing citizens with access to essential community services.[8] It is generally agreed that advanced telecommunications services will play an important role in addressing these challenges. Over the last five years, the state's Telecommunications Infrastructure Fund (TIF) has had a major impact in providing access to essential community services, such as health care, education, and library resources in rural Texas. This chapter describes the impact of the state's telecommunications investment on education and telemedicine and identifies continued barriers to deployment. The chapter also examines how telecommunications infrastructure deployment can contribute to other goals, such as promoting economic development and allowing rural areas to participate in the coming e-commerce revolution. Lastly, this chapter will present several Texas and national success stories where rural communities have developed "community networks" to bring the benefits of advanced services to their residents and businesses.

Advanced Services Goals and Benefits

ECONOMIC DEVELOPMENT

Economic development managers are "nearly unanimous in their belief that advanced telecommunications services are important to a company's ability to compete."[9] "The traditional way that state and local governments have recruited new businesses is through various

[7] *Net Will Lift Rural Life Says Greenspan* (visited Apr. 28, 2000) <http://www.nytimes.com>.

[8] Brian Staihr, *The Broadband Quandary for Rural America*, CENTER FOR THE STUDY OF RURAL AMERICA, FEDERAL RESERVE BANK OF KANSAS CITY at 1 (Aug. 2000).

[9] EDWIN B. PARKER AND HEATHER E. HUDSON, ELECTRONIC BYWAYS: STATE POLICIES FOR RURAL DEVELOPMENT THROUGH TELECOMMUNICATIONS at 86 (2d ed. 1995).

incentives: reduced income tax, wage subsidies, reduced rent of buildings, and similar inducements."[10] Today, these "old world" incentives must adapt to the "new world."

A common element of most successful economic development efforts is "strong local leadership committed to mobilizing the community's resources and obtaining the facilities it needs."[11] A critical community resource in today's economy is access to advanced services. While access to advanced services is not the only economic development challenge facing rural areas, it is one that offers measurable results and can readily distinguish one community from the next. Unfortunately, "like the interstate highways that bypassed many rural Texas towns, the network of high-speed lines into which ISPs connect run only to the major cities."[12]

"Education and worker training will be essential in helping rural communities grow high performance, knowledge-based companies."[13] However, "telecommunications technology has the potential to overcome many rural economic disadvantages, but current market trends suggest many rural places may not have access to this technology in the future."[14]

Rural Texas, like the rest of rural America, has "many competitive advantages on which to build."[15] Whether agriculture, tourism, oil and gas exploration, or manufacturing, rural Texas has much to offer. Additionally, advanced services will not only offer more to rural consumers, but will open up worldwide markets to those rural businesses and communities with the proper telecommunications infrastructure. Economic developers must remain mindful that "rural infrastructure contributes to rural economic growth, but by itself cannot guarantee growth."[16]

The remainder of this chapter, and the recommendations found in Chapter 6 of this Report, move beyond the concept of merely putting basic advanced services infrastructure in place. Instead, it begins to bridge the gap from advanced services that improve the quality of life in rural Texas (*e.g.* telemedicine and education) to the use of advanced services to encourage and stimulate economic development.

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[10] *Id.* at 87.

[11] *Id.* at 88.

[12] *See* Texas Comptroller of Public Accounts, *Fiscal Notes* (Jan. 2000) <http://www.cpa.state. tx.us/comp trol/fnotes/fn0001/fn.html>.

[13] Mark Drabenstott, *New Directions for U.S. Rural Policy*, CENTER FOR THE STUDY OF RURAL AMERICA, FEDERAL RESERVE BANK OF KANSAS CITY at 2 (Jun. 2000) (*New Directions for U.S. Rural Policy)*.

[14] *Id.*

[15] *New Directions for U.S. Rural Policy* at 3.

[16] *Id.*

E-COMMERCE

E-commerce is the sale of goods and services over the Internet.[17] Together, the Internet and e-commerce have transformed business-to-business and business-to-customer communications. Improved communications equates to improved productivity, higher profits, and larger markets. Many, including Federal Reserve Chairman Alan Greenspan, have stated that productivity gains from the Internet are reshaping the global economy. Greenspan said there was direct evidence that the surge in production of and demand for information technologies -- most notably computers, networking and communications hardware and software -- has created an unprecedented economic expansion. FCC Commissioner Gloria Tristiani reported that "between 1995 and 1998, information technology companies, while accounting for only about 8 percent of the U.S. Gross Domestic Product, contributed on average 35 percent of the nation's real economic growth."[18]

E-commerce generated more than $300 billion in revenue in 1998.[19] "Some sources estimate that by 2003 e-commerce will account for over $3.2 trillion dollars of U.S. economic activity annually, or the equivalent of 29 percent of all domestic sales and purchases."[20] On August 31, 2000, the U.S. Census Bureau of the Department of Commerce announced that the estimate of U.S. retail e-commerce sales for second quarter 2000 was $5.518 billion, an increase of 5.3 percent from first quarter 2000.[21] E-commerce sales in the second quarter accounted for 0.68 percent of total sales.[22]

E-commerce may be especially important for rural communities because it makes areas of Texas more attractive to businesses and residents. For the first time, proximity to customers is less significant. Yet proximity to fast Internet connections remains important, as new high-

[17] *Retail E-Commerce Sales in Second Quarter 2000 Increased 5.3 Percent From First Quarter 2000, Census Bureau Reports* (last modified Aug. 31, 2000) <http://www.census.gov/mrts/www/current.html>.

[18] FCC Commissioner Glori Tristiani, Address at the New Mexico Communications Network Symposium (Nov. 10, 1999).

[19] FEDERAL COMMUNICATIONS COMMISSION, BROADBAND TODAY at 16 (Oct. 1999).

[20] Brian Staihr, *Rural America's Stake in the Digital Economy*, CENTER FOR THE STUDY OF RURAL AMERICA, FEDERAL RESERVE BANK OF KANSAS CITY at 2 (May 2000) (*Rural America's Stake in the Digital Economy).*

[21] This estimate was not adjusted for seasonal, holiday, and trading-day differences.

[22] *Retail E-Commerce Sales in Second Quarter 2000 Increased 5.3 Percent From First Quarter 2000, Census Bureau Reports* (last modified Aug. 31, 2000) <http://www.census.gov/mrts/www/current.html>.

tech startups, as well as older, more established firms, are becoming increasingly dependent upon high-speed Internet connections. Plant sites and other location decisions are increasingly being driven by the presence of a quality telecommunications infrastructure. High-speed Internet connections are also becoming more important to professionals and affluent retirees.[23] Further, "e-commerce in agriculture is expected to flourish; estimates place the value of e-commerce for agriculture in the range of $70 billion by 2003, with greater growth in the years to follow."[24] In sum, e-commerce has become an essential part of economic development. Therefore, advanced services that, thus far, have primarily been utilized to improve the quality of life of rural Texans may now become a valued tool in the economic development and commercial success of rural businesses and communities.

TELEMEDICINE

One of the first uses of high-speed data connections in rural Texas was telemedicine. "Telemedicine enables patients and providers to interact with health care professionals located miles apart. It increases patients' access to specialists through video-imaging and real-time collaboration using computer and telecommunications technology. Telemedicine also brings continuing medical education and training to isolated providers."[25] As a result, patients are saved the inconvenience, expense, and burden of traveling to separate medical facilities.

Telemedicine requires extensive bandwidth because it is critical that images are sharp and clear. In time, the American Telemedicine Association believes that the Internet will provide the required bandwidth; however, medical facilities now typically use dedicated high-speed connections, such as T-1's.[26] These high-speed facilities link one medical facility to another and cannot be used for anything other than communications between the two sites.

The Texas Department of Criminal Justice (TDCJ) utilizes telemedicine to treat inmates. The University of Texas Medical Branch on Galveston Island and Texas Tech Health Science Center in Lubbock are responsible for providing health care for approximately 130,000 TDCJ inmates. Before telemedicine, some inmates traveled as far as 850 miles for a specialty clinic appointment, with the average travel distance estimated between 200 and 300 miles one way to

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[23] Chris O'Malley, *The Digital Divide: Small Towns that Lack High-Speed Internet Access Find it Harder to Attract New Jobs*, TIME (Mar. 22, 1999).

[24] *Rural America's Stake in the Digital Economy* at 3.

[25] Senate Health Committee: Report to the 77th Legislature at 5.42 (Oct. 4, 2000).

[26] American Telemedicine Association, *Telemedicine: A Brief Overview Developed for the Congressional Telehealth Briefing* (visited Jun. 23, 1999) <http://www.atmeda.org/news.newres.htm>. A T-1 is a digital transmission link with a capability of 1.544 Mbps that runs over two pairs of copper wires that are identical to those found in residential homes.

reach the Galveston clinics. Today, telemedicine is successfully being utilized in the TDCJ managed care program to treat inmates in a cost-effective manner.[27]

Still, barriers remain to full deployment of telemedicine to rural areas. The telecommunications infrastructure necessary for broadband access in many rural areas remains financially unattractive, because "rural areas may not have the number of potential customers that would be needed to support such a venture."[28] Additionally, the cost for telemedicine providers is prohibitive in many instances. While a Telecommunications Infrastructure Fund (TIF) grant may cover first year implementation costs, "beyond the first year, the provider must absorb the costs, which are often not recouped in the patient visit charges."[29] Additionally, for-profit medical providers are ineligible for TIF funding and may not access library or school infrastructure provided by TIF funding that is now available in many rural communities.[30]

However, the TIF has awarded:[31]

- more than $21 million to enhance current or establish new healthcare services through the purchase of telecommunications equipment;
- more than $20 million to establish local area networks connected to the Internet and to purchase telemedicine equipment to provide clinical services for direct patient care;
- more than $9 million to enhance patient care by improving distance learning facilities; and
- more than $3 million to enhance local health departments' ability to enhance and/or provide public access to medical information and services.

Many of these projects have a direct impact on the availability and quality of health care available to rural Texans.

[27] Senate Health Committee: Report to the 77th Legislature at 5.47-5.48.

[28] Senate Health Committee: Report to the 77th Legislature at 5.44 (*citing* CENTER FOR RURAL HEALTH INITIATIVE'S REPORT ON RURAL TELEMEDICINE ISSUES FOR THE HOUSE SELECT COMMITTEE ON RURAL DEVELOPMENT (Jun. 13, 2000)).

[29] *Id*.

[30] *Id*. at 5.45.

[31] E-mail from Whitney Sklar on behalf of Sam Tessen, Executive Director, Telecommunications Infrastructure Fund Board (Nov. 27, 2000) (Sklar e-mail).

TELECOMMUTING AND DISTANCE LEARNING

Colleges and universities were among the first institutions to link together through the Internet in order to "telecommute." Secondary educators are also beginning to link to each other. Telecommuting provides students with more diverse course offerings and specialized classes. Many primary and secondary schools currently use high-speed connections to provide distance learning, which allows students to attend classes in a location distant from where the course is being presented.

Importantly, the TIF has funded telecommunications infrastructure, Internet connectivity, and computer equipment for 99% of Texas public school districts, representing 55% of campuses and 50% of the state's 3.9 million public school students.[32] Additionally, the TIF has funded grants to 566 of 574 rural public school districts and to 335 rural public libraries.[33] These programs, as well as others,[34] are preparing and enhancing the ability of rural Texans to participate in the Internet Age.

Community Success Stories

Communities Uniting for a Common Goal

Some communities have been especially pro-active in investing in broadband infrastructure and provisioning advanced services to their citizens. This civic activism has been a powerful tool to help connect small towns. Examples of such endeavors are Commerce, LaGrange, Hamilton, and Dell City, Texas, La Grange, Georgia, and Blacksburg, Virginia.

[32] Office of the State Auditor of Texas, AN AUDIT REPORT ON THE TELECOMMUNICATIONS INFRASTRUCTURE FUND BOARD (Feb. 2000) at 15.

[33] Sklar e-mail.

[34] *See* Appendix N of this Report.

COMMERCE AND LAGRANGE, TEXAS[35]

The TIF's recent Community Network Implementation Grant program awarded 36 grants to help several small Texas communities, such as Commerce and La Grange, work collaboratively to obtain access to telecommunications resources.

On October 18, 2000, Commerce received a $500,000 grant from the TIF to establish a community network. The Commerce Community Network is a partnership of the City of Commerce, Commerce Economic Development Corporation, Commerce ISD, Texas A&M – Commerce, Commerce Public Library, the Chamber of Commerce, and Koyote Communications. Texas A&M – Commerce President Dr. Keith McFarland noted "the new technology can be used to revitalize our rural community . . . open opportunities to underemployed rural residents and create partnerships to help our students." The community network will use digital subscriber lines (xDSL) provided by Koyote Communications via a facilities-based interconnection agreement with Sprint. The goals of the community network are to maximize options for broadband user access; establish the infrastructure for the Northeast Texas Technology Academy; and establish a state model for using advanced technologies to enhance economic development for rural communities.

Similarly, LaGrange Independent School District, on behalf of the LaGrange Community Computer Network (LGCCN), received a community networking implementation grant from TIF to provide local as well as worldwide access to education, information, and communication resources. The LGCCN includes among its partners the Colorado Valley Telephone Cooperative, Verizon, and various local governmental agencies.

HAMILTON, TEXAS[36]

In Hamilton, connecting to the Internet has been primarily the result of private initiatives. Hamilton, located approximately 70 miles west of Waco, boasts that more than 60 percent of its households are connected to the Internet. Furthermore, its residents "stay connected about 59 minutes a day compared to the national average of 20 minutes."[37]

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35 *Commerce Community Network Receives $500,000 State Telecommunications Grant: Model Program to Increase Rural Access to Digital Economy*, COMMERCE JOURNAL (Oct. 18, 2000); *see also* information provided by the Texas Telephone Association (TTA) regarding the LaGrange Community Computer Network.

36 Carol Flake Chapman, *Tech of the Town*, TEXAS MONTHLY BIZ (Mar. 2000) at 30.

37 Mark England, *Man Leads Small Central Texas Town to Forefront of Technology* (Mar. 2, 2000) <http://www.accesswaco.com/auto/feed/news/local/2000/03/04/952213611.17471.8522.0900.html>.

Internet access has allowed the Hamilton General Hospital, which cannot afford a radiologist, to have CAT scans read by consultants in Nashville, Tennessee. Additionally, others have been able to pursue business opportunities or recreational interests while enjoying the benefits of life in a small town.[38] Further, a recent study conducted for the Hamilton Economic Development Corporation showed that one of the benefits of living in Hamilton is that it is "wired."[39]

DELL CITY, TX[40]

The Dell City project originated in a remote and sparsely populated school district in West Texas, about 90 miles east of El Paso. Facing consolidation, the former superintendent of the Dell City School District, Kay Carr, forged relationships with area schools, colleges, and businesses in order to bring a telecommunications network to the area.[41] The Dell City Initiative secured a number of grants, which paved the way for a series of technology innovations. With the help of the local telephone cooperative, cable was installed between the Dell City schools, Fabens Independent School District, Region 19 Educational Service Center, and the University of Texas at El Paso (UTEP), enabling them to exchange curriculum and resources via the network. Currently, the system is used for staff development and teleconferencing.

LA GRANGE, GEORGIA[42]

La Grange, Georgia, is a small rural community, approximately 45 minutes outside of Atlanta. The city of La Grange negotiated a deal with Worldgate Communications Inc. (Worldgate), which specializes in interactive television, to provide all 27,000 residents free Internet access. La Grange announced plans to capitalize on fiber-optic cable the city laid a decade ago by wiring every household, school, government office, and retail store. This makes La Grange the largest fully wired city in the country. By combining the old fiber-optic cable with coaxial cable from Charter Communications (Charter), the city's network provides Internet access at broadband speeds.

Households and businesses receive free installation, cable modems, and free Internet access for at least the first year. Homes without computers receive a set-top Internet access

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[38] *Id.*

[39] *Id.*

[40] *The Dell City Initiative* (last modified Dec. 21, 1999) <http://www.sedl.org/rural/seeds/texas/dell.html>.

[41] Kay Carr is now a member of the Telecommunications Infrastructure Fund (TIF) Board. Her term expires August 31, 2003.

[42] *Georgia City of 27,000 to be totally wired* (last modified Apr. 10, 2000) <http://www.chippewafallsnews.com/bym/tech/news/apr00/wired11041000.asp>.

device for their televisions. In addition, the city sends technicians into homes to train people unfamiliar with the Internet.

Under normal circumstances, Worldgate would receive $3 out of the $4 to $15 monthly subscription fee that cable operators charge their WorldGate users. In LaGrange, WorldGate is discounting its rate to the cable operator, receiving less than $1 per month per home from Charter. WorldGate says that its service combines proprietary technology with the cable television platform to use either the existing advanced analog or digital cable converter along with a remote control or wireless keyboard to bring the Internet to cable subscribers. With advanced analog converters, the service operates at more than twice the speed of a standard 56 Kbps telephone modem. With digital converters, the service operates at speeds up to 3.8 Mbps, or more than 3.5 times faster than a typical cable modem.

Jeff Lukken, the city's mayor, says one motivation for the "La Grange Internet TV Initiative" was maintaining the city's role as regional center for several Fortune 500 companies. Lukken also said the network should attract and keep big employers, let teachers communicate more easily with parents, enable more students to use the Internet at home, and help local retailers compete on the Internet.

BLACKSBURG, VIRGINIA[43]

The Blacksburg Electronic Village (BEV) is an outreach effort of Virginia Tech University, in partnership with the town of Blacksburg. Based entirely on the Internet, the BEV hopes to foster the virtual community that has been created to complement and enhance the physical community. Blacksburg is also investigating the factors that make community networks self-supporting and responsive to user needs, and is providing assistance to other communities that are trying to develop viable community networks.

Local residents in Blacksburg are actively engaged in a wide variety of network activities, such as contributing to the BEV Web site, using email to keep in touch with friends and family, discussing local issues online, and publishing information about themselves, their work, and their personal interests. The project includes citizens, government, and businesses. The BEV is committed to community-wide, comprehensive and inexpensive Internet access for all members of the community. Through strong cooperative efforts with the public schools and the public library, all school children have free direct access to the Internet, including personal electronic mail accounts. Citizens may choose several connection methods, including dial-up access through several local ISPs; integrated services digital network (ISDN); Ethernet provided by the BEV, Bell Atlantic, and other ISPs; or access through public Internet workstations at libraries and schools.

[43] *Blacksburg Electronic Village: About the BEV* (visited Nov. 9, 2000) < http://www.bev.net/ project/brochures/about.html#2>.

The BEV has broken new ground in many areas of networking and technology use. The BEV is one of the oldest Internet-based community networks in the country and has the highest per capita use of the Internet in the world, with more than 87% of Blacksburg residents online as of late 1999. Even more notable is that Blacksburg is the first town in the world to adopt an all-Internet model for a community-wide network and the first community in the United States to offer residential Ethernet service as an amenity in apartments and town homes.

In Montgomery County, every classroom in every school has direct, high-speed Internet access. As a result, Blacksburg has the highest per capita availability of ISPs in the world, with more than a dozen local and national providers offering modem and dedicated access, including cable modem, ISDN, and digital subscriber line (xDSL) services. Blacksburg has the highest business use of the Internet of any community in the world, with more than 75% of Blacksburg businesses using the Internet for commerce and advertising; more than 475 businesses have listings on the BEV.

Clearly, the Internet can contribute to the improvement of any community regardless of size or location. Rural Texas' opportunities for economic development and improved quality of life may lie in significant part within the Internet and access to advanced services.

CHAPTER 2: COMMUNITY PERCEPTIONS ON INTERNET TECHNOLOGIES

> "He desires not merely larger quantities of the things he has been accustomed to consume, but better qualities of those things; he desires a greater choice of things, and things that will satisfy new wants growing up in him."
>
> --Alfred Marshall, On Wants and Their Satisfaction

This chapter analyzes two surveys regarding Internet use and access in Texas. The first survey is a scientific study that examines demographic and behavioral aspects of Internet use, with correspondents randomly selected from the general population of Texas. The survey was headed by Dr. Sharon Strover from the Telecommunications and Information Policy Institute (TIPI), at the University of Texas. This study is titled "Aspects of Internet Use in Texas" and was conducted in conjunction with the Electronic Government Task Force. It was sponsored jointly by the Texas Department of Information Resources and the Public Utility Commission (PUC or Commission). The study will be referred to as the "TIPI Study."

The second survey was developed and distributed to community leaders by the Texas Rural Development Council (TRDC) and the Texas Economic Development Council (TEDC) to collect community leaders' points of view on community needs. This survey is non-scientific and the population was selected by TEDC, not a random sample. The results of the survey were compiled and analyzed by the PUC staff.

Conclusions

Based on the results from the TIPI study and the TRDC/TEDC survey and informed by the National Telecommunications and Information Administration (NTIA) studies, this Report offers the following insights about community perceptions of the Internet:

- Rural Texans use the Internet at nearly the same rate as those residing in urban areas. Additionally, Internet use in rural households is growing at a faster rate than in urban or central city households.

- While most rural Texans currently access the Internet via dial-up modem, they are just as interested in broadband connectivity as those in urban areas.

- Customers are adopting broadband Internet services faster in urban areas than in rural areas.

- Rural communities recognize the importance of a high quality telecommunications infrastructure to their economic development.

- A "digital divide" likely exists for those who are older and poorer and for Hispanic and African Americans earning less than $30,000 per year.

TIPI Study

The TIPI study compares rural and nonrural Texas in terms of (1) who does and does not use the Internet, (2) what sort of Internet connectivity they have, (3) their attitudes toward and behaviors in using computers and the Internet for various services, and (4) related issues concerning using advanced telecommunications services. Broadband services in rural Texas and the nature of Texas' digital divide are addressed in this study.

The data for this study came from a survey conducted in March-April 2000 using telephone interviews with 1,002 respondents. Of those, 800 comprise a random sample survey of households in the state, while an additional 202 households are exclusively from rural counties. Some of the main issues analyzed in the study are highlighted in this chapter. An entire copy of the study is provided in Appendix L of this Report. The methodology of the survey is provided in Appendix K of this Report.

USE OF COMPUTER AND THE INTERNET

According to the TIPI study, a large majority – 67% - of the Texas population currently uses a computer and 60% use the Internet. People who have never used either computers or the Internet represent just 17% of the sample. The study also finds that demographic factors, such as ethnic group, age, income, and education differences, affect Internet use.

RURAL/NONRURAL COMPARISONS

There is concern nationwide about the effects of less well-developed telecommunications infrastructure in rural areas. A study jointly sponsored by the NTIA and the Rural Utilities Service[44] raised several issues pertaining to the availability of advanced telecommunications facilities in rural areas, noting that deployment of such facilities in rural areas lags that in urban areas. In Texas, while the gap exists between the percentage of rural and nonrural Internet users, the percentage of rural Texans using the Internet far exceeds national rural usage, as shown in the following two figures.

TIPI sought to compare rural versus nonrural respondents' behaviors and attitudes with respect to their use of computers and the Internet.[45] TIPI's results reveal that people in rural

[44] NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION, ADVANCED TELECOMMUNICATIONS IN RURAL AMERICA: THE CHALLENGE OF BRINGING BROADBAND SERVICE TO ALL AMERICANS (April 2000) (*Advanced Telecommunications in Rural America).*

areas are only somewhat less likely to use the Internet than are people in metropolitan areas: 55% of rural respondents in Texas use the Internet compared to 60% of nonrural respondents (Figure 1a).

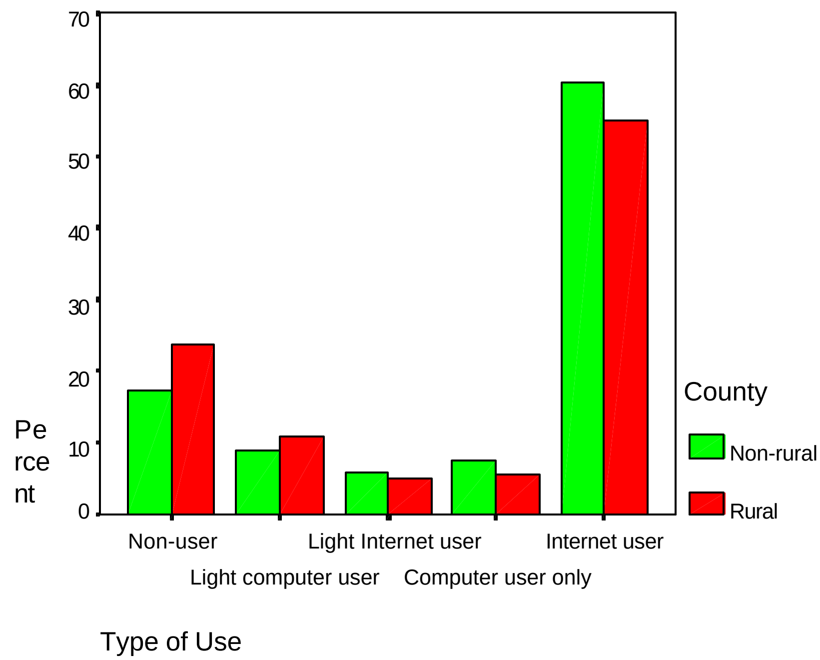


Figure 1a: Rural and Nonrural Computer & Internet use

This information compares favorably with recent NTIA data (Figure 1b) that shows 42% of U.S. households currently having Internet access. Importantly, this data shows that Internet access in rural areas grew 75% during the period 1998 to 2000 and now approaches the national average and exceeds usage in central cities.

[45] Counties were coded as "rural" if they had no Metropolitan Statistical Area (See Appendix K of this Report for more details on defining rural). Out of 1,002 respondents, 328 are from rural counties, and 674 are located in non-rural counties.

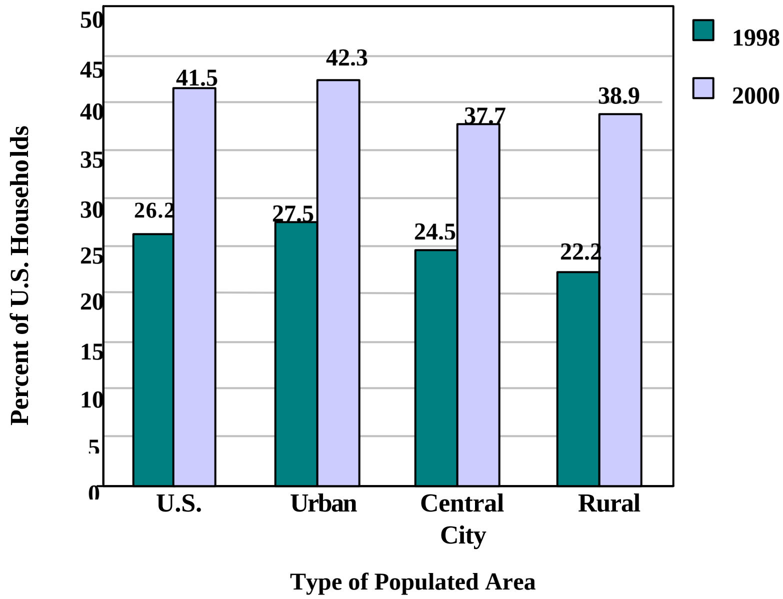


Figure 1b: National Internet Usage

Source: NTIA and ESA, U.S. Department of Commerce, using U.S. Bureau of the Census Population Survey Supplements

DEMOGRAPHIC FACTORS AND INTERNET USE

The differences in the ethnic composition of computer and Internet users in Texas are shown in Figure 2. According to the TIPI study, nearly 68% of the Anglo community regularly use the Internet, compared to 45.2% of Hispanics and 32.8% of African Americans. The reverse pattern is true for those who use neither a computer nor the Internet: 32.8% of the African Americans, 28% of the Hispanics, and 14.2% of the Anglos.

However, among people who routinely use the Internet ("Internet users"), ethnic differences are negligible in terms of the amount of time spent on the Internet (10.6 hours per week for Anglos, 10.8 for Hispanics, and 9.5 for African Americans). Predictably, higher percentages of people in older age categories do not use computers or the Internet (Figure 3). About 50% of the people 66 and older used either a computer or the Internet, but nearly 26% did use both. Not surprisingly, people under 55 were far more likely to use the Internet than were older people.

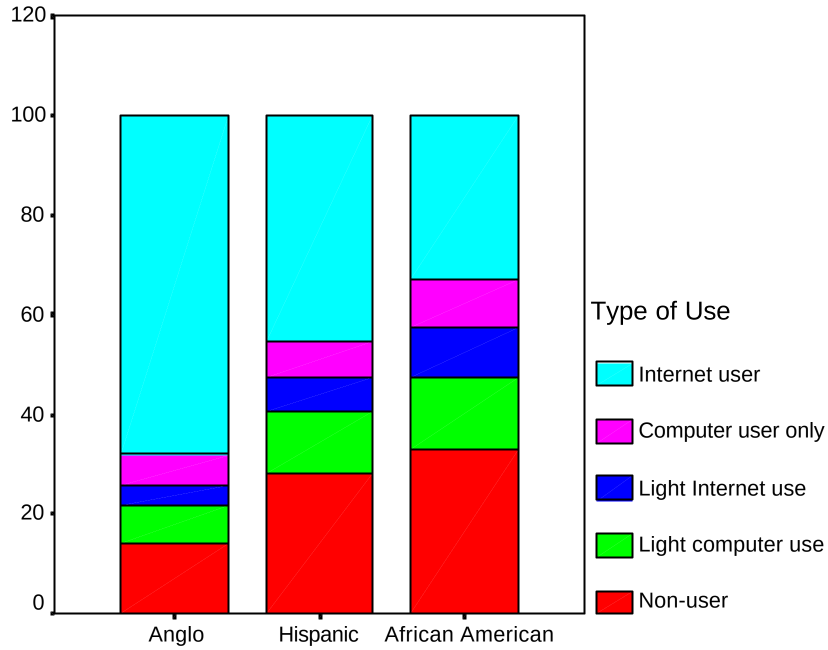


Figure 2: Ethnicity/Race by Type of Use (%)

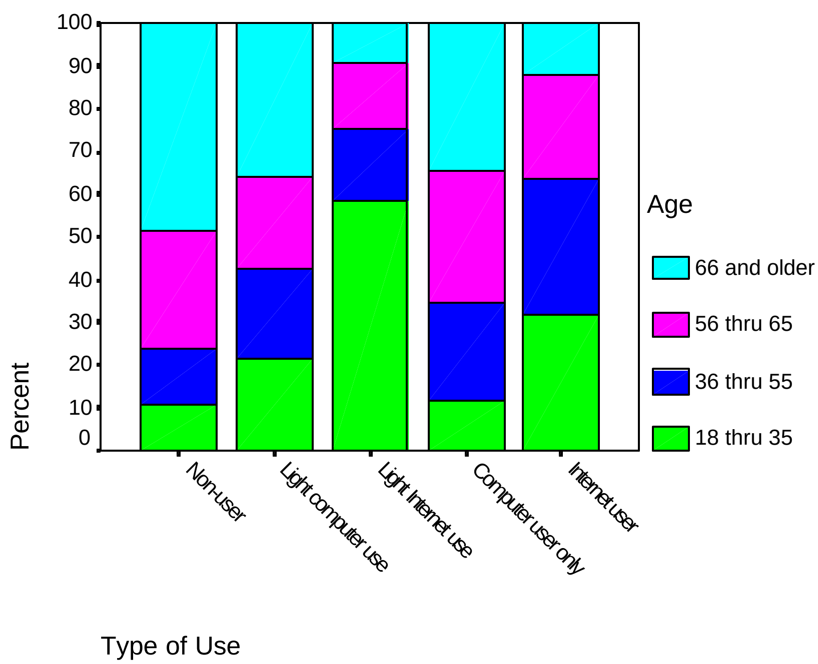


Figure 3: Type of Use by Age

Consequently, those not using a computer or the Internet can generally be characterized as being older, poorer, and often members of a minority group. They also tend to be less well educated. TIPI's analyses also showed that the better-educated and wealthier individuals are, the more likely they are to use computers and the Internet. At higher incomes, there are virtually no differences in Internet use by ethnic group, but at lower income levels, ethnic group membership still makes a difference -- Anglos in lower income groups use computers and the Internet in greater numbers than do African Americans or Hispanics at the same income level.

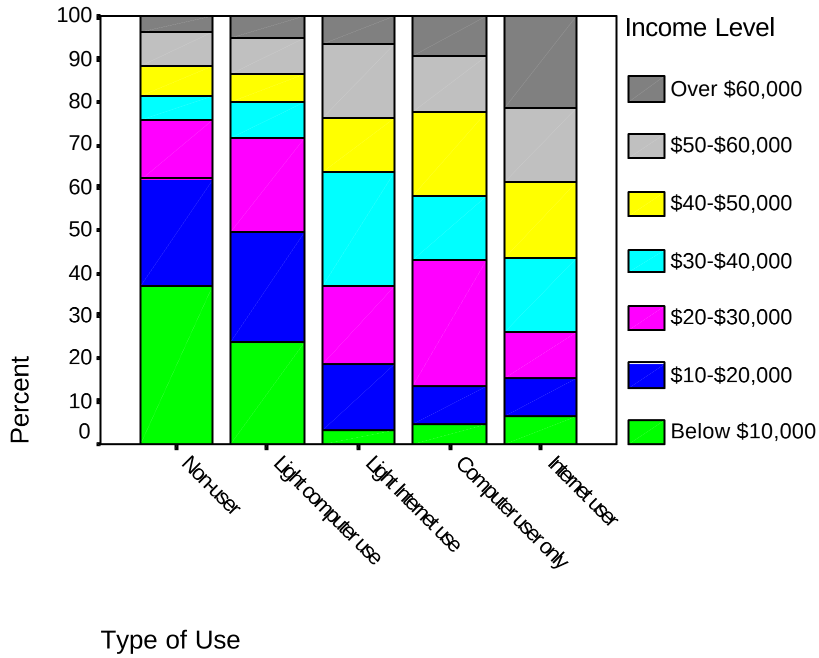


Figure 4: Type of Use by Income

As income and education increase, so do computer and Internet use. Figure 4 indicates that people making less than $10,000 represents the largest cluster of people who use neither computers nor the Internet. At incomes over $30-$40,000, Internet use is very common; the results for high and lower levels of education follow a similar pattern, with more highly educated people using the Internet more commonly than those less well educated. As Figure 5 below demonstrates, most Internet users have had some education beyond high school, while the nonusers are disproportionately composed of people who did not complete high school.

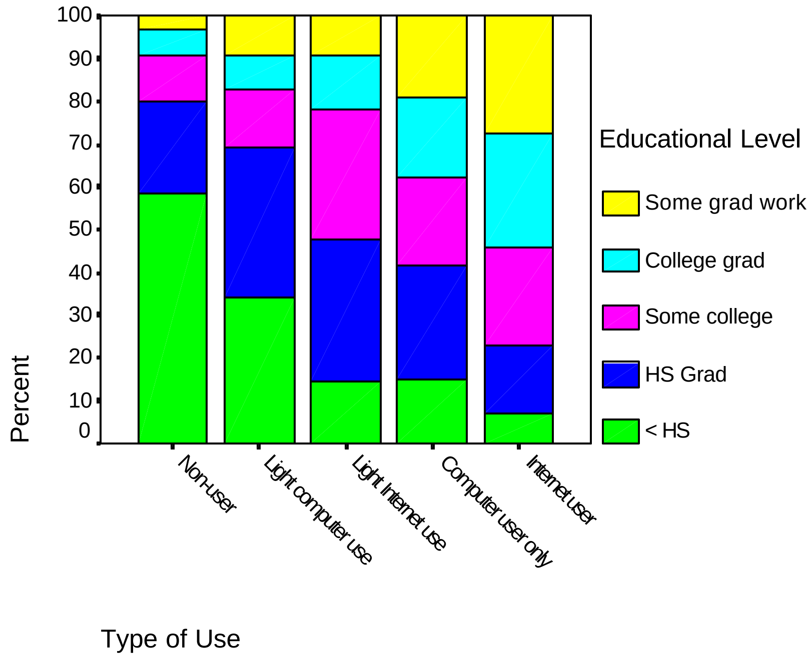


Figure 5: Type of Use by Education

Ethnic group, age, income and education differences all appear to differentiate these user groups from each other. These differences have been chronicled in NTIA's "Falling Through the Net" reports as well. The most recent report notes that the period from 1998-2000 was one of rapid uptake of new technologies among most groups of Americans, regardless of demographic factors. For example, it reports that the disparity between men and women using the Internet has all but disappeared, and that the gap between households in rural areas and households nationwide with access to the Internet has narrowed to 2.6 percentage points.[46] However, this study reports that the Internet access gap between rural and nonrural areas in Texas is closer to 5 percentage points.

The TIPI study on the "digital divide" in Texas conforms to national trends in all respects save the findings on rural location. The TIPI study suggests that the penetration of computers and Internet use is generally higher for rural residents in Texas than studies undertaken by NTIA regarding the entire United States. However, there are still some important differences between rural and nonrural segments of the population. For example, the TIPI study finds that the rural population spends somewhat less time on the Internet, and also undertakes fewer commercial or financial transactions on the Internet.

[46] NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION, FALLING THROUGH THE NET: TOWARD DIGITAL INCLUSION at xv-xvi (Oct. 2000).

ACCESS AND CONNECTIVITY

Types of Connections from Home

The TIPI Study shows that most people who use computers use them and access the Internet from home. People who access the Internet from home were asked what type of Internet connection they had. The following table shows how people connect to the Internet from their homes.

Table 1: Most frequently used home connection by rural/nonrural[47]

		County	
		Rural	Non-rural
Type of connection	Dialup modem	80.8%	77.2%
	Cable modem	5.4%	7.9%
	DSL	.6%	4.5%
	Other	1.8%	1.2%
	DK	11.4%	8.7%
	RF		.5%
Total		167 100.0%	403 100.0%

Internet Connections from Non-home Environment

People accessing the Internet from the non-home environment were asked the same question regarding their connection to the Internet. The table below shows how people get to the Internet from non-home environments. The authors point out that large proportions of the sample did not know how they were connected to the Internet, as represented in the "Don't Know" (DK) cells.

Table 2: Connection Type Outside of Home

[47] Throughout the TIPI study DK means individuals responded "Don't Know" and RF means individuals "Refused" to answer.

		County	
		Rural	Non-rural
Type of connection most used	Dialup modem	35.4%	23.2%
	Internal network	31.3%	30.3%
	Cable modem		2.0%
	DSL	4.2%	6.1%
	Other		1.0%
	DK	29.2%	37.4%

Satisfaction with Speed of Connection

The following chart shows how Internet users were satisfied with the speed of their connection. Only 17% of the sample said they were not satisfied. About 60% stated they were "satisfied," and another 20% stated they were very satisfied.

Table 3: Satisfaction with Speed

		County		Total
		Rural	Non-rural	
How satisfied with speed	Not at all satisfied	14.9%	17.3%	16.6%
	Satisfied	65.6%	56.9%	59.5%
	Very satisfied	15.3%	21.7%	19.8%
	DK	4.2%	3.6%	3.8%
	RF		.6%	.4%
Total		215 100.0%	503 100.0%	718 100.0%

High-Speed Connections

The TIPI survey asked how interested the respondents were in having a high-speed connection to the Internet. Rural respondents were interested in broadband about the same as the percentage of nonrural respondents.

Table 4: Rural v. Nonrural Interest in Broadband

		County		Total
		Rural	Non-rural	
How interested in high speed connection	Not at all interested	38.3%	38.1%	38.2%
	Interested	26.8%	25.2%	25.7%
	Very interested	28.2%	28.8%	28.6%
	DK	6.4%	7.8%	7.3%
	RF	.3%	.1%	.2%
Total		100.0%	100.0%	100.0%

Uses for High-Speed Connections

The TIPI Study also found that there are slight differences in how rural, as opposed to nonrural, Texans believe they would use the Internet if they had high-speed connections. As shown below, "surfing the web," telecommuting, and downloading video were the most frequently cited possible uses of broadband access for both rural and nonrural respondents, with somewhat more rural respondents being interested in telecommuting, downloading video files, and doing news-related research.

Table 5: Uses of High-speed Connections by Rural/Nonrural

		County	
		Rural	Non-rural
Use high speed connection for...	Surfing the web	40.8%	45.4%
	Telecommuting	13.6%	12.4%
	Downloading video	10.9%	6.8%
	Commercial	6.5%	4.9%
	Personal Finance	1.6%	1.9%
	Communication-Email	3.8%	3.5%
	Shopping-shopping	1.1%	1.4%
	News-research	6.0%	3.8%
	School related		3.5%
	Entertainment	1.1%	1.4%
	Everything	5.4%	5.7%
	Other	2.7%	4.1%
	DK	6.5%	4.6%
	RF		.8%
Total		184 100.0%	370 100.0%

ATTRIBUTES AND BEHAVIOR

Perceptions about Access

A follow-up opinion item asked people how easy it was for them to access the Internet. The TIPI Study that rural respondents believe they have a more difficult time gaining access than is the case for nonrural members of the population. About 22.6% of the rural group strongly disagree or disagree, compared to about 18% of the nonrural group.

Table 6: Agree/disagree with "*I have easy access to the Internet*" by rural/nonrural

		County	
		Rural	Non-rural
I have easy access to the Internet	Strongly disagree	15.9%	9.9%
	Disagree	6.7%	8.2%
	Neither agree nor	11.0%	8.3%
	Agree	24.1%	27.7%
	Strongly agree	38.1%	41.2%
	DK	4.0%	4.6%
	RF	.3%	
Total		100.0%	100.0%

Cost and Access

About 65% of the entire random sample agreed or strongly agreed that they were worried about privacy on the Internet. This was true across all age, income, and education groups. Overall, 67% of the sample agreed or strongly agreed that they had easy access to the Internet, as noted above. Predictably, younger age groups, nonrural residents, higher income, and higher education groups especially agreed with this statement.

Rural residents also significantly differed from nonrural residents on the matter of expense: 30% agreed or strongly agreed that accessing the Internet was too expensive versus 21% among non-rural residents.

Table 7: Agreement with "*The Internet is too expensive for people like me.*"

		County		
		Rural	Non-rural	Total
Too expensive	Strongly disagree	29.6%	34.1%	32.6%
	Disagree	22.3%	25.3%	24.4%
	Neither agree nor	8.4%	10.1%	9.5%
	Agree	14.5%	11.9%	12.8%
	Strongly agree	15.1%	8.8%	10.8%
	DK	10.1%	9.8%	9.9%
Total		100.0%	100.0%	100.0%

CONCLUSIONS

The authors of the TIPI study conclude the following about Internet use in Texas:

There is a wide base of home computer and Internet users around the state. Various programs -- local, state and federal -- are broadening access to computers and the Internet at public sites such as libraries. These are important prerequisites to ensuring parity in telecommunications services throughout the state.

However, some difficulties clearly exist. Some disparities with respect to access to computers and the Internet need to be addressed. For example, this study illustrates that although computer and Internet use among Texans is at high overall levels, income and education, race and ethnic origin, and age factors differentiate how or whether one uses these technologies. Older people, poorer people, and members of minority groups show lower use of computers and the Internet, and these populations are for numerous reasons possibly the least able to avail themselves of government-provided services even without the aid of newer technologies. While location in rural Texas appears to be a less significant variable than other studies have shown, it still interacts with other demographic factors to intensify access problems.

In this study many rural residents report that they do not have easy Internet access and that it is too expensive, even though the actual reported use statistics show only modest differences between rural and nonrural people in using computers or the Internet. This result may indicate that because incomes in rural areas are generally lower, using the Internet costs proportionately more for this population. At same time, rural households have the same interest in having a broadband connection to the Internet as do nonrural residents. That people in rural areas spend less time on the Internet and also engage in fewer commercial transactions on it may reflect some perceived lack of value with the types of connections rural households have; if speeds are slow, commercial transactions (which sometimes require more time, graphics, or other features that slower connections render difficult) and extended web searches for products or services may not be attractive.

The issue for many individuals is access: an important reason for not using the Internet is not having a computer. The costs of computers and the Internet cannot be dismissed. However, beyond access is the issue of how individuals perceive computers' or the Internet's relevance to their lives, and particularly how they would respond to government services that were delivered via the Internet. For example, many older people, even at higher income levels, are not Internet users. A generational and cultural gap exists that makes using computers and the Internet seem too difficult or simply something that does not evoke interest or for which people do not have time. When people do not have to use computers through school or work, which is the case for most retired people and less well educated people, it is understandable that the Internet might be seen as irrelevant. When the sorts of resources, information and entertainment on the Internet are similarly foreign for cultural reasons, lack of interest in the medium is a logical result. Simple lack of interest in the Internet or perceived difficulty with it discourages the prospects for a broadly used Internet. In addition, this study shows that people appear to be concerned about children's access to the Internet, although other studies amply document adults' belief that children need to be computer-literate and adept with the Internet.

Community Telecommunications Survey

The PUC, TEDC and TRDC joined forces to identify telecommunications needs in rural Texas communities. The TEDC, a non-profit professional organization, distributed the survey to its members with the hope of identifying ways to stimulate new telecommunications infrastructure and services and to help communities across Texas create solutions for their telecommunications needs. The survey was also intended to map the status of telecommunications in rural Texas from a grassroots point of view. An entire copy of the report is provided in Appendix M of this Report. The methodology of the survey is provided in Appendix K of this Report.

TELECOMMUNICATIONS INFRASTRUCTURE AND ECONOMIC DEVELOPMENT

Availability of Telecommunication Services

This section of the survey inquired about the availability of wireless, cable, and EAS/ELC services. Cable is available in 93% of the communities, followed by wireless and EAS/ELC services in 88% of the communities. Eleven percent of the communities responding indicated that they do not have EAS/ELC services, but that there is a need for them.

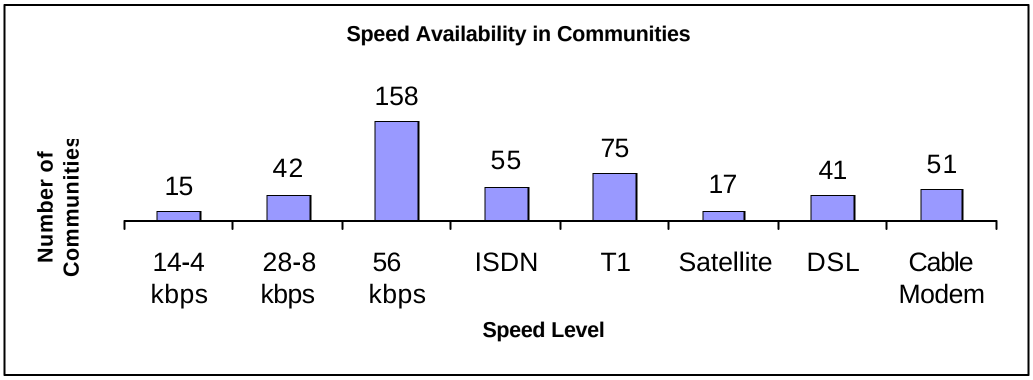
Types of Infrastructure Communities Desire

This section of the survey focused on the telecommunications infrastructure (currently not available) required to attract businesses to the community. Not surprisingly, rural communities have a strong desire for high-speed Internet access. This surpasses even their desire for higher quality of services.

Telecommunications Infrastructure Desired	Number of Communities
Fiber Optic or Other High Capacity Lines	92
High-speed Internet Access	88
Higher Quality of Services	66
Internet Backbone Access	41
Voicemail	34
Local Internet	28
Cell Phone	19
Call Forwarding	15
Call Waiting	12

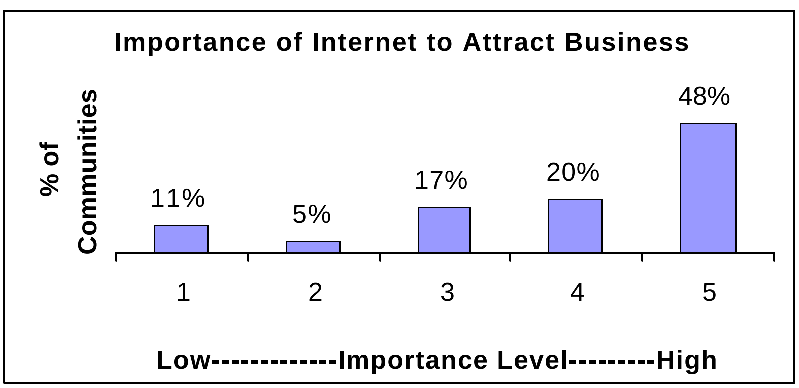
SPEED AT WHICH INTERNET IS AVAILABLE

This section asked about the speed of Internet connections available in the community. About 50% of the communities responding are accessing the Internet at speeds of 56Kbps or better. This figure appears to be a bit higher than expected. It is speculated that the survey respondents chose the option for 56Kbps even if one connection in their town or village operated at this speed. It does not necessarily indicate that that all parts of the town or village operate at 56Kbps. Similar reasoning regarding survey responses should be applied to the other speeds offered as well.



IMPORTANCE OF THE INTERNET

This section surveyed communities about the importance of high quality telecommunications infrastructure to attract businesses to the community. Not surprisingly, a large majority of communities responding indicated that high quality telecommunications infrastructure is very important to attract businesses to the community.



CHAPTER 3: ADVANCED SERVICES TECHNOLOGIES OVERVIEW: DEVELOPMENT AND CONVERGENCE

> "I use to think that cyberspace was fifty years away. What I thought was fifty years away, was only ten years away. And what I thought was ten years away... it was already here. I just wasn't aware of it yet."
>
> -Bruce Sterling, Writer

Traditional telephone lines remain the principal means of accessing the Internet. Traditional high-speed services, such as ISDN and T-1's, have been used for Internet access, telemedicine, and other applications requiring high-speed connections. However, new technology alternatives that offer high-speed or broadband access are increasingly being used to access the Internet and other applications.[48] Preeminent among these new technologies are digital subscriber lines (xDSL), cable modems, wireless technologies, and satellite access.[49] Importantly, these various technologies will be major contributors to broadband deployment in rural areas.[50]

Different needs, geographies, and abilities to pay create necessity for all of these advanced services. In regard to the geography of both rural and urban areas, the "last mile" to the residential customer remains the largest constraint on the availability of broadband services.[51] Today, incumbent telephone and cable companies provide the majority of these "last mile" broadband connections. However, in the future wireless technologies (including multi-channel (MMDS) and local multi-point distribution systems (LMDS)), commercial mobile radio service (CMRS), and satellite technologies will likely provide an increasing share of these "last mile" connections.

[48] The FCC defines broadband or "advanced services" as transmission speeds greater than 200 Kbps in both the downstream and upstream path. "High-speed" is defined as transmission speed greater than 200 Kbps in only one direction, typically the downstream path with the upstream path being less than 200 Kbps.

[49] Each of these technologies is discussed in greater detail in Appendix E of this Report.

[50] *Advanced Telecommunications in Rural America* at ii.

[51] *Second Advanced Services Report* at ¶ 28. The "last mile" is an imprecise term that is analogous to the local road between a larger, divided highway, and a traveler's driveway.

Types of High-Speed Connections to Residential Customers[52]

	Marketed Residential			Price[53]
Technology	**Downstream Speed**	**Upstream Speed**	**Distance Limitations**	**Per Month (including ISP)**
Wireline Technologies				
Dial-up Modem	56 Kbps	34 Kbps	N/A	$0 – $21.95
ISDN-BRI	128 Kbps	128 Kbps	18k ft.	$57.50 -- $104.50
ISDN-PRI	1.5 Mbps	1.5 Mbps	N/A	$57.50 -- $104.50
ADSL	> 200 Kbps	< 200 Kbps	18k ft.	$ 29.95 -- $39.95
Cable Technology				
Cable Modem	1.5 Mbps	> 200 Kbps	N/A	$29.95 -- $99.95
Wireless Technologies				
MMDS	310 Kbps	310 Kbps	35 mi.	$39.95
LMDS	1.5 Mbps	> 200 Kbps	3 – 5 mi.	$125 -- $940
Satellite Technology				
Satellite – Today	400 Kbps	34 Kbps	N/A	$19.99 -- $49.99
Satellite – Future	40 Mbps	128 – 256 Kbps	N/A	Approx. $70

Wireline Technologies

Two widely available high-speed wireline services are comprised of ISDN and xDSL technologies.

INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

ISDN is a digital-based connection over the public telephone network that allows simultaneous voice and data transmission. ISDN can integrate voice, data, video, and image services. However, since ISDN is a switched service, both ends of the transmission must support the service. ISDN, as used today, comes in two well-defined interface standards: Basic Rate Interface (BRI), which operates at 128 Kbps, and Primary Rate Interface (PRI), a standard T-1 line offering speeds of 1.544 Mbps.

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[52] Adapted from *An Executive White Paper on Telecommunications for the State of New Mexico Prepared for the Office of the Governor,* Office of Science and Technology, New Mexico Economic Development Department, at 48 (Dec. 1999).

[53] Price does not include equipment and installation charges; per month charges may vary considerably by location. *See* Appendix F of this Report for a more detailed discussion of advanced services pricing.

For a number of years the PUC has had a rule requiring certain carriers to deploy ISDN. The PUC's rule seeks to balance the relatively high expense of ISDN deployment with low demand for the service, while at the same time recognizing that ISDN may be the only relatively high-speed service available in many rural areas.

ISDN penetration in Texas is currently very low. Texas Telephone Association (TTA) data shows that only 0.43% of access lines in Texas are ISDN-PRI,[54] while only 1.05% of access lines in Texas use lower speed ISDN-BRI.[55] On the other hand, ISDN demand has continued to grow. FCC data shows that ISDN-BRI subscribership grew 42 percent between 1995 and 1999. Although ISDN is being supplanted by newer technologies, these statistics indicate its value, particularly where other technologies are unavailable.

DIGITAL SUBSCRIBER LINES (XDSL)[56]

xDSL technology is the second most widely used broadband service.[57] The most common form of xDSL is asynchronous digital subscriber line (ADSL).[58] ADSL is capable of serving customers over the copper loop within 18,000 feet of specially equipped phone company central offices or remote terminals. Generally, ADSL only provides service at speeds in excess of 200 Kbps in the downstream path.[59] However, ADSL permits the customer to have both conventional voice and high-speed data carried over the same line simultaneously because it segregates the high frequency data traffic from the voice traffic.[60] Consequently, the Internet connection is "always on" and permits simultaneous voice conversations without the need for a second phone line.[61]

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[54] P.U.C. Advanced Services Data Request (Aug. 2000) (53,134 of 12,721,474 total access lines).

[55] *Id.* (133,475 of 12,721,474 total access lines).

[56] xDSL is a generic name for a family of digital lines being provided by ILECs and CLECs including: Asynchronous DSL (ADSL), High Data Rate DSL (HDSL), Symmetric DSL (SDSL), and Very High Data Rate DSL (VDSL). *See* Appendix E of this Report for a more technical discussion of the various xDSL services.

[57] *Advanced Telecommunications in Rural America* at 12.

[58] *Second Advanced Services Report* at ¶ 36.

[59] *Id.* at ¶ 36 and 38.

[60] *Id.* at ¶ 36.

[61] *Id*.

Cable Technology

Advanced or high-speed cable services are currently limited to cable modems.

CABLE MODEM

Cable modems are the most common source of broadband connections for residential users.[62] Cable modem service, while offered on the same basic network architecture used to provide multi-channel video service, typically requires significant equipment upgrades and enhancements to support advanced services.[63] Cable modem Internet access is shared with other active users in the same neighborhood. Consequently, this results in a reduction in speed as the number of users increases.[64] Due to this shared architecture, cable speeds typically are below 1.5 Mbps.[65]

The significance of continuing to upgrade the cable network, and thereby allowing cable modems to compete in the advanced services market, is seen in the next generation of communication, information, and entertainment services.[66] Not only will broadband access continue to play a significant role in Internet development, but the expansion of services such as cable telephony, video conferencing, and video on demand, which have been discussed in the communication industry for close to ten years, are now much closer to residential deployment.[67]

Wireless Technologies

Wireless technologies are another means for delivery of high-speed services to residential, rural, and otherwise under-served areas, and potentially may increase competition in the "last mile" in the near future.[68] For purposes of this Report, wireless technologies include fixed wireless (including both MMDS and LMDS), cellular, and broadband Personal Communications Services (PCS). Wireless technologies are important to rural Texans because they have the potential of cost effectively providing advanced services to sparsely populated geographic areas

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[62] *Second Advanced Services Report* at ¶ 96.

[63] *Id*. at ¶ 29.

[64] Harry Newton, NEWTON'S TELECOM DICTIONARY 118-119 (1998).

[65] *Second Advanced Services Report* at ¶ 33.

[66] Scott C. Cleland, *Residential Broadband Outlook: Investment Implications of a Duopoly?*, PRECURSOR GROUP (Aug. 11, 2000).

[67] Bill Michael, *Cable VoIP*, COMPUTER TELEPHONY.COM at 37 (Aug. 2000).

[68] *Second Advanced Services Report* at ¶ 42.

FIXED WIRELESS[69]

Fixed wireless is a system, typically either MMDS or LMDS, that provides advanced or high-speed services to customers by attaching to the customer's premises a "pizza box" sized radio transmitter/receiver (transceiver) that communicates with the provider's central antenna site. By doing so, the central antenna site acts as the gateway into the Internet. In short, the radio signals serve as a substitute for the copper wire or cable strand that traditionally connect customers to the network.

MMDS

MMDS is a high-speed system that can potentially provide service in a 35-mile radius with downstream Internet speeds from 750 Kbps to 11 Mbps.[70] MMDS's larger service radius makes it ideal for deployment "in rural, under-served, and unserved areas, where the larger cell size substantially reduces the cost of providing service."[71] While MMDS does not degrade in adverse weather conditions, it does function best with direct line of sight between the transmitter and receiver.[72]

LMDS

LMDS is capable of very high-speed transmissions, but its geographic range is much smaller than that of MMDS. A single tower can provide service only in a three to five mile radius - similar to that of a cellular phone. LMDS generally provides data rates up to 1.55 Mbps, a speed adequate to support a host of multimedia applications.[73]

The most critical shortcoming of LMDS is that it is essentially a line of sight technology and is therefore more sensitive to adverse atmospheric conditions.[74]

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[69] *See* Appendix I of this Report for a detailed discussion of Fixed Wireless technologies.

[70] *Second Advanced Services Report* at ¶ 51-52. *See also Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Fifth Report, FCC No. 00-289 at E-8 (rel. Aug. 18, 2000) (*Fifth Wireless Report*).

[71] *Id*. at ¶ 52.

[72] *Id*.

[73] *Second Advanced Services Report* at ¶ 50.

[74] *Fifth Wireless Report* at E-17.

CELLULAR AND MOBILE

Cellular technology is usually characterized by a low-powered, duplex, radio/telephone. Cellular uses multiple transceiver sites that are linked to a central computer for coordination. The sites or "cells" cover a range of one to six or more miles in each direction. Each cell can accommodate up to 45 different voice channel transceivers.

PERSONAL COMMUNICATIONS SERVICES (PCS)

PCS is a new, lower power, higher-frequency technology that is competitive with, and, in some respects comparable to, cellular. PCS phones are often less expensive, digital, and with less range. Perhaps surprisingly, the shorter range has been an advantage because airtime is actually cheaper for the smaller cell radius.

Broadband PCS services growth has been substantial in the last year with subscribership increasing more than 100 percent to 14.5 million customers, who primarily use the service for voice communications.[75] Although cellular and broadband PCS technically support high-speed services, few licensees are using spectrum in this manner.[76] One of the few offerings using this spectrum for advanced services is AT&T's Project Angel in the Dallas area, which uses broadband PCS spectrum to reach homes and small businesses.[77]

3G TECHNOLOGY

"3G technology promises Internet access with speeds up to 2 Mbps from a fixed location, 384 Kbps at pedestrian speeds, and 144 Kbps at traveling speeds of 100 kilometers per hour."[78] Planned 3G services include video and audio streaming and location based services that could notify individuals of services in an area they are visiting.[79] Ultimately, 3G capabilities may allow vendors to build handsets that work anywhere in the world.[80]

[75] *Id*. (for PCS providers for whom information is publicly available).

[76] *Second Advanced Services Report* at ¶ 53.

[77] *Id.*

[78] *Fifth Wireless Report* at 37.

[79] *Id*.

[80] *Id*.

UNLICENSED SPECTRUM

Small wireless companies may choose to provide high-speed Internet access by transmitting in unlicensed bands, or spread spectrum.[81] This unlicensed spectrum offers maximum downstream speeds in the 25 Mbps range.[82] This spectrum "offers a low-cost means for smaller companies to enter the wireless high-speed market."[83] However, because there is no licensing requirement, the potential exists for interference from other applications. Consequently, high-speed Internet services provided over unlicensed spectrum may perform well in rural areas where there is limited interference from competing applications; however, due to power output limitations, the service cannot be provided over a wide area.

Satellite Technology

Traditional satellite networks have been limited to specialized private services and direct to home (DTH) video. However, new broadband satellite systems are offering service comparable to current broadband wireline and wireless services. Today, residential satellite offerings are capable of providing speeds in excess of 200 Kbps only in the downstream path with the upstream path provided by a standard dial-up telephone connection.[84] However, several satellite providers have announced plans to provide residential, high-speed, two-way service in the very near future.[85]

[81] *Id.* at E-10.

[82] *Id.*

[83] *Second Advanced Services Report* at ¶ 55.

[84] *Id.* at ¶ 56.

[85] *Id.* at ¶56 and ¶201. The companies that have announced two-way satellite service include Hughes' Direct PC and Gilat Communications, who will provide "Gilat to Home" in partnership with Microsoft.

CHAPTER 4: STATUS OF ADVANCED SERVICES DEPLOYMENT IN TEXAS

> "New capabilities emerge just by virtue of having smart people with access to state-of-the-art technology."
>
> --Robert E. Kahn, President Corporation for National Research Initiatives

This chapter evaluates the current deployment of advanced services in Texas, including wireline technologies, cable services, wireless technologies, and satellite services.[86] Advanced services are being deployed to rural Texas, whether it is cable modem service in Brady or LMDS service in Goldthwaite. However, the question remains to what extent advanced services will be deployed to rural Texas.[87]

Conclusions

This Report makes the following insights regarding the deployment of advanced services infrastructure to rural Texas:

- Dial-up modem access to an ISP is generally available throughout Texas. Currently, there are only seven telephone exchanges in Texas which do not have the local dial-up option to gain access to an ISP.[88]

- "Middle mile" transport[89] infrastructure is generally available; however, the availability and cost of connecting to points of presence (POP) in some rural areas contributes to those areas not having access to the high-speed infrastructure.

- Deployment of "last mile" broadband connections are occurring at a faster pace in urban than in rural communities. Lower population density and longer distances increase the cost and make it more expensive to deploy wireline and cable advanced services to many areas of rural Texas.

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[86] *See* Appendix G of this Report for a summary of high-speed Internet access in Texas.

[87] PURA § 55.014 requires, beginning September 1, 2001, that Chapter 58 companies, holders of certificates of operating authority, and holders of service provider certificates of operating authority, if providing service in urban areas, provide advanced telecommunications services that are reasonably comparable to the advanced services provided in urban areas to their rural customers upon a bona fide request. The PUC is addressing the implementation of this provision in Project No. 21175 -- *Rulemaking to Address the Provision of Advanced Services by Electing Companies, COA or SPCOA Holders in Rural Service Areas*.

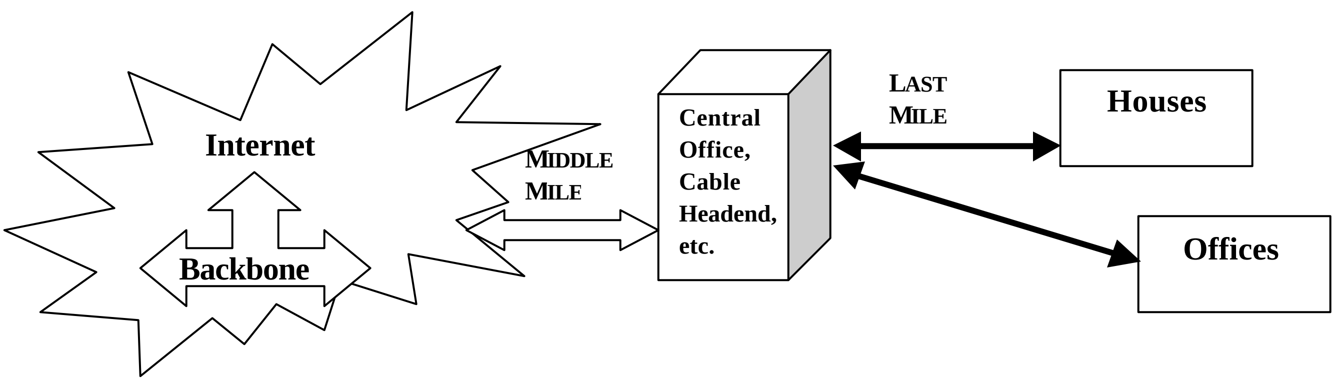
[88] *See* Appendix B of this Report.

[89] *Second Advanced Services Report* at ¶ 18.

High-speed Deployment Issues

A description of the various network infrastructure components is essential to understanding high-speed deployment issues. The FCC has divided the telecommunications network into several general categories easily analogized to the nation's highway system:

- Backbone—Multi-lane Interstate Highway: Provides long distance high capacity high-speed transmission for massive amounts of data, much like the interstate highway system.
- Middle Mile—Divided Highway: Relatively fast, high-speed connections between the backbone and the last mile, similar to a divided highway connecting local roads to the interstate.
- Last Mile—Local Roads: The relatively slower links between the middle mile and the user's business or home. Most of the focus and expense in providing high-speed connections to businesses and residential customers involves last mile connectivity.[90]



Broadband Network

In addition, the FCC noted that there are numerous connection points between network segments that are analogous to the intersections, on-ramps, and interchanges between local roads, divided highways and interstates. As shown in the next section, these connection points are crucial to getting on and off the information superhighway.

"MIDDLE MILE" TRANSPORT

"Middle mile" transport facilities provide the link between last mile aggregation points and national Internet backbone providers. Generally, these transport facilities, which are

[90] *Id*. at ¶ 18.

predominately fiber optic, exist along public rights of way.[91] Originally, these "middle mile" facilities were built by telephone and cable companies for ordinary telecommunications or cable television services.[92] For example, fiber optic connections between telephone company central offices are considered a "middle mile" facility.[93] Additionally, statewide networks, such as the TEX-AN network, and commercial enterprises, such as CapRock Communications regional network to connect second tier Texas communities, are middle mile facilities.[94] Generally, ISPs and high-speed providers lease middle mile transport capacity on these networks.[95]

This section of the network does not get much attention but it may have a significant impact on rural deployment of advanced services. In fact, the FCC notes that the potential for a bottleneck exists with respect to the middle mile.[96] Two issues are of concern to the middle-mile network: congestion and availability of points of presence (POP).

Connections from a fiber interexchange point, commonly referred to as a POP, to a business' office may be an issue in rural Texas. The POP usually refers to a location along a network where appropriate equipment is in place to allow interconnection with another network. The situation is analogous to the interstate highway system, with the most desirable point of location being near the exit ramp. The closer a business is to a POP, the easier and more cost effective it is to connect. If there is no POP available, then even if the middle-mile network passes through a town, a user will be able to connect with the Internet at advanced services speed, but will incur significant costs to have the traffic hauled to the closest interconnection point.

The initial challenge of getting a POP in a rural town is determining whether a middle mile network even passes through or near the town. While it is easy to observe the deployment of new fiber, the telecommunications network already has hundreds of miles of cable buried in the ground. Knowing where the cable is, who owns it, and being able to obtain a POP to the middle mile transport facility is a challenging task for a small rural community. In fact, there is no centralized map or database in Texas with this information.[97]

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[91] *Id.* at ¶ 23.

[92] *Id.* at ¶ 24.

[93] *Id.*

[94] *Id.;* See Appendix H of this Report for a discussion of the TEX-AN 2000 network and information gateway.

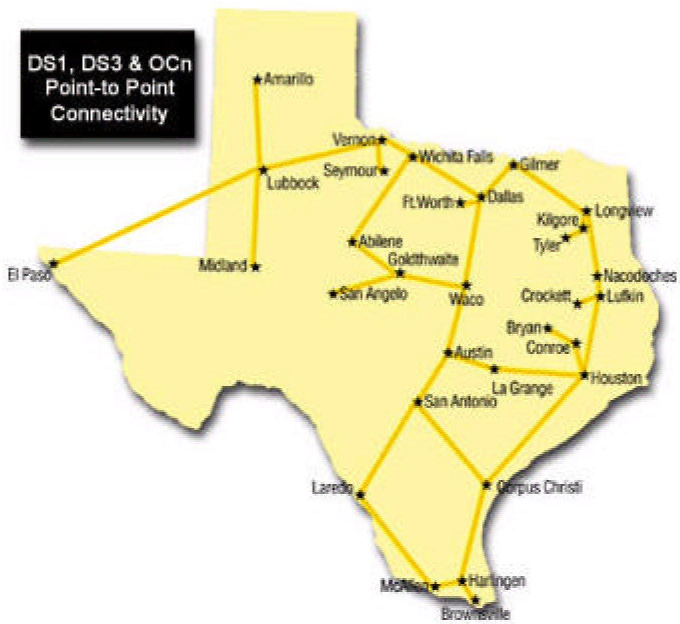
[95] *Id.* at ¶ 25.

[96] *Id.* at ¶ 211.

[97] Some states, such as Georgia and Pennsylvania, have built an Internet-based inventory of telecommunications services. *See* Georgia's map <http:/maps.gis.gatech.edu/telecomweb/index.html> and Pennsylvania's map <http://guoray.ist.psu.edu/info/Publications/ESRI_P147.htm>.

The available data suggests that lack of facilities equipped for high-speed transport may be an issue for rural Texas. Data collected by the National Exchange Carrier Association for 44 small Texas carriers that serve rural Texas suggests that up to 41 percent of local telephone companies have central offices currently capable of providing some form of high-speed transport.[98] Additionally, organizations such as the Texas Lone Star Network (TLSN), owned by 38 independent Texas telecommunications providers, offer "middle mile" point-to-point transport solutions to many rural areas in Texas, as shown below.[99]

Texas Lone Star Network



Anecdotal evidence also suggests that the cost and availability of high-speed connections to the fiber optic network may be limiting the ability of rural Texas to attract businesses to locate in a community. For example, in a letter to Texas Agriculture Commissioner Susan Combs, the Greater Kingsville Economic Development Council detailed the difficulty in

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[98] These companies use Synchronous Optical Network (SONET) to provide high bandwidth connections using fiber optic rings. Only five percent of the offices use newer technologies called ATM and Frame Relay to transport data across the state. NECA Access Market Survey at 14-15.

[99] TLSN transport options are diverse and state-of-the-art (visited Nov. 27, 2000) <http://www.tlsn.net/services.htm>.

attracting a telemarketing firm to locate in the community when the cost of connectivity was $14,400 per month greater than in Corpus Christi or San Antonio.[100]

In discussions with members of Texas Telephone Association, it has been suggested that the key problem is not the lack of data transport facilities in rural Texas, but the high cost of service due to distance sensitive pricing under existing tariffs. Carriers note that they would have to make a significant infrastructure investment to equip more central offices with data transport capabilities. The carriers note that this investment may not be cost effective if there is not sufficient demand for these facilities.

Data indicates that costs are declining for equipping more central offices with data transport facilities. For example, Nortel Networks estimates the capital costs of an xDSL POP, for a city of 85,000 served by 3 central offices with residential xDSL penetration increasing from 5% to 60% over a five year period, at $1.3 million to $2.8 million per year.[101]

Where cost-effective transport does exist, congestion may be a problem. Congestion refers to inadequate bandwidth in the middle-mile network to transport data from the last mile to the Internet backbone. Consumers are using substantially more bandwidth in the last mile than they did when they used it primarily for telecommunications services. For instance, it is becoming common to use audio-visual and graphic intensive applications on the Internet. Carriers are rapidly discovering that in many areas there is not enough capacity to move data traffic from the phone company's central office (where the local loop aggregates traffic) or the cable company's head-end (where the cable network aggregates traffic) to the Internet backbone.[102] The problem will likely become more prevalent in the future as bandwidth intensive applications increase.[103]

This problem of middle mile congestion will even affect rural areas that have favorable demographics to support deployment of broadband services. If broadband penetration increases in those densely populated rural areas without a corresponding upgrade to middle mile facilities, rural residents may once again be challenged to obtain adequate Internet access.

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[100] Letter from Dick Messbarger, Executive Director, Greater Kingsville Economic Development Council, to Susan Combs, Commissioner, Texas Department of Agriculture (Aug. 29, 2000) (the City of Kingsville and local businesses and individuals committed $280,000 in building improvements to compensate for the higher phone line costs).

[101] Capital costs include Remote Access Concentration, Central Office DSLAM, Digital Loop Carrier DSLAM, leased transport links, servers, and central office routing switch. Capital costs do not include significant operating expenses. *See* Nortel Networks, BUILDING A PUBLIC LOCAL AREA NETWORK at 37 (2000).

[102] *Federal – State Joint Conference on Advanced Services* (last modified Mar. 8, 2000) <http:// www.fcc.gov/jointconference/transcript-dc-1.htm>.

[103] *Id.*

LAST MILE CONNECTIONS

The "last mile" is often identified as the most expensive missing link to providing access to advanced telecommunications services. Fortunately, multiple technologies exist that can cost-effectively provide "last mile" connections. The last mile can use wireline, cable, wireless, or satellite technologies to provide high-speed Internet connections. This section describes the overall status of "last mile" connectivity in Texas and then discusses the deployment of various technologies.

The FCC currently requires providers of high-speed telecommunications services to report twice yearly on the growth of lines, providing the most comprehensive and current data on advanced services deployment. [104]

High-speed Lines by Technology

State	Dec. 1999 Total	June 2000 ADSL	June 2000 Cable	June 2000 Other*	June 2000 Total	% Change 1999 to June 2000	% HH Connected 1999	% HH Connected June 2000
Texas	**152,518**	**73,117**	**135,999**	**65,014**	**274,130**	**80**	**1.75**	**2.83**
North Carolina	**57,881**	**8,662**	**42,290**	**30,158**	**81,110**	**40**	**1.44**	**1.69**
Massachusetts	**114,116**	**15,802**	**148,233**	**19,922**	**183,957**	**61**	**4.28**	**6.64**
California	**547,179**	**373,574**	**297,415**	**238,700**	**909,689**	**66**	**4.22**	**6.53**
Pennsylvania	**71,926**	**18,313**	**38,340**	**23,239**	**79,892**	**11**	**1.30**	**1.36**
Nationwide Reported Total	**2,756,492**	**950,590**	**2,248,981**	**1,119,794**	**4,319,365**	**57**	**2.29**	**3.17**

*Other includes fiber, satellite, and fixed wireless.

The FCC data shows that last-mile connectivity is undergoing rapid growth but that the absolute numbers of subscribers and the percentage of overall residential households connected remains relatively low. High technology states like California and Massachusetts are experiencing higher levels of subscribership to high-speed services than Texas. As discussed in a subsequent chapter, this pattern fits the overall adoption pattern for new technologies, with rapid growth rates among small numbers of early adopters that ultimately lead over time to adoption by mainstream users.

[104] *High-speed Services for Internet Access: Subscribership as of June 30, 2000* at Table 5 (Oct. 2000) (*FCC High-speed Services Report, June 2000*).

The FCC also examined the overall geographic distribution of advanced services deployment, by requiring providers to identify those zip codes in which there was at least one high-speed customer. This data set provides only a very rough estimate of the geographic distribution of advanced services deployment because it does not show the number of customers who can actually obtain service. For Texas, the data shows that 62 urban cities have four or more high-speed service providers, while 264 urban cities have one to three service providers. In contrast, no rural city has four or more providers, and 182 rural cities have at least one provider.

The next section of this Report examines in more detail the geographic distribution of advanced services, based on data obtained by the PUC.

Wireline Technologies

xDSL

The chart on the next page illustrates the deployment of xDSL as of December 1999 by incumbent local exchange companies (ILECs) in Texas by population area, with the Council of Governments (COGs) representing rural areas. The data indicates that approximately 94.5% of xDSL subscribers were in urban areas at the end of 1999.[105]

[105] *High-speed Services for Internet Access: Subscribership as of June 30, 2000* at 2 and Table 5 (Oct. 2000) (*FCC High-speed Services Report, June 2000*). This report notes that there are 73,117 ADSL lines in Texas as of June 2000 and that nationwide ADSL lines increased 156% in the first six months of 2000. Consequently, the increase in subscribership appears consistent with the PUC data.

xDSL Market in Texas – ILEC Figures (End of Year 1999)

Area	No. of xDSL access lines
Large Metro (Group 1)	19,884
Suburban (Group 2)	7,105
Small and Medium Metro (Group3)	1,169
Sub-Total Urban	**28,158**
Alamo Area Council of Governments	52
Ark-Tex Council of Governments	164
Central Texas Council of Governments	24
Coastal Bend Council of Governments	88
Deep East Texas Council of Governments	169
East Texas Council of Governments	14
Middle Rio Grande Development Council	1
North Central Texas Council of Governments	1,081
South Plains Association of Governments	1
South Texas Development Council	44
Texoma Council of Governments	5
West Central Texas Council of Governments	3
Sub-Total Rural	**1,646**
Statewide Total	**29,804**

The following chart illustrates the deployment of xDSL by CLECs in Texas at the end of 1999. The data suggests that competitive local exchange companies (CLECs) had about 5% of the total xDSL market in urban areas. It is assumed that the total number of customers that CLECs currently serve has increased substantially since this data was gathered. While the data reflects that CLEC deployment has been entirely in urban areas, there is some evidence that suggests that CLECs are beginning to provide xDSL service in some rural areas with high population densities.

xDSL Market In Texas – CLEC Figures (End of Year 1999)

Area	No. of xDSL access lines
Large Metro (Group 1)	881
Suburban (Group 2)	22
Subtotal Urban	**903**
Subtotal Rural	**0**
Statewide Total	**903**

RECENT XDSL DEPLOYMENT PROJECTS

Since the PUC's data request, many telecommunications carriers have made significant announcements of intentions to deploy advanced services capability. These announcements represent a significant investment in upgrading telecommunications infrastructure to permit high-speed Internet access.

"Project Pronto"[106]

SBC Communications (SBC) recently announced a $6 billion initiative to deliver super-fast, always-on broadband Internet access, utilizing ADSL technology, to customers in its 13 state territory, including Texas. The network developed through the "Project Pronto" initiative is intended to serve as a platform to deliver next generation, broadband-powered services. These services include entertainment quality video and emerging products such as Voice-over-ADSL, personal videoconferencing, interactive online games, and home networking.

Project Pronto is an example of the migration towards a converged voice, data, and video network. In general, the convergence of voice, data, and video into a single network increases the efficiency of the network and provides end users with a single source for their communications needs.

The key to achieving the benefits of Project Pronto is the "re-architecturing" of the SBC network by pushing fiber deep into residential neighborhoods. Next generation remote DSLAM equipment will be installed at fiber-copper interfaces to accommodate the transport of xDSL signals.

SBC's goal for Project Pronto is to quadruple its ADSL deployment. This will require upgrading approximately 1,400 central offices with ADSL equipment, laying more than 12,000 miles of fiber optic cable, and installing or upgrading 25,000 neighborhood broadband gateways.[107] Through this new network, SBC claims that its customers will receive minimum downstream connection speeds of 1.5 Mbps, with more than 60% of its eligible customers receiving speeds up to 6.0 Mbps.

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[106] *SBC Launches $6 Billion Initiative to Transform it into America's Largest Single Broadband Provider*, SBC Communications Inc. News Release (Oct. 18, 1999).

[107] Important to the deployment of Project Pronto is the FCC's recent decision allowing SBC's ILECs to own next generation equipment functionally equivalent to DSLAMs. *See* FEDERAL COMMUNICATIONS COMMISSION, CC DOCKET NO. 98-141, SECOND MEMORANDUM OPINION AND ORDER (Sept. 8, 2000).

Other Initiatives

Sprint, the third largest ILEC in Texas, has agreed, through the operation of its ILECs, United Telephone Company of Texas and Central Telephone Company, to provide unbundled xDSL capable loops as part of its proposed Sprint Texas Agreement (STA).[108] Further, Valor Telecommunications of Texas, which purchased a number of rural exchanges from Verizon, formerly GTE, has agreed to provide xDSL service to ten exchanges[109] within 18 months of the closing of the transaction with Verizon. Subsequently, Valor will provide xDSL service within 15 months of a bona fide request from customers for no less than 75 xDSL lines.[110]

In addition, many of the smaller ILECs in the state, *i.e.* co-ops and other independent telephone companies, have also begun the process of deploying advanced services to their customer base. These companies, some 35 of which serve fewer than 5000 access lines, are beginning to respond to a growing desire for advanced services.

Prominent examples include Eastex Telephone Cooperative and Valley Telephone Cooperative.[111] Eastex began offering ADSL service in December 2000. Initially, Eastex can make service available with equipment located in each central office switching location to 50% of its customers (approximately 720). The investment required for these facilities totals approximately $1 million, or $1400 per potential user. Additional customers may be added at a cost of approximately $2000 for each additional 12 customers per central office. Eastex expects to make ADSL available to approximately 85% of its customers by the end of the first quarter of 2001.

Valley Telephone Cooperative began offering xDSL service to its customers in February 1998. At the end of October 2000, Valley Telephone Cooperative served 132 customers, or 2.5 percent of its customer base. Valley Telephone serves 7,300 square miles of South Texas ranch country. From February 1998 until May 1999, Valley Telephone installed equipment designed for central office applications in remote digital loop carrier (DLC) cabinets

[108] *Notification of MCI Worldcom, Inc. and Sprint Corporation of the Transfer of Control of Sprint Corporation's Texas Operating Subsidiaries to Worldcom, Inc.*, Docket No. 21835, Notice of Withdrawal at 3 and 13 (Jul. 18, 2000) (despite the demise of its merger with Worldcom, Sprint has agreed to develop a standard interconnection agreement for use by its operating subsidiaries).

[109] *Applications of Valor Telecommunications of Texas, L.P. for Approval of Sale, Transfer, or Merger, Issuance of Certificate of Convenience and Necessity, Designation as an Eligible Telecommunications Provider, and Designation as an Eligible Telecommunications Carrier*, Docket No. 21834, Final Order at 11 (Jun. 15, 2000). The ten exchanges are Andrews, Brownfield, Crockett, Dumas, Glen Rose, Lamesa, Levelland, Pecos, Texarkana, and Perryton.

[110] *Id.* at 11-15.

[111] Information regarding Eastex Telephone Cooperative and Valley Telephone Cooperative provided by TTA (Dec. 2000).

allowing Valley Telephone to deliver xDSL to customers in remote areas. Through the deployment of fiber optics and DLC technology, Valley Telephone can now offer xDSL service to 81 percent of its customer base. Additionally, Valley Telephone plans to deliver video services through its network in the future.

Cable Technology

CABLE MODEM

As of June 1, 2000, there were 148,566 cable modems installed in Texas, the majority of which offer two-way access to the Internet.[112] This subscriber data reveals that approximately 4% of the 3,700,000 cable subscribers in Texas subscribe to cable modem service.[113] An analysis provided by the Texas Cable and Telecommunications Association shows that high-speed cable service is currently deployed in 49 urban cities. High-speed cable service is also available in 28 rural towns in counties with populations greater than 20,000 an in five rural towns in counties with populations between 5,000 - 20,000; it is not available in any town in a county with a population of 5,000 or less.

Appendix I of this Report contains a brief discussion of recent consolidation in the cable industry and the debate surrounding "open access" to the cable system by ISPs. A map and list of cities where high-speed cable access is available in Texas is included in Appendix J of this Report.

Wireless Technologies

FIXED WIRELESS

The market for fixed wireless services is forecasted to reach approximately $1 billion by the end of 2002, according to market researcher Gartner Group. Additionally, analysts expect the fixed wireless market to grow significantly in the next three to five years with projections estimated at 2 to 2.6 million subscribers by 2003.[114]

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[112] Fax from the Texas Cable and Telecommunications Association (TCTA), *Membership Profile as of July 2000* (Oct. 5, 2000) (on file with TCTA). Of the 148,566 cable modem subscribers in Texas only 455 are one-way systems that utilize the telephone network for the return path to the Internet. In addition, cable providers in Texas have 394 dial-up subscribers who do not utilize cable modems.

[113] *Id.*

[114] PETER JARICH & JAMES MENDELSON, U.S. WIRELESS BROADBAND at 243, 252, and 262; Strategis Group, *High-Speed Internet Report* at 131 (visited Nov. 8, 2000) <http://www.strategisgroup.com/>.

In geographic areas with limited cable or telephone infrastructure, as in many rural areas of the United States, including Texas, a fixed wireless network arguably can be deployed much faster and with substantially less expense than can xDSL or cable modem offerings.[115] Consequently, fixed wireless may prove an excellent alternative for deploying advanced services into rural areas. First, the substantial costs associated with installing and maintaining wires to a customer's premises, which can be cost-prohibitive for wireline technologies, are not incurred.[116] Second, installation at the customer's premises is minimal. Third, the architecture of a wireless network allows providers to roll out their facilities in a manner that is more closely related to customer demand.

MMDS

MMDS Internet access offerings currently exist in the following areas of Texas:[117]

Company	**Location**	**Direction**	**Maximum Downstream Speed**
IJNT.net, Inc.	Beaumont	One-way	10 Mbps
Nucentrix Broadband Networks, Inc.	Austin Sherman	Two-way	1.54 Mbps
U.S. Interactive d/b/a AccelerNet	Houston	One-way	10 Mbps

Additionally, Worldcom, the largest holder of MMDS licenses, ran MMDS trials in Dallas during the summer of 2000.[118] In February 2000, Nucentrix announced that it would run field trials of Cisco Systems Vector Orthogonal Frequency Division Multiplexing (VOFDM), which utilizes MMDS and unlicensed spectrum, in Austin and Amarillo, during 2000 and that it plans to deploy the technology in at least 20 markets nationwide by the end of 2001.[119]

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[115] *Second Advanced Services Report* at ¶ 44. In its most basic form, a fixed wireless network requires only a transmission device on one end and a transceiver on the other end to be operational. In contrast, wireline systems incur the expense of negotiating rights of way, digging trenches, and laying fiber-optic cable.

[116] FEDERAL COMMUNICATIONS COMMISSION, 14 FCC RCD 10145, 10267, IMPLEMENTATION OF SECTION 6002(B) OF THE OMNIBUS BUDGET RECONCILIATION ACT OF 1993, ANNUAL REPORT AND ANALYSIS OF COMPETITIVE MARKET CONDITIONS WITH RESPECT TO COMMERCIAL MOBILE SERVICES, FOURTH REPORT (1999) (*Fourth Report*).

[117] *Fifth Wireless Report* at E-19.

[118] *Id.* at E-6.

[119] *Id.* at E-20. Additionally, Nucentrix plans to enter 30 additional markets in Texas in the near future.

Nucentrix currently holds MMDS licenses in over 30 Texas markets, predominantly in rural Texas, an area that covers includes 3.3 million households.

LMDS

While LMDS is being tested and deployed by several companies nationwide, most deployment is to business customers in urban areas.[120] LMDS Internet access offerings currently exist in the following areas of Texas: Dallas (NextLink); San Angelo, Brownwood, and Goldthwaite (Central Texas Communications); and Irving (Frazier/King Media).[121]

One of the early deployments of LMDS has been by Central Texas Communications, an affiliate of Central Texas Cooperative.[122] Currently, Central Texas Communications is billing for broadband service to seven business customers in San Angelo and is expanding service to Brownwood and Goldthwaite.[123]

CELLULAR AND MOBILE

In the United States, in the twelve months ending December 1999, mobile telephony subscribership increased 24 percent from 69.2 million to 86 million.[124] In fact, 88 percent of the total U.S. population have three or more different operators offering mobile telephone service in the county where they reside.[125] Moreover, 69 percent of the population lives in areas with five or more mobile telephone operators offering service.[126]

PCS

Although cellular and broadband PCS technically supports high-speed services, few licensees are using spectrum in this manner.[127] The primary offering currently using this spectrum for advanced services is AT&T's Project Angel, which uses broadband PCS spectrum to reach homes and small business in the Dallas area.[128]

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[120] *Advanced Telecommunications in Rural America* at 17.

[121] *Fifth Wireless Report* at E-19.

[122] *Advanced Telecommunications in Rural America* at 27.

[123] PAUL SHULTZ & RANDY SUKOW, *Building the Last Mile: Broadband Deployment in Rural America* at 9 (Jun. 2000).

[124] *Fifth Wireless Report* at 5-6.

[125] *Id.* at 6.

[126] *Id.*

[127] *Second Advanced Services Report* at ¶ 53.

[128] *Id.*

Satellite Technology

Service to whole regions, reaching low subscriber density areas without costly construction of terrestrial networks, makes satellite access to broadband services a viable alternative for rural areas.[129] Moreover, satellite access is not geographically constrained, unlike other advanced services. For example, "DirectPC reports that remote customers are assured a clear satellite signal so long as a clear line of sight to the southern sky is maintained."[130] Further, because satellite service "provides customers in the most remote rural areas with the same quality of service provided to those in urban areas, it provides a preview of the potential for satellite broadband to eliminate geography and location as a cost factor."[131]

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[129] PIONEER CONSULTING, LLC, *Next Generation Broadband Satellite Networks* at 6-7 (1999).

[130] *Advanced Telecommunications in Rural America* at 16.

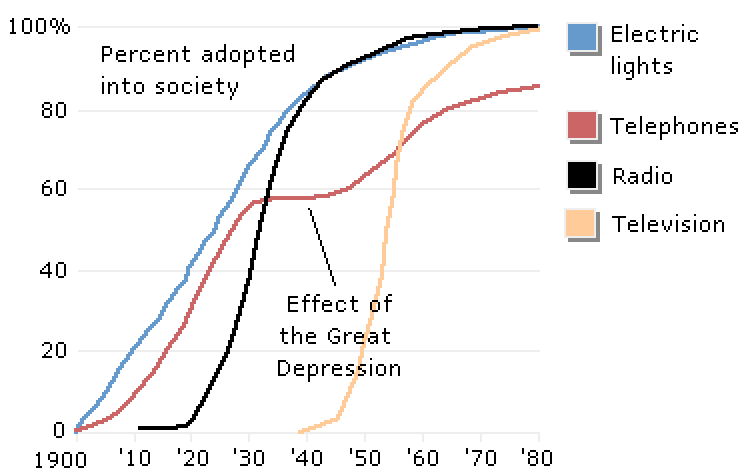
[131] *Id.* at 17.

CHAPTER 5: ISSUES AND PROSPECTS FOR BROADBAND DEPLOYMENT

> "The capital cost of providing DSL to the 397 customers served directly from the central office will be only $38 per customer…. In cold contrast, the average capital cost to provide DSL to the 390 customers too far away to be served directly from the central office is nearly $32,000 per customer."
>
> --Bob Rowe, NARUC President[132]

Despite the aggressive effort by carriers to roll out advanced services, most competitive and innovative services are available only in densely populated areas. Targeting these areas allows advanced services providers to spread the cost among more customers. Recent studies show that rural households lack access to advanced services and will be much less likely to have access to advanced services if left without government assistance.[133]

However, competition is rapidly driving the adoption of broadband technology by users. It is expected that as users become more familiar with the advantages of speed and as Internet content becomes more bandwidth extensive, they will demand broadband access. History tells us that successful products take time to gain a foothold but then rapidly become part of our lives. This pattern, illustrated below for the telephone, radio, electric lights, and television, will no doubt occur for broadband products. The difference, today, is that the adoption curve is far more compressed in time.

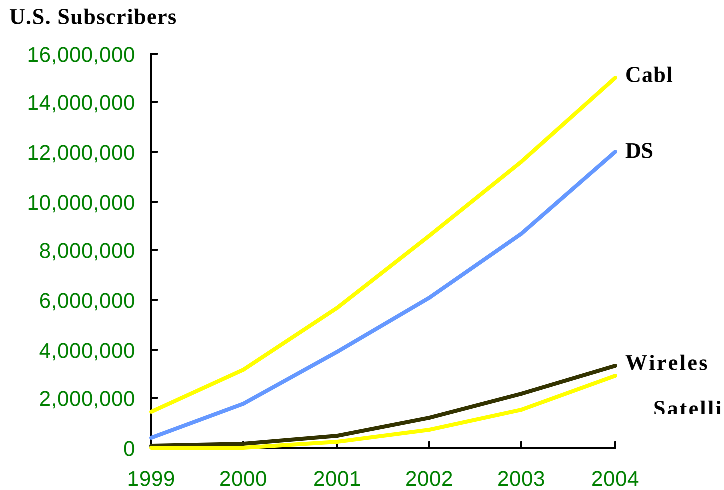


Source: <www.startribune.com>

[132] Bob Rowe, *The Telecom Act Toolbox*, (visited Oct. 3, 2000) <http://www.naruc.org/Congressional/ToolboxAct.htm>.

[133] *See Falling Through the Net III.*

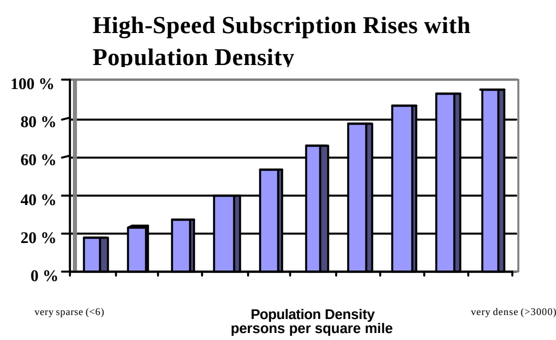
This can be illustrated further by analysts' predictions of broadband adoption over the next four years.



Source: FCC Second Advanced Services Report

In Texas, "rural areas face unique demographic and distance challenges in receiving advanced telecommunications services. Carriers are deploying advanced telecommunications services faster in urban than rural areas due to distance, demographic, and technology factors."[134] Given the disparities between rural and urban areas in demographic characteristics such as income, population, and density, such an outcome is hardly surprising.

Advanced Service Deployment is Driven by Distance and Density



Texas

- 8 Texas counties have 51% of the population, but only 3% of land area
- 89 Texas counties have only 2.3% of the population, but 44% of land area

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[134] Brett Perlman, *TTA Conference Presentation* (last modified Sept. 15, 2000) <http://www.puc.state.tx.us/about/perlman.cfm>.

Population density has been determined to be an important aspect of broadband deployment, irrespective of population.[135] Consequently, for broadband providers it is more cost effective to provide services if the population of an area is concentrated rather than dispersed. While the cost of wiring rural Texas would certainly be large, it is believed that many rural telephone companies are deploying broadband-capable networks.[136]

Market forces alone are unlikely to address the high-speed needs of all rural Texans. In more isolated areas, xDSL or cable modem Internet access may not be a plausible solution for the reasons discussed above. Consequently, in these areas, other technologies, such as fixed wireless or satellite, may offer more cost-effective deployment options today. However, in more densely populated rural areas or for those near a central office, xDSL or cable modem Internet access may be a viable market oriented solution.

For example, NECA estimated the following xDSL upgrade costs per line in rural exchanges:[137]

- $493 per line for customers within 18,000 feet of a central office.
- $4,121 per line for customers beyond 18,000 feet of a central office but within 18,000 of a digital loop carrier terminal.
- $9,328 per line for isolated territories where factors such as distance, population density, or difficult terrain make it uneconomical to upgrade lines.

However, upgrade costs will differ enormously among rural telephone companies because of differences in size of customer bases, locations, age, and condition of their networks.[138] As illustrated below, in Texas rural counties, approximately 21% of access lines (or 148,000 lines) are more than 18,000 feet from a central office.[139] Additionally, the impact

[135] *High-Speed Services for Internet Access: Subscribership as of June 30, 2000* at 4 (Oct. 2000).

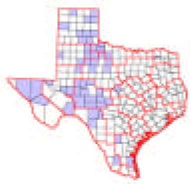
[136] NECA RURAL BROADBAND COST STUDY: SUMMARY OF RESULTS at 2 (Jun. 21, 2000).

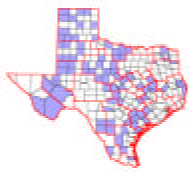
[137] *Id.* at 4. These costs per line are based on average characteristics such as line size and customer density of rural exchanges not upgraded.

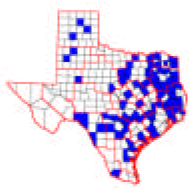
[138] *Id.* at 6.

[139] Source: 1999 Texas Carrier Data. Ironically, in communities with populations between 20,000 and 100,000, 30% of the access lines (or 589,000 lines) are more than 18,000 feet from a central office. However, this data does not indicate whether a customer may be within 18,000 feet of a DLC or located in an isolated area.

of deployment from SBC's Project Pronto and other commitments of Texas ILECs on rural Internet access remains to be seen.[140]







	< 12kft from CO	12 to 18kft from CO	> 18kft from CO
Counties with Population <5000	50,000 59%	19,500 23%	15,000 18%
Counties with Population >5000, <20000	383,000 61%	109,000 17%	133,000 21%
Counties with Populaton >20000, <100000	907,000 46%	487,000 25%	589,000 30%
Total	1,340,000 50%	615,500 23%	737,000 27%

Conclusion

It is difficult to estimate the cost of upgrading all the loops in Texas to advanced service capability. The difficulty is compounded by the fact that the PUC only has jurisdiction over telecommunications companies that provide xDSL service; the PUC does not regulate wireless technologies, cable services, and satellite technologies. It is important to note that on a nationwide basis "the number of sparsely populated [areas] with high-speed subscribers increased by 69% during the first half of this year, compared to an increase of 4% for the most densely populated [areas]."[141] Consequently, while market forces alone are unlikely to address the high-speed needs of Texans in isolated areas for xDSL or cable modem Internet access, other technologies, such as fixed wireless or satellite, may offer cost effective deployment options.

Policy makers and governments have a role in accelerating the deployment of advanced services to traditionally underserved areas, such as rural communities. A starting point is to identify places in Texas where market forces are not likely to deliver broadband services. These areas will most likely need some form of public assistance or intervention before broadband services will be deployed. By focusing only on such places, targeted incentives or

[140] *See* Chapter 3 of this Report for further information regarding alternative technologies and SBC's Project Pronto.

[141] *High-Speed Services for Internet Access: Subscribership as of June 30, 2000* at 4 (Oct. 2000).

programs that are cost effective and manageable can be formulated. This topic is addressed in Chapter 6 of this Report.

CHAPTER 6: POTENTIAL POLICY SOLUTIONS[142]

> "Public policy to close the digital divide should build human capital by giving people the capital skills to use the information age technologies, the experience to make them comfortable with these technologies and the resources to obtain the necessary hardware at home, where they conduct their daily activities."
>
> -- Marc N. Cooper, Consumer Federation of America

Meeting State and Federal Policy Goals for Advanced Services

Both Congress and the Legislature have recognized the importance of access to advanced telecommunications services. In Section 706 of the Federal Telecommunications Act, Congress requires that advanced telecommunications capability be deployed to all Americans on a reasonable and timely basis. Similarly, Section 51.001(g) of the Public Utility Regulatory Act enunciates Texas' policy that all regions of the state, including low-income customers and customers in rural and high cost regions, have "reasonably comparable" access to advanced telecommunications services.

These sections make clear that the ultimate policy objective is universal broadband access for all citizens within a reasonable time period. Indeed, some jurisdictions have begun to establish a date certain for achieving ubiquitous broadband access. In Iowa, for example, the recently released Iowa 2010 Strategic Plan established 2005 as the goal for all Iowans to have access to advanced telecommunications services and 2010 as the goal to electronically connect all Iowans to each other and the world.[143]

Additionally, the State of North Carolina has entered a "social contract" with BellSouth, Sprint and Verizon.[144] These companies have agreed to work with ISPs, telephone cooperatives, state government, and others in the communications industry to provide affordable, high-speed Internet access to all areas of the state within three years. They will provide local dial-up Internet access from every telephone exchange within one year.

[142] Numerous state and federal policies and programs that affect the deployment of advanced services in rural and high cost areas of Texas have already been implemented. *See* Appendix N of this Report for a discussion of current state and federal policies or programs.

[143] Governor's Stragetic Planning Council, IOWA: THE STATE OF THE FUTURE 2010 at 13 (Nov. 2000) < http://www.iowa2010.state.ia.us/library/finalreport/finalreport.htm>.

[144] North Carolina, Office of the Governor, BRIDGING THE DIGITAL DIVIDE IN NORTH CAROLINA <http://www.governor.state.nc.us/news/releases/DigitalDivide.htm>.

Similarly, Texas should establish a goal that all Texans have access to advanced services by a date certain. Importantly, this access should be affordable and service should be reliable, easy to use, robust, and scaleable to growing needs and uses. Finally, it must remain flexible enough to adapt to next generation technological advances.

Issues in Meeting State and Federal Policy Goals for Broadband Access

As this Report has shown, there are many encouraging signs that competition and technology are driving broadband deployment, particularly in urban parts of the State. Telecommunications carriers, cable companies, wireless providers, and satellite companies are all making large investments across the state to provide access to advanced telecommunications capabilities. At the same time, the state is at an early stage of technology adoption with current penetration levels for broadband remaining relatively low.

This Report has also highlighted several emerging issues indicating that some regions of the state and certain customers may be not be receiving reasonably comparable access to advanced telecommunications services. These issues are:

- Cost and availability of "middle mile" connectivity in rural areas.
- Lack of widespread deployment of "last mile" broadband connections in rural areas.
- Lower usage of computers and the Internet by certain groups of Texans, particularly "at risk" populations, in both rural and low-income areas.

This Report has described why access to advanced telecommunications services is important for maintaining the economic viability of rural communities and for obtaining access to vital community services, such as health care and education. If the Legislature believes that certain communities and individuals are being left behind, then the state should adopt public policies to address these issues.

The next section offers policy objectives and recommendations that the Legislature may wish to consider in implementing the state's policy "to ensure that customers in all regions of this state, including low-income customers and customers in rural and high cost areas, have access to telecommunications and information services, including…cable services, wireless services, and advanced telecommunications and information services." This section first suggests overall policy objectives that the Legislature should adopt and then discusses specific policy alternatives that the Legislature may consider.

PUBLIC POLICY OBJECTIVES

The following tenets are important for developing an overall framework for supporting advanced services deployment in rural Texas.

TECHNOLOGY NEUTRALITY

Rural Texas is not only vast but has varying geography and levels of wealth. Consequently, an advanced services technology or service that is well suited for one region might be inappropriate for another. Even when geographic similarities exist, demographic characteristics like population density and income level may affect the cost of deployment. To meet these challenges, advanced services providers are experimenting with a variety of technologies to reach "end-use" customers.

Therefore, it is important to encourage the deployment of advanced services to rural Texans in a technology neutral and cost-effective manner. In this rapidly changing, dynamic environment, it is too early to declare a particular technology or service the winner. Consequently, any public policy adopted at the State level should encourage advanced services deployment without reference to any specific technology.

AVOIDANCE OF EXCESSIVE REGULATION

Potential policy solutions for encouraging deployment in rural areas require creativity, innovation, and simplicity. Currently, unregulated companies or unregulated affiliates of regulated entities provide most broadband services. Further, regulating these entities or requiring them to provide broadband services to specific rural areas could hamper innovation and competition. Consequently, to the extent the Legislature desires to speed-up the wide scale deployment of advanced services, incentives could be used rather than regulation. However, if regulation is necessary, it should be the least intrusive means available.

ENCOURAGING LOCAL SOLUTIONS

Public policies that are pro-competition and pro-investment should encourage deployment of advanced services to rural areas. Additionally, policies that encourage these solutions at the local level are more likely to result in the efficient use of resources and better meet the needs of rural communities.

For instance, while the overall data shows that broadband deployment is occurring at a much faster pace in urban areas, there are examples of rural communities that have obtained advanced services via innovative market-based thinking. Consequently, the Legislature should encourage local solutions and the sharing of "best practices" among rural communities in Texas and other states.

AVOIDING "ONE SIZE FITS ALL" SOLUTIONS

One-Size-Fits-All policies are unlikely to achieve widespread success. The differing capabilities of various broadband technologies guarantee that one particular technology or set of market players may not provide the best answer in all locations and circumstances. For example, consumers in remote areas may be more cost-effectively served by wireless and satellite services than by existing telecommunications or cable infrastructure.

Moreover, differing economic and demographic characteristics in various communities may require different policy solutions. Developing a "tool kit" approach that allows communities to select the program that best fits the need may be the most effective policy solution.

Specific Policy Alternatives to Encourage Deployment

In this section, specific policy alternatives to encourage advanced services deployment in rural areas are explored.

EXPANDED DATA COLLECTION ACTIVITIES

Pennsylvania and Georgia have recently developed Internet-based comprehensive telecommunications facility inventories.[145] These inventories have been useful both in identifying those parts of the state lacking telecommunications facilities and for use by economic development officials and others in site selection decisions. While carriers were initially reluctant to provide data, they have found these tools useful in better understanding telecommunications deployment.

DEMAND AGGREGATION

Demand aggregation is a concept that is based on the simple premise that the sum of the parts is more valuable than the parts themselves. In demand aggregation, several small customers who desire broadband services join together and hold themselves out to a provider as a single customer that is large enough to warrant private investment in providing the service. This group may consist of local school districts, local government entities, small businesses, and individual residents. Once this group reaches critical mass, they become an attractive business opportunity to an advanced services provider.

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[145] *See* Georgia's map <http:/maps.gis.gatech.edu/telecomweb/index.html> and Pennsylvania's map <http://guoray.ist.psu.edu/info/Publications/ESRI_P147.htm>.

The approach has worked. For instance, in Stanly County, North Carolina, the local school district, library, hospital, and community college banded together through demand aggregation to bring high-speed access to their rural community.[146]

Berkshire Connect, a consortium of private companies, government officials and nonprofit organizations, is one of the best-known demand aggregation success stories. Businesses in rural Western Massachusetts faced high costs for telecommunications services due to the lack of a community point of presence.[147] In response to this problem citizens formed a consortium with state backing to measure the demand for services, assess potential technology solutions, and develop an economically viable business plan to attract a new advanced services provider to the region. Massachusetts provided $1.5 million in funding for the initial needs assessment and additional capital expenditures.

Demand aggregation creates a win-win situation for the rural resident and the advanced services provider. While individual customers in a rural area may not justify the investment necessary to bring advanced services to a rural area, demand aggregation creates a level of certainty for providers that an investment can be profitable. Conversely, rural communities, by projecting the aggregate demand of their customer base, increase their buying clout and gain collective bargaining power.

Importantly, demand aggregation creates an incentive for deployment of advanced services infrastructure in areas that otherwise would be overlooked. Consequently, demand aggregation may be a policy worth considering for the deployment of advanced telecommunications services to rural areas.

ANCHOR TENANCY

Anchor tenancy follows the demand aggregation concept, but utilizes large consumers of telecommunications services (such as local government, schools and libraries) to guarantee a certain level of consumption, thus mitigating the risk of making the relatively high fixed investment.

Once the fixed investment is made, the incremental cost associated with serving additional businesses and individuals is relatively low, thus increasing the penetration of advanced services to communities while maintaining profitability.

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[146] William Wright, *Overcoming Barriers to Rural Access: Policy Recommendations* (visited Nov. 8, 2000) <http://www.itc.org/aaron/archive/current/msg00079.html>.

[147] Louise Finckel, *The Road Less Traveled*, CIO MAGAZINE (Oct. 15, 2000) <http://www.cio.com/archive/101500_road.html>.

Colorado's Beanpole Project (HB 99-1102), enacted in the 1999 session, provides an example of anchor tenancy. Under the "Beanpole Project," public sector users pool buying power to provide market incentives to private providers to set up a multitude of local Network Access Points. In this way private providers are guaranteed sufficient return to mitigate risking the relatively high fixed costs of locating this facility in under-served areas. Once the Network Access Point is located in the community to serve these "guaranteed" customers, the incremental cost to add additional individuals and businesses to the network is relatively small, thus an increase in broadband diffusion is possible. A total of $4.6 million was appropriated to assist local communities in accomplishing this in Colorado.

The concept behind the Beanpole Project is similar to the Texas General Services Commission's Texas Telecommunications Infrastructure Gateway (TTIG). The TTIG project, currently being piloted in four sites, seeks to push technology and Network Access Points further into communities.[148] While currently unfunded, GSC has long range plans to roll out services to 50 sites.

ENCOURAGE COMMUNITY NETWORKS

The recent Community Network Initiatives undertaken by the TIF could be expanded. During the first round, the TIF Board funded 36 proposals for community networks. While the details of each network differed, each proposal was required to have public access, training, local content and ability to demonstrate long term sustainability.

These community networks allow broad community participation and appear to have been successful in bringing advanced telecommunications services to the communities they serve. These initiatives could be expanded, and participation by other than existing TIF stakeholders (schools, libraries, hospitals, and universities) could be encouraged.

PROVIDE COMMUNITY INTERNET ACCESS AND TRAINING TO "AT RISK" POPULATIONS

The state could establish and fund public/private partnerships to develop Community Technology Centers (CTC). These CTCs provide individuals in under- served inner cities and rural areas with access to computers, technology literacy training and the Internet. For example, Florida has entered into a partnership with Virginia based non-profit PowerUP to link communities to computers and information technology. PowerUP provides computers, software, technical support and staff training. Private corporate sponsors provide infrastructure. The State funds other program costs.[149]

[148] For more information on the Texas Telecommunications Infrasturture Gateway, *see* <www.ttig.state.tx.us>.

[149] The "PowerUP Florida" partnership is currently composed of the Governor's Office, industry leaders, non-profit community groups, the Searcy Foundation, Florida A&M University's Institute on Urban Policy and Commerce, and the national PowerUP Inc. Senate Bill 406 provides $500,000 through Florida

USE ECONOMIC DEVELOPMENT FUNDS FOR RURAL TELECOMMUNICATIONS INFRASTRUCTURE INVESTMENT

The state could use existing or new economic development funding specifically for the purposes of enhancing telecommunications infrastructure. Existing funding mechanisms for economic development include state sales tax adder programs ("4A/4B" programs) and Community Development Block Grants. Making minor changes to existing programs may allow the funds to more easily be used for telecommunications infrastructure given that the infrastructure is appropriate for economic development.

Similarly, the Texas Agricultural Finance Authority ("TAFA") could be used to make loans to rural telecommunications projects. TAFA provides financial assistance to creditworthy individuals and businesses in partnership with banks or other agricultural lending institutions through six programs to eligible agricultural businesses.

PROVIDE TAX INCENTIVES FOR DEPLOYMENT

The state could provide tax relief in some form for companies that agree to provide or that are currently providing advanced services in rural areas. For example, the Comptroller has proposed a refund of the sales and use taxes that companies pay on items used to bring advanced services infrastructure to rural areas; and, telecommunications companies being eligible for a franchise tax credit for advanced services infrastructure investments outside the state's metropolitan areas.[150]

DEPLOY FIBER OPTIC CABLES IN THE STATE'S RIGHTS OF WAY

The state could adopt a policy that that allows the state to contract with a private advanced services provider to install and maintain a public/private fiber optic network along the state's highway rights of way. This network would lease capacity in a non-discriminatory fashion to providers. For example, Florida's Department of Transportation and Department of Management Services entered into a contract with Florida Fiber Networks for a 99-year build, operation, and maintenance arrangement. This fiber network will provide broadband capacity to rural and urban areas.[151]

A&M's institute to help fund the project. Among those companies partnering in the Florida initiative include: Intermedia Communications, AT&T, Universal Studios, Maxcess, Forrester Research, Verizon, Time Warner, MasTech, Cenetec, Gulf Power, and Semtor.

[150] Russell Gold, *Tax Proposal Seeks Wider Web Access*, WALL STREET JOURNAL at T1 (Nov. 1, 2000).

[151] Kim Sunderland, *Florida Regulators, Industry Spread Broadband Plan*, PHONE PLUS MAGAZINE at 36 (Oct. 1, 2000).

Allow Private Access in Limited Situations to the TEX-AN 2000 Infrastructure

The state could allow private access to the TEX-AN 2000 system in rural areas in limited situations. This access would only be allowed where specific criteria are met, the market has failed to provide an advanced services solution, and the community or private entity agrees to bear a portion of the infrastructures cost. For example, private access may only be afforded to private entities in communities of 5,000 or fewer residents upon a demonstration by the community that demand aggregation and/or anchor tenancy has failed, that an economic benefit is attainable, and the private entity commits to bear a portion of the infrastructure costs.

Provide a Narrow Exception for Rural Municipal Governments to Provide Advanced Services

Similarly, the state could create a narrow exception to PURA § 54.202 that would allow rural municipal governments to build their own telecommunications infrastructure and provide advanced services. This alternative would only be available if local efforts to aggregate demand fail or the serving ILEC fails to provide advanced services within a specific amount of time of a specified number of bona fide requests for such service. Currently state law prohibits municipal authorities and local governments from operating as telecommunications companies in Texas.[152] Consequently, in a rural area if the ILEC does not initiate rollout of advanced services, rural residents may be challenged to find an alternative provider.

Enhance Statewide Telecommunications Strategic Planning

The state could enhance statewide telecommunications planning. Currently, multiple state agencies share responsibility for various aspects of telecommunications and/or advanced services planning. The PUC has responsibility for regulatory and policy issues, the General Services Commission has responsibility for the state network, the Department of Information Resources oversees state information technology resources, the Comptroller's office is implementing an e-government initiative to move government information online, and the TIF Board issues grants to eligible recipients.

A more coordinated approach to addressing state advanced services policy issues may be required to ensure that advanced telecommunications services reach all Texans. While coordination could be done through informal interagency staff meetings and policy discussions, or through a more formal mechanism, the state could assign one state agency the authority necessary to coordinate planning for deploying advanced services. Affixing accountability to one agency should provide a more focused and efficient effort.

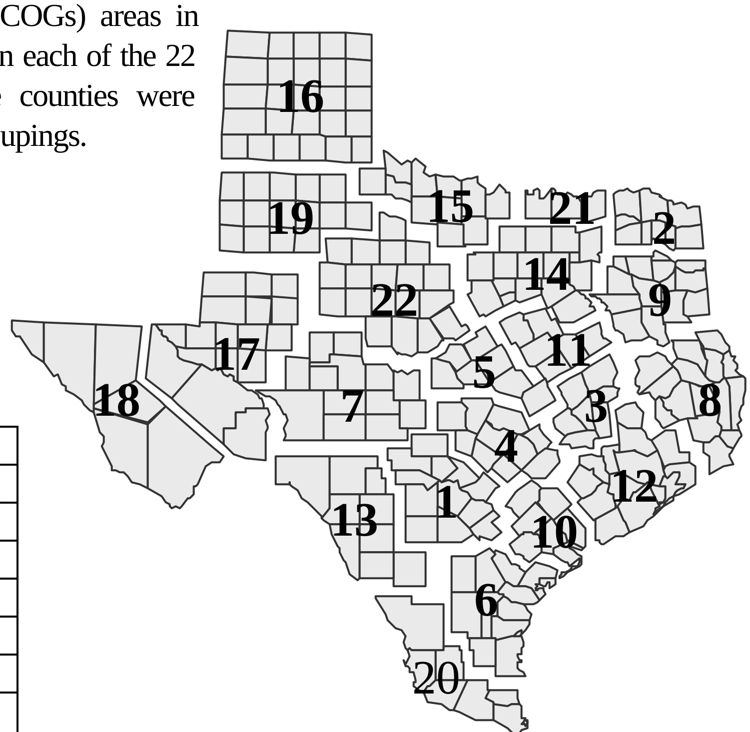
[152] PURA § 54.202.

In determining accountability, the state may also want to adopt easily verifiable performance measures. By developing measurable goals the state could assure that a policy objective, such as obtaining universal broadband access by a date certain is met. The PUC has recently implemented an internal performance measure for broadband access. Other states, such as Iowa, have implemented a broad set of objective measurements to ensure that the state meets its policy objective of universal access.[153]

[153] Governor's Stragetic Planning Council, IOWA: THE STATE OF THE FUTURE 2010 at 16.

Appendix A: County Listing

Parties in these proceedings explored methods in which to gather and aggregate useful information without compromising confidentiality of competitively-sensitive data. As a result, the data are first aggregated by county, and then the largest counties in the state are grouped according to size. Because the Rural category of counties (populations below 100,000) still varied so widely in both population and access to services, they were separated by geographic area and by size grouping. The geographic areas used for this study correspond to boundaries of the 24 Councils of Government (COGs) areas in Texas, with two exceptions.[154] Within each of the 22 resulting geographic areas, then, the counties were separated into three population size groupings.



Regional Groupings

1	Alamo Area C. O. G.
2	Ark-Tex C. O. G.
3	Brazos Valley C. O. G.
4	Capital Area P. C.
5	Central Texas C. O. G.
6	Coastal Bend C. O. G.
7	Concho Valley C. O. G.
8	Deep East Texas C. O. G. (Incl. S. E. Texas R. P. C.)
9	East Texas C. O. G.
10	Golden Crescent R. P. C.
11	Heart of Texas C. O. G.
12	Houston-Galveston A. C.
13	Middle Rio Grande D. C.
14	North Central Texas C. O. G.
15	North Texas R. P. C.

16	Panhandle R. P. C.
17	Permian Basin R. P. C.
18	Rio Grande C. O. G.
19	South Plains A. G.
20	South Texas D. C. (Includes Lower Rio Grande Val. D.C.)
21	Texoma C. O. G.
22	West Central Texas C. O. G.

[154] To further preserve confidentiality, counties in the Deep East Texas Council of Governments are combined with the South East Texas Regional Planning Commission, and counties in the South Texas Development Council are combined with the Lower Rio Grande Valley Development Council.

County Population Aggregation Groupings

Large Metro (Group 1) Counties

Harris	3,158,095	Tarrant	1,327,332
Dallas	2,023,140	El Paso	701,576
Bexar	1,359,993	Travis	693,606

Suburban (Group 2) Counties: Larger Counties near Metro Areas

Collin	401,352	Galveston	242,979
Denton	365,058	Brazoria	225,406
Fort Bend	321,149	Williamson	210,477
Montgomery	258,127		

Small and Medium Metro (Group 3) Counties: Other Larger Counties

Hidalgo	510,922	Ector	124,727
Cameron	320,801	Taylor	121,456
Nueces	317,474	Midland	118,662
Jefferson	241,940	Johnson	114,052
Lubbock	230,672	Gregg	113,147
Bell	222,302	Potter	109,243
McLennan	202,983	Tom Green	102,648
Webb	183,219	Grayson	101,541
Smith	166,723	Ellis	100,627
Brazos	133,008	Randall	98,922
Wichita	128,827		

Rural Counties

Alamo Area Council of Governments

Over 20,000	
Kendall	20,394
Wilson	30,194
Atascosa	35,268
Medina	36,827
Kerr	42,623
Comal	70,682
Guadalupe	77,963

5,001 – 20,000	
Gillespie	19,909
Frio	15,875
Bandera	15,005
Karnes	12,501

5,000 or Less	
(None)	

Ark-Tex Council of Governments

Over 20,000		5,001 – 20,000		5,000 or Less	
Titus	25,245	Franklin	9,589	Delta	4,941
Cass	30,518	Morris	13,302		
Hopkins	30,535	Red River	13,794		
Lamar	45,772				
Bowie	83,672				

Brazos Valley Council of Governments

Over 20,000		5,001 – 20,000		5,000 or Less	
Grimes	22,846	Madison	11,932	(None)	
Washington	29,033	Leon	14,450		
		Burleson	15,368		
		Robertson	15,534		

Capital Area Planning Council

Over 20,000		5,001 – 20,000		5,000 or Less	
Fayette	21,101	Blanco	8,213	(None)	
Burnet	30,755	Llano	13,104		
Caldwell	31,625	Lee	14,792		
Bastrop	49,031				
Hays	86,284				

Central Texas Council of Governments

Over 20,000		5,001 – 20,000		5,000 or Less	
Milam	24,266	San Saba	6,424	Mills	4,771
Coryell	77,438	Hamilton	7,608		
		Lampasas	17,491		

Coastal Bend Council of Governments

Over 20,000		5,001 – 20,000		5,000 or Less	
Aransas	22,579	Brooks	8,458	Kenedy	427
Bee	28,054	Live Oak	10,157	McMullen	783
Kleberg	30,216	Duval	13,607		
Jim Wells	39,842				
San Patricio	69,626				

Concho Valley Council of Governments

Over 20,000		5,001 – 20,000		5,000 or Less	
(None)		Refugio	7,882	Sterling	1,385
		McCulloch	8,778	Irion	1,696
				Menard	2,333
				Schleicher	3,047
				Concho	3,104
				Coke	3,426
				Mason	3,650
				Kimble	4,199
				Reagan	4,228
				Sutton	4,437
				Crockett	4,518

Deep East Texas Council of Governments
(Includes South East Texas Regional Planning Commission)

Over 20,000		5,001 – 20,000		5,000 or Less	
Tyler	20,107	San Augustine	8,184	(None)	
San Jacinto	20,860	Sabine	10,565		
Houston	21,884	Trinity	12,410		
Shelby	22,652	Newton	14,418		
Jasper	33,203				
Polk	47,452				
Nacogdoches	56,716				
Angelina	76,799				
Hardin	48,403				
Orange	84,648				

East Texas Council of Governments

Over 20,000		5,001 – 20,000		5,000 or Less	
Panola	23,005	Rains	8,213	(None)	
Wood	34,170	Marion	10,672		
Upshur	35,416	Camp	10,978		
Cherokee	42,778				
Van Zandt	42,998				
Rusk	45,636				
Anderson	52,540				
Harrison	59,687				

Henderson	67,347				

Golden Crescent Regional Planning Commission

Over 20,000		5,001 – 20,000		5,000 or Less	
Calhoun	20,806	Goliad	6,776	(None)	
Victoria	82,024	Jackson	13,656		
		Gonzales	17,569		
		Lavaca	18,676		
		Dewitt	19,674		

Heart of Texas Council of Governments

Over 20,000		5,001 – 20,000		5,000 or Less	
Limestone	21,059	Bosque	16,674	(None)	
Hill	30,033	Freestone	17,540		
		Falls	17,747		

Houston-Galveston Area Council

Over 20,000		5,001 – 20,000		5,000 or Less	
Austin	22,903	Colorado	18,880	(None)	
Chambers	23,545				
Waller	26,792				
Matagorda	37,910				
Wharton	40,146				
Walker	54,528				
Liberty	63,948				

Middle Rio Grande Development Council

Over 20,000		5,001 – 20,000		5,000 or Less	
Uvalde	25,619	LaSalle	5,935	Real	2,686
Val Verde	43,115	Dimmitt	10,486	Kinney	3,481
Maverick	47,877	Zavala	11,955	Edwards	3,738

North Central Texas Council of Governments

Over 20,000		5,001 – 20,000		5,000 or Less	
Palo Pinto	25,494	Sovervell	6,235	(None)	
Erath	31,275	Jack	7,314		
Rockwall	35,923				
Hood	36,205				

Navarro	41,366				
Wise	42,387				
Kaufman	63,857				
Hunt	69,309				
Parker	78,811				

North Texas Regional Planning Commission

Over 20,000		5,001 – 20,000		5,000 or Less	
(None)		Archer	8,276	Foard	1,726
		Clay	10,407	Cottle	1,957
		Wilbarger	14,138	Baylor	4,165
		Young	17,575	Hardeman	4,701
		Montague	18,290		

Panhandle Regional Planning Commission

Over 20,000		5,001 – 20,000		5,000 or Less	
Gray	23,719	Hartley	5,121	Roberts	988
Hutchinson	23,973	Wheeler	5,309	Briscoe	1,982
		Hansford	5,396	Armstrong	2,172
		Dallam	6,361	Oldham	2,219
		Carson	6,698	Sherman	2,905
		Childress	7,630	Lipscomb	3,027
		Castro	8,307	Collingsworth	3,330
		Swisher	8,347	Hemphill	3,618
		Ochiltree	8,902	Hall	3,705
		Parmer	10,475	Donley	3,810
		Deaf Smith	19,448		
		Moore	19,510		

Permian Basin Regional Planning Commission

Over 20,000		5,001 – 20,000		5,000 or Less	
Howard	32,562	Martin	5,078	Loving	106
		Winkler	8,037	Borden	748
		Ward	11,891	Terrell	1,189
		Andrews	14,072	Glasscock	1,454
		Dawson	14,793	Upton	3,815
		Reeves	14,856	Crane	4,557
		Gaines	14,985		

		Pecos	16,196		

Rio Grande Council of Governments

Over 20,000	
(None)	

5,001 – 20,000	
Presidio	8,577
Brewster	9,039

5,000 or Less	
Jeff Davis	2,234
Culberson	3,136
Hudspeth	3,328

South Plains Association of Governments

Over 20,000	
Hockley	23,933
Hale	36,603

5,001 – 20,000	
Lynn	6,591
Bailey	6,831
Crosby	7,375
Yoakum	8,169
Floyd	8,213
Terry	13,003
Lamb	14,849

5,000 or Less	
King	348
Motley	1,280
Dickens	2,254
Cochran	3,978
Garza	4,632

South Texas Development Council
(includes Lower Rio Grande Valley Development Council)

Over 20,000	
Starr	55,560

5,001 – 20,000	
Zapata	11,266
Willacy	19,662

5,000 or Less	
Jim Hogg	4,925

Texoma Council of Governments

Over 20,000	
Fannin	27,655
Cooke	32,989

5,001 – 20,000	
(None)	

5,000 or Less	
(None)	

West Central Texas Council of Governments

Over 20,000	
Brown	36,903

5,001 – 20,000	
Haskell	6,107
Mitchell	8,768
Coleman	9,590
Stephens	9,902
Runnels	11,457
Callahan	12,816
Comanche	13,595
Nolan	16,486
Eastland	17,857
Scurry	18,185
Jones	18,803

5,000 or Less	
Kent	863
Throckmorton	1,704
Stonewall	1,807
Shackelford	3,335
Knox	4,309
Fisher	4,352

Appendix B: Exchanges without Access to a Local Dial-Up ISP[155]

EXCHANGE (COUNTY)	COMMENTS
Big Bend National Park (Brewster)	Schools have access through regional connections.
Comstock (Val Verde)	Schools have access through regional connections.
Falcon (Zapata)	
Heath Canyon (Brewster)	
Langtry (Val Verde)	Schools have access through regional connections.
Orla (Reeves)	
Sheffield – (Pecos, Crockett, Terrell)	

155 Information provided by the Texas Telephone Association (TTA); Accurate as of Dec. 1, 2000.

Appendix C: EAS and ELC Policies

Texas' Extended Area Service (EAS) and Extended Local Calling (ELC) policies are designed to expand the calling scope of local exchanges for the price of a local call or a flat rate.[156] These policies enable rural and high cost areas to access other exchanges and possibly even additional ISPs with a local call. Whether the gains made in the provision of basic telephone services resulting from these policies can be duplicated to enhance the provision of advanced services for rural and high cost areas has not been fully answered.

The EAS and ELC policies have provisions and mechanisms that both enable and constrain access to advanced services. The mechanisms that enable access to advanced services are the petition and community of interest. The constraining mechanisms are exemptions to the ELC policy that protect small and cooperative type telephone companies.

The exercise of petitioning for an extended calling area is an enabling mechanism that demonstrates a community of interest and substitutes for demand in the market. This mechanism is efficient in identifying demand for advanced services in rural and high cost areas but also leads to cross subsidies due to the flat rates that are charged. Cross subsidization has occurred in basic telephone service EAS and ELC arrangements as non and low users subsidize the petitioning special interest groups who gain more from the extended calling area. However, this mechanism also leads to greater equity in the availability of telephone services. In terms of advanced services, particularly Internet access, the notion that a flat rate is better may also lead to the same cross-subsidies observed in providing basic telephone services.

The exemptions to EAS and ELC policies for local exchanges owned by cooperatives and small companies with less than 10,000 lines may be a detriment to the provision of advanced services. The underlying motive of the exemption is to protect small telephone companies and cooperatives that largely serve the rural and high cost areas. However, the reverse side of the policy creates a disincentive for small companies to expand and invest in telephone infrastructure, and even more so in infrastructure and technologies that support advanced services. This leads to a very critical aspect of access to advanced services: technology.

The availability and price of access to advanced services is contingent upon the deployment of technology for advanced services. EAS and ELC policies potential success as the vehicle of deployment of advanced services for the rural and high cost areas lies in its ability to support, or perhaps even mandate, the level of technologies described in Chapter 3 of this Report.

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[156] *See* Public Utility Regulatory Act, TEX. UTIL. CODE ANN. §§ 55.021-55.024 and 55.041-55.048 (Vernon 1998 & Supp. 2000) (PURA).

Appendix D: Interexchange Services

With the divestiture of the Bell Operating System in 1984, the nation was divided into serving areas known as Local Access Transport Areas (LATAs). Bell Operating Companies (BOCs), such as Southwestern Bell Telephone Company (SWBT), were restricted from providing long-distance calling services between LATAs (interLATA services). InterLATA long-distance calls were to be provided by interexchange carriers (IXCs).[157] BOCs were allowed to provide intraLATA toll services; i.e. long distance calling services within LATAs. A separate consent decree created similar geographic areas, called Service Market Areas (SMAs), in the GTE Southwest, Inc. (GTE-SW) operating area. There are 16 LATAs and two SMAs in Texas.[158]

After the passage of the federal Telecommunications Act (FTA),[159] GTE-SW's affiliate GTE Long-Distance, Inc. (GTE-LD), like the affiliates of some smaller ILECs, began providing interexchange services to retail customers. In addition, the FCC has since permitted SWBT to offer such services in Texas.[160]

In order to promote fair competition, "equal access" features were installed in switching offices. Equal access allow callers to pre-select their long-distance company and then connect to that carrier directly by dialing "1" before they place a long distance call. Nearly all telephone customers in Texas now have equal access to long-distance companies for interLATA calls. Prior to equal access customers were forced to dial at least five extra digits, usually an access code of the form 10-10-XXX, before reaching their desired long distance carrier.

Equal access and pre-subscription were not mandated for intraLATA long-distance calls. ILECs were allowed to retain their role as the carriers of intraLATA toll calls unless the customer dialed special codes to access another carrier. However, P.U.C. SUBST. R. 26.275 required certificated telecommunications utilities to file an implementation plan to provide intraLATA equal access no later than February 8, 1999.[161] With the implementation of intraLATA equal access, customers are able to select a long-distance carrier other than the

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[157] IXCs are traditionally long distance companies such as AT&T, Worldcom, and Sprint.

[158] Public Utility Commission of Texas, *Scope of Competition in Telecommunications Markets of Texas* at 70 (Jan. 1999).

[159] Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (codified as amended in scattered sections of 15 and 47 U.S.C.) (FTA).

[160] FTA § 271 allows SWBT and other BOCs to provide interLATA services after they meet certain specified conditions. (These conditions are enumerated in the PUC's *1997 Scope of Competition in Telecommunications Markets of Texas Report* at Appendix D-4,5; The FTA gave authorization to GTE to provide interLATA services upon its enactment.

[161] P.U.C. SUBST. R. 26.275 allows a local service provider serving fewer than two percent of the nation's subscriber lines to petition the PUC for a suspension or modification of the rule.

local service provider to carry intraLATA calls. SWBT implemented intraLATA equal access on May 7, 1999.[162]

[162] *Petition of AT&T Communications of the Southwest, Inc. to Require Southwestern Bell Telephone Company to Implement IntraLATA Presubscription no later than February 8, 1999*, Docket No. 17000, Final Order (Apr. 8, 1999); *Application of Southwestern Bell Telephone Company for Approval of Implementation Plan for Texas 1+ Equal Access or IntraLATA Toll Dialing Parity*, Docket No. 19919, Final Order (Apr. 8, 1999).

Appendix E: Technology Overview

Wireline Technologies

Advanced or high-speed wireline services are comprised of ISDN and xDSL technologies.

INTEGRATED SERVICES DIGITAL NETWORK (ISDN)

ISDN is a digital-based connection over the public telephone network that allows simultaneous voice and data transmission. ISDN can integrate voice, data, video, and image services. ISDN, as used today, comes in two well-defined interface standards: Basic Rate Interface (BRI) and Primary Rate Interface (PRI). ISDN-PRI is a standard T-1 line offering speeds of 1.544 Mbps. ISDN-BRI, while faster than a traditional analog phone wire, is not considered an advanced or high-speed service because it only operates at 144 Kbps (128 Kbps downstream).

DIGITAL SUBSCRIBER LINES (XDSL)[163]

xDSL technology "is the second most widely used broadband service."[164] The most common form of xDSL is asynchronous digital subscriber line (ADSL).[165] ADSL is capable of serving customers over the copper loop within 18,000 feet of the phone company's central office or remote terminal, which contain Digital Subscriber Line Add/Drop Multiplexer (DSLAM) equipment. Generally, ADSL only provides service at speeds in excess of 200 Kbps in the downstream path and is, therefore, considered only a high-speed service.[166] "However, ADSL permits the customer to have both conventional voice and high-speed data carried over the same line simultaneously because it segregates the high frequency data traffic from the voice traffic."[167] Consequently, the Internet connection is "always on" and permits simultaneous voice conversations without the need for a second phone line.[168]

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[163] xDSL is a generic name for a family of digital lines being provided by ILECs and CLECs including: Asynchronous DSL (ADSL), High Data Rate DSL (HDSL), Symmetric DSL (SDSL), and Very High Data Rate DSL (VDSL). *See* Appendix G of this Report for a more technical discussion of the various xDSL services.

[164] *Advanced Telecommunications in Rural America* at 12.

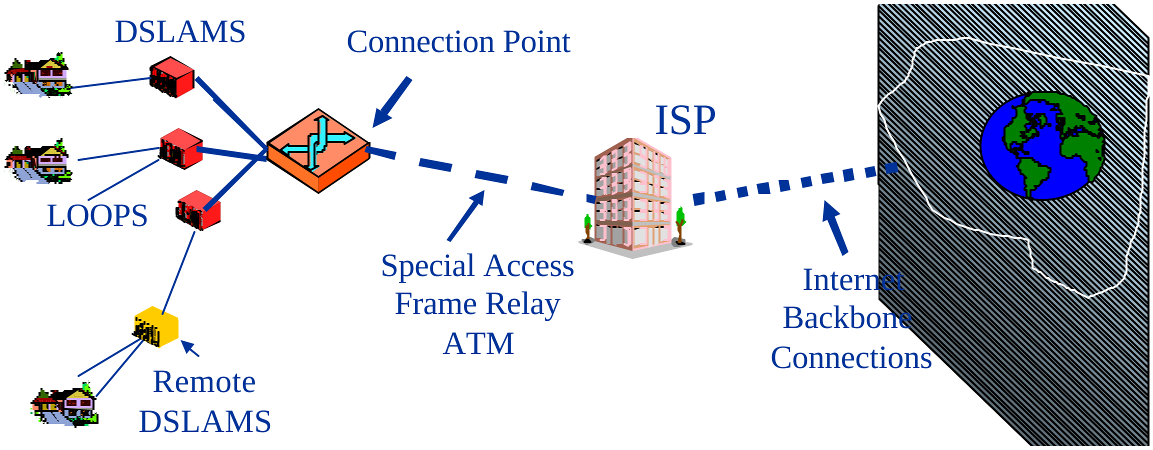
[165] *Second Advanced Services Report* at ¶ 36.

[166] *Id.* at ¶ 36 and 38. Consequently, ADSL does not meet the FCC's definition of advanced service and is, therefore, considered a high-speed offering.

[167] *Id.* at ¶ 36.

[168] *Id.*

An example, of a typical xDSL network is observed below.



xDSL Technologies and Characteristics

Type	Description	Data Rate Downstream/ Upstream	Distance Limit	Application
ADSL	Asymmetric DSL	1.544 to 6.1 Mbps downstream; 16 to 640 Kbps upstream	1.544 Mbps at 18,000 feet; 2.048 Mbps at 16,000 feet; 6.312 Mbps at 12,000 feet; 8.448 Mbps at 9,000 feet	Used for Internet and Web access, motion video, video on demand, remote LAN access
IDSL	ISDN Digital Subscriber Line	128 Kbps	18,000 feet on 24 gauge wire	Similar to the ISDN BRI service but data only (no voice on the same line)
CDSL	Consumer DSL from Rockwell	1 Mbps downstream; less upstream	18,000 feet on 24 gauge wire	Splitterless home and small business service; similar to DSL Lite
G.Lite (or DSL Lite)	"Splitterless" DSL without the "truck roll"	From 1.544 Mbps to 6 Mbps, depending on the subscribed service	18,000 feet on 24 gauge wire	The standard ADSL; sacrifices speed for not having to install a splitter at the user's home or business
HDSL	High bit-rate DSL	1.544 Mbps duplex on two twisted-pair lines; 2.048 Mbps duplex on three twisted-pair lines	12,000 feet on 24 gauge wire	T1/E1 service between server and phone company or within a company; WAN, LAN, server access
SDSL	Symmetric DSL	1.544 Mbps duplex (U.S. and Canada); 2.048 Mbps (Europe) on a single duplex line downstream and upstream	12,000 feet on 24 gauge wire	Same as for HDSL but requiring only one line of twisted-pair
RADSL	Rate-Adaptive DSL from Westell	Adapted to the line, 640 Kbps to 2.2 Mbps downstream; 272 Kbps to 1.088 Mbps upstream	Not provided	Similar to ADSL
UDSL	Unidirectional DSL proposed by a company in Europe	Not known	Not known	Similar to HDSL
VDSL	Very high DSL	12.9 to 52.8 Mbps downstream; 1.5 to 2.3 Mbps upstream; 1.6 Mbps to 2.3 Mbps downstream	4,500 feet at 12.96 Mbps; 3,000 feet at 25.82 Mbps; 1,000 feet at 51.84 Mbps	ATM networks; Fiber to the Neighborhood

Cable Technology

Advanced or high-speed cable services are currently limited to cable modems.

CABLE MODEM

Currently, cable modems are the most common source of broadband connections for residential users.[169] Cable modem service, while offered on the same basic network architecture used to provide multi-channel video service, typically requires significant equipment upgrades and enhancements to support advanced services.[170] Until the recent demand to use the cable network for high-speed Internet access, the cable network was designed for one-way, analog transmissions. Cable modem Internet access is a shared access technology, meaning the bandwidth is shared with other active users on the same node, which will result in a reduction in speed as the number of users increases.[171]

Under optimal conditions, and using the best available technology, an upgraded system can provide maximum downstream speeds of 27 Mbps and maximum upstream speeds of 10 Mbps.[172] However, due to the shared nature of its architecture, cable speeds typically are below 1.5 Mbps.[173] Therefore, a principle concern expressed by some is that cable's shared architecture, limited capacity, and general Internet congestion could cause transmission speeds to dip below the FCC defined parameters for advanced services.[174]

The significance of continuing to upgrade the cable network, and thereby allowing cable modems to compete in the advanced services market, is seen in the next generation of communication, information, and entertainment services.[175] Not only will broadband access continue to play a significant role in Internet development, but the expansion of services such as cable telephony, video conferencing, and video on demand that have been discussed in the communication industry for close to ten years are much closer to residential deployment.[176]

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[169] *Id*. at ¶ 96.

[170] *Id*. at ¶ 29.

[171] HARRY NEWTON, NEWTON'S TELECOM DICTIONARY 118-119 (1998).

[172] *Second Advanced Services Report* at ¶ 33.

[173] *Id*.

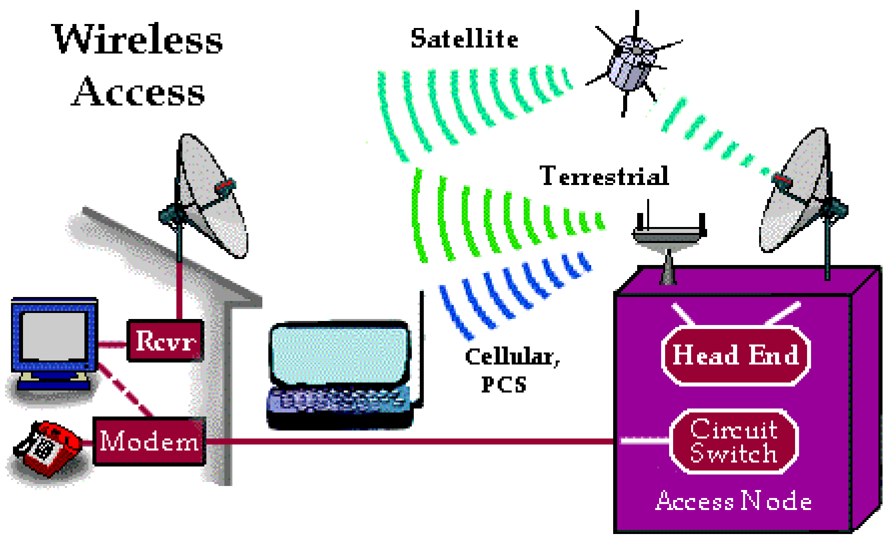
[174] *Id*. at ¶ 33.

[175] Scott C. Cleland, *Residential Broadband Outlook: Investment Implications of a Duopoly?*, PRECURSOR GROUP (Aug. 11, 2000).

[176] Bill Michael, *Cable VoIP*, COMPUTER TELEPHONY.COM at 37 (Aug. 2000).

Wireless Technologies

Wireless technologies are another means for delivery for high-speed services to residential, rural, and otherwise under-served areas, and may increase competition in the "last mile" in the near future.[177] For purposes of this Report, wireless technologies include fixed wireless (including both MMDS and LMDS), cellular, and broadband Personal Communications Services (PCS). Wireless technologies are important to rural Texans because they have the potential of cost effectively providing advanced services to sparsely populated geographic areas.



Source: *Iowa's Digital Divide Securing Advanced Telecommunications Services, Including High-speed, Affordable Internet Access, For All Of Iowa*, Feb. 2000, Iowa Utilities Board.

FIXED WIRELESS[178]

Fixed wireless is a system, typically either MMDS or LMDS, that provides advanced or high-speed services to customers by attaching to the customer's premises a "pizza box" sized radio transmitter/receiver (transceiver) that communicates with provider's central antenna site. By doing so, the central antenna site acts as the gateway into the public switched telephone network and the Internet. In short, the radio signals serve as a substitute for the copper wire or cable strand that connect customers to the network in traditional, wired technologies.

177 *Second Advanced Services Report* at ¶ 42.

178 *See* Appendix I of this Report for a detailed discussion of Fixed Wireless technologies.

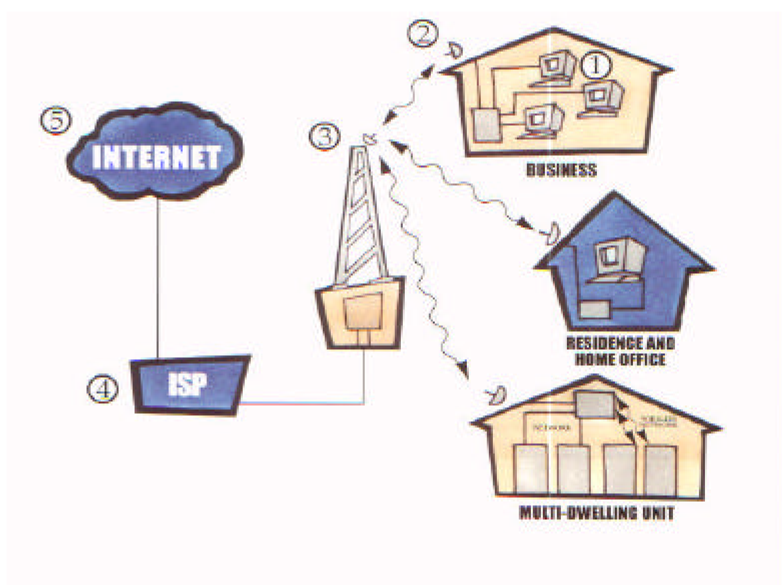
MMDS

Originally a video programming service, MMDS is now a high-speed, fixed wireless system that can potentially provide service in a 35-mile radius with downstream Internet speeds from 750 Kbps to 11 Mbps.[179] MMDS's larger service radius makes it ideal for deployment "in rural, under-served, and unserved areas, where the larger cell size substantially reduces the cost of providing service."[180] While, MMDS does not degrade in adverse weather conditions, it does function best with direct line of sight between the transmitter and receiver.[181]

MMDS is a low-bandwidth service that generally operates in the 2 GHz range. As an alternative to cable based television, providers have reported that, in digital form, MMDS can provide more than 100 channels. Used in this manner, the signal is received by an antenna on the customer's home, then sent through coaxial cable to a box atop the customer's television set. From there, the box decodes and decompresses the digital signal.

MODEL MMDS SYSTEM

1) Data query sent from computer to MMDS modem
2) MMDS modem sends request to small transceiver on customer premise
3) Transceiver sends request to MMDS base station
4) MMDS base station connects to telephone network and then to the Internet
5) The data then returns back the same path to the customer – *at* 128 Kbps up to 10 Mbpsback the same path to the customer – *at* 128 Kbps up to 10 Mbps



[179] *Second Advanced Services Report* at ¶ 51-52. *See also Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services*, Fifth Report, FCC No. 00-289 at E-8 (rel. Aug. 18, 2000) (*Fifth Wireless Report*).

[180] *Id*. at ¶ 52.

[181] *Id.*

Recently, MMDS providers have shifted their focus to providing high-speed two-way Internet access.[182] As of 1999, those providers offering MMDS high-speed Internet access had climbed to nine nationwide. In March 1999, Sprint and WorldCom each spent more than $1 billion to acquire the MMDS licenses of several other companies. Both companies currently have trials of high-speed, two-way data services under way. Broad-scale commercialization of MMDS by Sprint and WorldCom is expected by the end of 2000 and during 2001.[183] Including the two aforementioned companies, BellSouth and Nucentrix round out the major MMDS spectrum holders.

The video programming service that attaches to the MMDS spectrum obligates providers to coordinate with education facilities in the Instructional Television Fixed Service (ITFS) Band.[184] Interestingly, several decades ago, the federal government donated spectrum rights to schools and universities to televise educational programs. In order to obtain this spectrum allocation, a school needed to apply with the FCC, meet certain engineering standards, and demonstrate that they would provide at least 20 hours of educational programming a week. Upon receiving this high quality and large quantity of MMDS spectrum, schools are permitted to lease up to 95% of their unused spectrum capacity to private users. Since this spectrum is potentially being underutilized by schools both the wireless-cable and wireless-phone industries are seeking to reclaim this portion of spectrum. Some suggest that, as in 1983, the FCC may be tempted to reclaim this unused spectrum from schools.[185]

The few examples of MMDS deployment have provided encouraging results. The single stick architecture that most MMDS operators are using today may satisfy some of the FCC's hopes for closing the digital divide.[186] The stick architecture is able to indiscriminately cover a large percentage of residents within a given operational radius.

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[182] *Request for Declaratory Ruling on the Use of Digital Modulation by Multipoint Distribution Service and Instructional Television Fixed Service Stations*, 11 FCC Rcd 18839 (1996); *Amendment of Parts 21 and 74 to Enable Multipoint Distribution Service and Instructional Television Fixed Service Licensees to Engage in Fixed Two-Way Transmissions*, Report and Order, 13 FCC Rcd 19112 (1998), *Order on Reconsideration*, 14 FCC Rcd 12764 (1999).

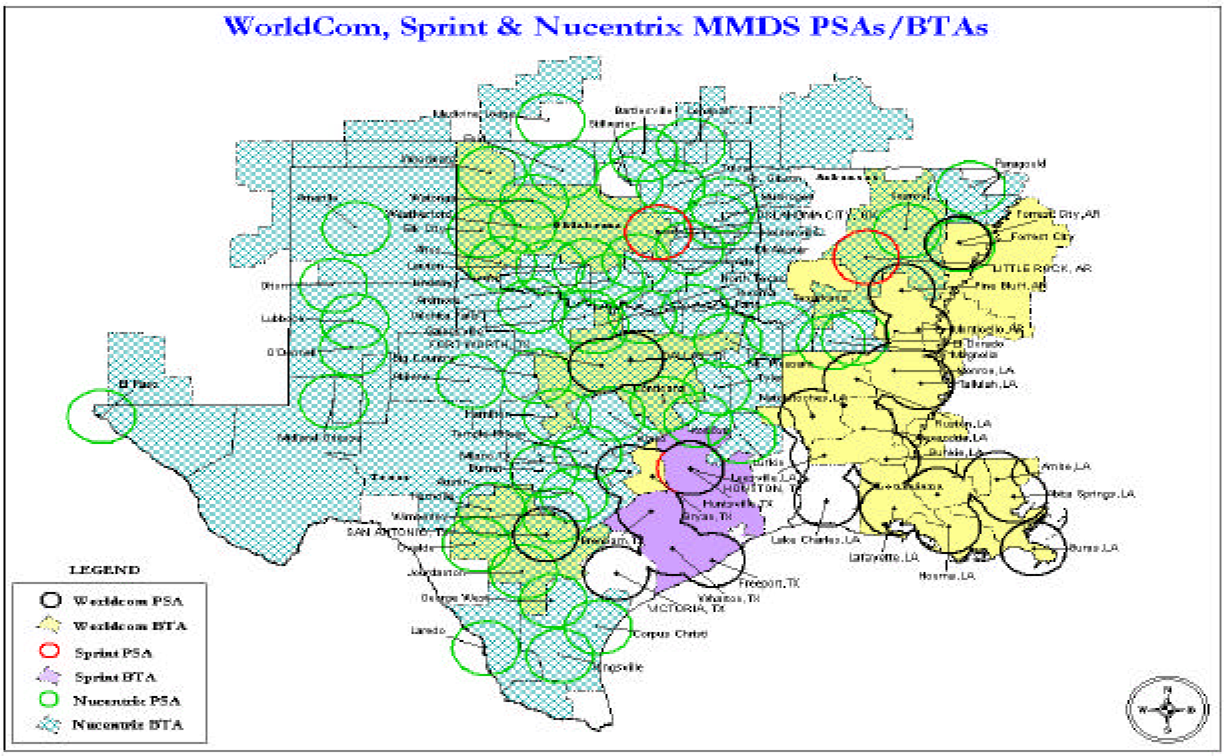
[183] *Broadband Wireless Services*, DAIN RAUSCHER WESSELS at 76-77 (Jun. 2000).

[184] *Id*. at 82.

[185] Mark Wigfield, *Schools' Spectrum Rights Promise a Bonanza, but Can They Cash In?,* THE WALL STREET JOURNAL (Sept. 6, 2000).

[186] Nancy Gohring, *Broadband Moves Wireless Ahead,* SPECTRUM MAGAZINE (Feb. 15, 1999).

The map below shows MMDS licenses held by WorldCom, Sprint, and Nucentrix in Texas.



LMDS

Local Multi-point Distribution System (LMDS) is a fixed wireless system capable of very high-speed transmissions, but its geographic range is much smaller than MMDS. A single tower can provide service only in a 3-5 mile radius - similar to that of a cellular phone. LMDS generally provides data rates up to 1.55 Mbps, a speed adequate to support a host of multimedia applications.[187]

The most prevalent shortcoming of LMDS, since the upperband signals behave more like light, is that LMDS is essentially a line of sight technology and is more sensitive to adverse atmospheric conditions.[188] In addition, as with other wireless services, LMDS tends to have a deteriorating signal in unfavorable weather conditions.[189]

[187] *Second Advanced Services Report* at ¶ 50.

[188] *Fifth Wireless Report* at E-17.

General rollout of LMDS is in its very early stages. Whether LMDS will become as common place as cable TV is still unclear. "It depends on how quickly the operators that won that spectrum roll out service."[190] Nevertheless, by early 1999, NEXTLINK Communications (NEXTLINK) had become the largest holder of LMDS with its $695 acquisition of WNP Communications. At this writing, NEXTLINK is deploying its LMDS network in major markets across the country.[191] Teligent, Inc., NEXTLINK, and Winstar Communications (Winstar) are all operative in 24 GHz, 28 GHz (LMDS) and 39 GHz respectively. The three companies are referred to as "anchor tenants" of each frequency because they are the most active providers of broadband services to date.

Listed in order of appearance, the major LMDS licensees are: NEXTLINK, Adelphia Business, Winstar, Eclipse, Actel, Cortelyou, ARNet, Telecorp, CoServ, Vanguard, ALTA, U.S. West, HighSpeed, Blackwater, Touch America, BTA Association, PCTV Gold, LMDS Lmtd, Command Connect, and ABS LMDS Venture.

CELLULAR AND MOBILE

Cellular Mobile Telephone Systems (CMTS) are usually characterized by a low-powered, duplex, radio/telephone that operates between 800 and 900 Mhz. This technology actually uses multiple transceiver sites that are linked to a central computer for coordination. The sites or "cells," named so for their honeycomb shape, cover a range of one to six or more miles in each direction. Each cell can accommodate up to 45 different voice channel transceivers. Although the cells overlap one another, they operate at different frequencies in order to avoid crosstalk.[192]

PERSONAL COMMUNICATIONS SERVICES (PCS)

Personal Communication Service (PCS) is a new, lower powered, higher-frequency technology that is competitive, and, in some respects comparable, to cellular. Instead of the 800-900 MHz range, PCS operates in the 1.5 to 1.8 GHz range. PCS phones are often less expensive, digital, and with less range. Perhaps surprisingly, the shorter range has been an advantage because airtime is actually cheaper for the smaller cell radius.

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[189] *Second Advanced Services Report* at ¶ 50.

[190] Chris Stamper, *Finally, High-Speed Surfing*, (visited Oct. 2, 2000) <http://www.ABCNEWS.go.com/sections/tech/DailyNews/ glite981103.html>.

[191] *Broadband Wireless Services*, DAIN RAUSCHER WESSELS at 77 (Jun. 2000).

[192] HARRY NEWTON, NEWTON'S TELECOM DICTIONARY 177 (1999).

Broadband PCS services generally operate between 1850 and 1990 MHz.[193] Growth in this area has been substantial in the last year with subscribership of operators for whom public information is available increased more than 100 percent to 14.5 million for this digital format.[194]

Although cellular and broadband PCS technically supports high-speed services, few licensees are using spectrum in this manner.[195] One of the few offerings using this spectrum for advanced services is AT&T's Project Angel which uses broadband PCS spectrum to reach homes and small business in the Dallas area.[196]

3G TECHNOLOGY

"3G technology promises Internet access with speeds up to 2 Mbps from a fixed location, 384 Kbps at pedestrian speeds, and 144 Kbps at traveling speeds of 100 kilometers per hour."[197] Planned 3G services include video and audio streaming and location based services that could notify individuals of services in an area they are visiting.[198] Ultimately, 3G capabilities may allow vendors to build handsets that work anywhere in the world.[199]

UNLICENSED SPECTRUM

Small wireless companies may choose to provide high-speed Internet access by transmitting in unlicensed bands, or spread spectrum.[200] This unlicsened spectrum is in the 2 GHz and 5 GHz spread spectrum bands and offers maximum downstream speeds in the 25 Mbps range.[201] This spectrum "offers a low-cost means for smaller companies to enter the wireless high-speed market."[202] Because there is no licensing requirement, the potential exists for interference from other applications. Consequently, high-speed Internet services provided over unlicensed spectrum may perform well in rural areas were there is limited interference from

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[193] *Id.* at 28.

[194] *Id.*

[195] *Second Advanced Services Report* at ¶ 53.

[196] *Id.*

[197] *Fifth Wireless Report* at 37.

[198] *Id.*

[199] *Id.*

[200] *Id.* at E-10.

[201] *Id.*

[202] *Second Advanced Services Report* at ¶ 55.

competing applications. However, due to power output limitations, the service cannot be provided over a wide area.

Satellite Technology

Traditional satellite networks have been limited to specialized private very small aperture terminal (VSAT) networks, low bandwidth services, and direct to home (DTH) video. However, new broadband satellite systems are offering service comparable to current broadband wireline and wireless services.

Today, most current residential satellite offerings are capable of providing speeds in excess of 200 Kbps only in the downstream path with the upstream path provided by standard dail-up telephone connection.[203] However, several satellite providers have announced plans to provide residential service with both downstream and upstream paths provided by satellite.[204]

Other Emerging Technologies

USE OF POWER LINES[205]

It may soon be possible for consumers to access the Internet both faster and cheaper through ordinary domestic electricity lines. Two companies, Northern Telecom (Nortel) and Norweb Communications (Norweb), said they had found the "holy grail" of telecommunications: the ability to send vast amounts of data along power lines without it being distorted by interference.

Norweb intends to offer a commercial trial to 2,000 homes in the North West next spring. The two companies contend that this service could offer an Internet connection 20 to 30 times faster than commonly available through today's telephone modems and that the cost would be lower by up to 50 percent.

The system works by using either fiber-optic or radio links to transmit data from the Internet to local electricity sub-stations. The low-voltage part of the electricity network then becomes a local area network. A small box is installed next to the electricity meter in the home to send and receive data. The box itself is connected by ordinary cable to personal computers, which will need to be fitted with a special card and software.

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[203] *Second Advanced Services Report* at ¶ 56.

[204] *Id.* at ¶56 and ¶201; The companies that have announced two-way satellite service include Hughes' Direct PC and Gilat Communications, who will provide "Gilat to Home" in partnership with Microsoft.

[205] Snoddy, Raymond, *Breakthrough will bring Internet on power lines* (last modified Oct. 8, 1997) < http://www.peak.org/mailing-list/archive/tforum/msg00283.html>.

This new technology enables data to be transmitted at rates of more than 1 Mbps by using a patented technology to screen data from electrical interference on the host power line. Customers will require a computer card, which is comparable in cost to a conventional ISDN terminal adapter, but offers 10 times the peak bandwidth.

<u>All Fiber "Middle Mile"Transport</u>

SYNCHRONOUS OPTICAL NETWORK (SONET)

When different networks communicate with each other they require complicated multiplexing/demultiplexing and coding/decoding processes to convert a signal from one format to another. The differences in digital signal hierarchies, encoding techniques, and multiplexing strategies increase the cost of communication between various localized networks. SONET was developed to solve this problem by standardizing the rates and formats of transmission. SONET provides the flexibility needed to transport mainly digital signals with different capacities and to provide a standard design standard for manufacturers. SONET is a family of fiber optic transmission rates from 51.84 Mbps (OC-1/STS 1) to 13.27 gigabits (thousand million) per second (Gbps).

VERY HIGH-SPEED BACKBONE NETWORK SERVICE (VBN OR VBNS)

VBN is a high-speed SONET fiber optic backbone network being developed by Worldcom for the National Science Foundation (NSF). VBN will serve as the backbone transport network for Internet 2. Initially, VBN will run at a speed of 155 Mbps (OC –3); ultimately, the network will operate at 2.4 Gbps (OC-48). The first deployment of VBN connects NSF funded super computing centers (SCCs); Cornell Theory 6 Center, National Center for Atmospheric Research, National Center for Supercomputing Applications, and Pittsburgh Center. Also connected are the NSD-funded Network Access Points (NAPs) at Hayward, CA; Chicago, IL; Pennsauken, NJ; and Wasington, DC.[206] VBN will provide users with a number of cutting edge services such as: native IP multicast, high bandwidth throughput with negligible loss, VPN services, MPLS based traffic engineering, usage and performance based statistics, web-based knowledge management, and IPv6 Native service.[207]

When deployed VBN will provide a high bandwidth networking environment for research applications and allow researchers to push the boundaries of networking research.[208] The combination of high performance networking and a portfolio of advanced Internet protocol

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[206] HARRY NEWTON, NEWTON'S TELECOM DICTIONARY 771 (1998).

[207] *Advanced Services Multicast 2* (visited Oct. 15, 2000) <http://www.vbns.net/index.html?g=1&t=&f=2>.

[208] *Collaboration on the very high-speed Backbone Network Services (vBNS)* (last modified Sept. 1, 1995) <http://www.nlar.net/VBNS/vBNS.html>.

(IP) services make VBN unparalleled for today's most demanding customers and their applications.[209] Internet users will be the ultimate beneficiaries of the technology and applications developed using VBN. VBN will allow business to experience the same speed, performance, and reliability enjoyed by the SCCs, Research Organizations, and Academic Institutions.[210] The network itself will be accessible only by high bandwidth users and will not be available for general Internet traffic.[211]

PASSIVE OPTICAL NETWORK (PON)

PON is a high bandwidth point to multipoint optical fiber network based on the asynchronous transfer mode (ATM) protocol. PONs generally consists of an Optical Line Termination (OLT), which is connected to Optical Network Units (ONUs), i.e. subscriber terminals, using only fiber cables, optical splitters and other passive components that do not transmit signals using electricity. Up to 32 ONUs can be connected to an OLT. The OLT is located at a local exchange, and the ONU is located either on the street, in a building, or even in a customer's home. PON systems rely on light waves for data transfer. In a PON system, signals are routed over the local link with all signals along that link going to all interim transfer points. Optical splitters route signals through the network and optical receivers, at intermediate points and subscriber terminals, tuned for specific wavelengths of light direct signals intended for their groups of subscribers. At the final destination, a specific residence or business can detect its specified signal. PONs are capable of delivering high volumes of upstream and downstream bandwidth (up to 622 Mbps downstream and 155 Mbps upstream), which can be changed "on-the-fly" depending on an individual customer's needs.

[209] *Advanced Services Multicast 2* (visited Oct. 15, 2000) <http://www.vbns.net/index.html?g=1&t=&f=2>.

[210] *Id.*

[211] *Collaboration on the very high-speed Backbone Network Services (vBNS)* (last modified Sept. 1, 1995) <http://www.nlanr.net/VBNS/vBNS.html>; For additional discussion regarding VBNS visit <http://www.vbns.net>.

Appendix F: Pricing of Advanced Services

Wireline Service

ISDN PRICING

The cost of ISDN customer premises equipment is relatively high when compared with other advanced services offerings. In Texas, ISDN is typically priced on a flat rate basis although several carriers have usage sensitive rates, which may be cost prohibitive for Internet usage.

A survey of the rates posted on the Internet reveals that a majority of ISDN service providers in other areas of the country have usage sensitive rates.[212] The survey points to a probable reason for the low deployment of ISDN: tariff structure. Usage sensitive tariffs may prevent the user from using the Internet for communications purposes. Among ISDN service providers, SWBT tariff is of particular interest. SWBT's tariff is both channel and usage sensitive. This channel sensitive rate structure will affect the deployment of advanced services since a user is required to lease at the very least, 4-B channels to attain a speed of greater than 200 Kbps.

ISDN Service Providers	Monthly Recurring Rates
Ameritech	$32.00 -$106 + usage
Bell Atlantic	$23.50 -$250
Bell South	Varies by state (no data given)
GTE	Varies by state (no data given)
NYNEX	$36 (business)/ $24(residential) per month + usage
Pacific Bell	$24.50 + usage
Southwestern Bell	$57.50 for 10 channel hours/month, $75.50 for 80 channel hours, or $104.50 for unlimited use
US West	Varies considerably over a large section

Source: (www.isdnshop.com)

XDSL PRICING

A survey of various companies offering xDSL "indicates that prices for low-end ADSL service typically range from $39.95 to $49.95 per month, including ISP services. Faster ADSL services ranged from $99.95 to $179.95 per month. Installation fees ranged from free, typically

[212] Se*rvice Providers* (visited Oct. 5, 2000) <www.isdnshop.com/isdn-service.html>.

where customers are offered 'DSL in a box,'[213] to $99.95, where a technician visit is necessary to install premise equipment.[214]

The following charts show sample prices for xDSL across Texas. Most of the companies listed in the table are resellers of ILEC lines. In general, the monthly price for business or residential xDSL ranges from $35 to $65 with varying fixed installation costs. The price of xDSL services from SWBT and Verizon fall within the above range as well, and depending upon the speed package could cost more. However, it should not be assumed that residents across Texas are eligible for these monthly rates. As noted above, there are several factors that could determine the availability of xDSL. Therefore, in some instances, customers may not obtain xDSL services at all.

Modifications that may have to be done to a customer's line to make it "xDSL ready" could cost several hundred dollars. This could lead to a situation where there may be reasonable recurring monthly charges, but prohibitive up-front costs. Few companies, if any, make modifications to the local loop to make it xDSL ready, unless a special circumstance or volume justifies the investments. The residential market, which is extremely price sensitive, does not have this option.

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[213] "DSL in a box" is a form of ADSL in which the provider sends the customer filters and a modem that the customer installs. By having the customer install these filters, the provider avoids sending a technician to the customer's premises, thus reducing the time and cost associated with establishing ADSL service.

[214] *Second Advanced Services Report* at ¶ 36. By comparison, SDSL, because of its higher capacity needs, typically requires a dedicated copper pair for its high-speed data transmissions. Consequently, "the price of SDSL service currently ranges from $150 to $450 per month, with installation costs ranging from free to $1550, and equipment costs from $225 to $360, depending on the transmission speed desired and the equipment purchased." *Id.* at ¶ 37.

xDSL Rates Across Texas[215]

ISP	Res/Bus	XDSL	Speed	Net Install	Monthly Charge	Due on Order
Wire Web Internet of San Antonio, TX	All	ADSL	1544/128	$49	$37	*
jump.net of Austin, TX	All	ADSL	384/128	$49	$39	*
Cyberstation Inc. of Wichita Falls, TX	All	ADSL	1500/128	Free	$45	$45
TICNET.com of Dallas, TX	Res	ADSL	608/128	Free	$49	$247
Smart Guys of Houston, TX	Res	ADSL	608/128	Free	$50	$0
AustinTX.COM of Austin, TX	Res	ADSL	384/128	$200	$59	$260
Smart Guys of Houston, TX	Res	IDSL	144/144	$199	$60	$0

* Information not available.

IDSL Rates Across Texas

ISP	Res/Bus	Speed	Net Install	Monthly Charge	Due on Order
Wire Web Internet of San Antonio, TX	All	144/144	$200	$89	*
TICNET.com of Dallas, TX	All	144/144	Free	$99	$324
Smart Guys of Houston, TX	Bus	144/144	Free	$120	$0
AustinTX.COM of Austin, TX	Bus	128/128	$670	$120	$790

* Information not available.

215 *xDSL Rates Across Texas* (visited Oct. 3, 2000) <http://dslreports.com>.

SDSL Rates Across Texas

ISP	Res/Bus	Speed	Net Install	Monthly Charge	Due on Order
Wire Web Internet of San Antonio, TX	All	192/192	$200	$89	*
TICNET.com of Dallas, TX	All	160/160	Free	$99	$324
jump.net of Austin, TX	All	160/160	$299	$99	*
TICNET.com of Dallas, TX	All	200/200	Free	$115	$340
TICNET.com of Dallas, TX	All	192/192	Free	$115	$340
jump.net of Austin, TX	All	200/200	$299	$119	*
Smart Guys of Houston, TX	Bus	192/192	Free	$125	$0

* Information not available.

Cable Modem Service

The price of cable modem service in Texas ranges from $29.95 to $90.00+ per month, including ISP service. Generally, the number of connections at a given location; requests for increased bandwidth; residential vs. business connections; and the rental of cable modem equipment affect prices. Installation fees range from free, when the cable provider is offering a promotion, to $100.00.[216]

Wireless Technologies

FIXED WIRELESS

MMDS

A typical pricing plan for a MMDS offering charges residential customers $39.95 per month for two-way speeds of 310 Kbps and businesses $300 to $600 per month for speeds of 128 Kbps to 8 Mbps.[217]

LMDS

A typical pricing plan for LMDS provided by Central Texas Communications charges $125 to $940 per month for service at 128 Kbps to 768 Kbps, respectively.

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216 *Road Runner Pricing* (visited Oct. 30, 2000) <http://www.roadrunner.com/rdrun/>.

217 *Fifth Wireless Report* at E-6.

CELLULAR AND MOBILE

The price of mobile telephone service decreased by 8 percent in the last 6 months of 1999.[218] "This may indicate that competition is continuing to make mobile telephone services more affordable for all Americans."[219] Additionally, the entry level price of "one rate" plans has fallen substantially. "When AT&T introduced its [one rate] plan in May 1998, the least expensive package cost $89.99. Now Sprint PCS and Verizon Wireless offer [one rate] plans starting at $19.99 and $35 per month, respectively."[220] Important for rural areas, the local average roaming rate per minute from the fourth quarter of 1997 to the first quarter of 1999 dropped from $0.75 to $0.37.[221]

PERSONAL COMMUNICATIONS SERVICES (PCS)

AT&T Digital Broadband is "estimated to cost about $750 per customer (and expected to drop to $500 in five years), the system uses broadband PCS spectrum to transmit signals between an antenna at customers' premises and AT&T's network. The system permits four voice channels, data rates up to 512 Kbps, and "always on" Internet access. In early 2000, AT&T was serving 200 customers with a trial system in Dallas. In March 2000, it began offering service commercially to residential customers in Fort Worth. By mid-July 2000, AT&T was serving approximately 2,800 customers using 6,000 lines in the Dallas-Fort Worth area.[222]

[218] *Fifth Wireless Report* at 19.

[219] *Id.*

[220] *Id.*

[221] *Id.* at 20.

[222] *Fifth Wireless Report* at E-3.

Satellite Services

DirecPC Service Plans		
	Residential	
Service Plan	**Executive Surfer**	**Family Surfer Unlimited**
Price (without ISP)	$19.99/ month	$39.99/ month
Price (including ISP)	$29.99 /month	$49.99 /month
Hours of Service (availability)	24 hours a day	24 hours a day
Online time (Hours of usage for Turbo Internet)	25 hours/month	Unlimited
Additional hourly rate (including ISP)	$1.99/hour	N/A
Additional hourly rate (without ISP)	$.99/hour	N/A
Turbo Webcast service	included	included
Turbo Newscast service	included	included
Turbo Internet Service	Included in online time	included in online time
ISP service	Included in online time	included in online time
E-mail accounts	One	One
Networking (Number of seats)	N/A	N/A

Appendix G: High-Speed Internet Access in Texas

The following is a list of Texas cities that have high-speed[223] access to the Internet. The list is organized according to the number of service providers in each city. However, it should be noted that the numbers represent the maximum number of providers in the city. It is possible that some places in the city do not have access to the same number of providers.

<u>Urban Cities</u>

Cities with Nine Service Providers

Austin	Houston	

Cities with Eight Service Providers

Addison	Dallas	Farmers Branch
West Lake Hills		

Cities with Seven Service Providers

Arlington	Bedford	Carrollton
Euless	Fort Worth	Jersey Village
Richardson		

Cities with Six Service Providers

Bellaire	Grand Prairie	Grapevine	Mesquite
North Richland	Plano		San Antonio
Spring			

Cities with Five Service Providers

Cedar Park	Denton	Frisco
Hollywood Park	Hurst	Irving
Keller	Lakeway	Mc Kinney
Pasadena	Round Rock	Stafford
The Woodlands	Tomball	

[223] Data is current as of December 31, 1999; High-speed includes any technology over 200 Kbps in at least one direction; The services included in this data are wireline technologies (both copper and fiber), cable technologies, fixed wireless technologies, and satellite technologies.

Cities with Four Service Providers

Allen	Balcones Heights	Castle Hills
Cedar Hill	Colleyville	Corpus Christi
Crowley	Duncanville	El Paso
Everman	Garland	Humble
Kirby	League City	Leon Valley
Lewisville	Live Oak	Missouri City
Olmos Park	Rover Oaks	Saginaw
San Angelo	Sherman	Sugarland
Tyler	Watauga	White Settlement

Cities with One to Three Service Providers

Abilene	Alamo Heights	Alice
Alpine	Alton	Alvarado
Alvin	Amarillo	Andrews
Angleton	Aransas Pass	Athens
Atlanta	Azle	Bacliff
Balch Springs	Ballinger	Barrett
Bastrop	Baytown	Beaumont
Beeville	Bellmead	Belton
Benbrook	Bonham	Bowie
Brazoria	Breckenridge	Brenham
Bridge City	Bridgeport	Brownfield
Brownsville	Bryan	Burkburnett
Burleson	Burnet	Caldwell
Cameron	Canton	Canyon
Canyon Lake	Carthage	Center
Channelview	Cibolo	Cisco
Cleburne	Cleveland	Clute
Clyde	Cockrell Hill	Coleman
College Station	Colorado City	Columbus
Comanche	Commerce	Conroe
Converse	Coppell	Corsicana
Cotulla	Cuero	Daingerfield
Dalhart	Dayton	Decatur
Deer Park	Denison	Denver City
Devine	Diboll	Donna
Dublin	Dumas	Eagle Pass
Eastland	Edinburg	Edna
El Campo	El Lago	Electra
Elgin	Ennis	Falfurrias

Farmersville	Floresville	Flowermound
Floydada	Forney	Fort Bliss
Fort Hood	Fort Stockton	Fortworth
Fredericksburg	Freer	Fresno
Friendswood	Galena Park	Galveston
Georgetown	Giddings	Gilmer
Gladewater	Gonzales	Graham
Granbury	Greenville	Groesbeck
Groves	Gun Barrel City	Haltom City
Hamilton	Harker Heights	Harlingen
Haskell	Hebbronville	Hempstead
Henderson	Henrietta	Hereford
Hewitt	Hidalgo	Highland Village
Hillsboro	Howe	Huntsville
Hutchins	Iowa Park	Jacinto City
Jackboro	Jacksonville	Joshua
Kaufman	Keene	Kennedale
Kermit	Kerrville	Kilgore
Killeen	Kingsland	Kingsville Naval
La Grange	Lake Dallas	Lake Jackson
Lamesa	Lampasas	Lancaster
Laredo	Laughlin AFB	Leander
Levelland	Liberty Hill	Lockhart
Longview	Lubbock	Lufkin
Luling	Mansfield	Manvel
Marlin	Marshall	Mathis
McGregor	McAllen	Mercedes
Mexia	Midland	Midlothian
Mineola	Mineral Wells	Monahans
Mount Pleasant	Navasota	Nederland
Nocona	Nolanville	Odessa
Ozona	Palacios	Palestine
Pampa	Paris	Pearland
Pearsall	Perryton	Pflugerville
Pharr	Pilot Point	Pinehurst
Pittsburg	Plainview	Pleasanton
Port Arthur	Port Isabel	Port Lavaca
Port Neches	Portland	Refugio
Rio Grande City	Rockdale	Pockport
Rockwall	Roma	Rosenberg
Rowlett	Sachse	San Benito
San Juan	San Leon	San Marcos
San Saba	Sanger	Santa Rosa

Seagoville	Sealy	Seguin
Selma	Seminole	Seymour
Shavano Park	Shoreacres	Silsbee
Sinton	Smithville	Sonora
South Houston	Stamford	Stanford
Stephenville	Sulphur Springs	Sweetwater
Taylor	Temple	Terrell
Texarkana	The Colony	Trophy Club
Uvalde	Vernon	Victoria
Vidor	Waco	Wake Village
Waxahachie	Weatherford	Webster
Weslaco	West Columbia	West Orange
Wharton	Whitehouse	Whitesboro
Wichita Falls	Willis	Wills Point
Windcrest	Winnsboro	Woodway
Wylie	Yoakum	Zapata

Rural Cities

Cities with One to Three Service Providers

Aledo	Alvord	Ames
Anderson	Anton	Anderson
Anton	Appleby	Argyle
Arp	Atascosa	Aubrey
Baird	Bandera	Bayview
Bells	Ben Wheller	Big Sandy
Blanco	Blue Ridge	Boyd
Broaddus	Buchanan Dam	Buckholts
Buda	Buna	Burton
Caddo Mills	Calvert	Campbell
Castroville	Cedar Creek	Celina
Centerville	Chandler	China Springs
Clarksville City	Clear Lake Shore	Cookville
Cooper	Crandall	Cranfills Gap
Creedmoor	Cut and Shoot	Dawson
De Leon	Detroit	Dripping Springs
Early	East Bernard	Eden
Edom	Elmendorf	Eustace
Farwell	Ferris	Flatonia
Florence	Franklin	Frankston
Fulshear	Garden Ridge	Glen Rose

Goldthwaite	Goliad	Gordon
Graford	Grandview	Grey Forest
Hale Center	Hallsville	Happy
Harleton	Harper	Haslet
Hawkins	Heath	Hemphill
Hico	Hockley	Holland
Honey Grove	Horizon City	Hubbard
Huntington	Hutto	Ingram
Jayton	Jewett	Jonestown
Justin	Kent	Kerens
Kosse	Krum	Lakewood Village
Leaky	Leonard	Linden
Lipan	Liverpool	Lometa
Lone Oak	Lorena	Lorenzo
Lovelady	Magnolia	Malakoff
Manor	Marfa	Marion
Melissa	Merkel	Miami
Milano	Milford	Millsap
Montague	Montalba	Montgomery
Moulton	Mount Selman	Mount Vernon
Murchison	North Zulch	Novice
Oakhurst	Oakwood	Odem
Ore City	Overton	Ovilla
Perrin	Pineland	Point
Ponder	Pottsboro	Prairie Hill
Princeton	Queen City	Quinlan
Quitman	Ranson Canyon	Rhome
Rio Hondo	Rising Star	Rochester
Rocksprings	Rogers	Ropesville
Royse City	Saint Jo	Salado
San Augustine	Sandia	Seagraves
Seven Points	Shallowater	Silverton
Somerset	Somerville	Sour Lake
Springtown	Sterling City	Stockdale
Streetman	Sunrise Beach	Thornton
Thrall	Trinidad	Troup
Uhland	Valley Mills	Valley View
Van Alstyne	Waller	Waskom
Weimar	Wellington	Wimberley
Winnie	Winona	

Source: *Second Advanced Services Report* at ¶ 10-11.

Appendix H: TEX-AN Network

TEX-AN 2000[224]

The Telecommunications Services Division of the General Services Commission (GSC) is the state organization tasked with providing statewide telecommunications infrastructure to serve and support the needs of all state agencies. On an optional basis they also offer services to political subdivisions and local governments. In 1991, a Telecommunications Planning Group (TPG), consisting of the GSC, the Department of Information Resources (DIR), the Comptroller of Public Accounts, and six other advisory agencies, was formed. The 75th Texas Legislature required the TPG to develop a "Texas Government Strategic Plan" for Telecommunications Services with the goal of establishing a single statewide, centralized telecommunications network for state government called TEX-AN 2000. This section of this Report will discuss the architecture, features, and benefits of the TEX-AN 2000 network.

The TEX-AN 2000 network is slated to provide to its users both voice and long distance (V&LD) services and data services. V&LD services include: 1+ long distance, intraLATA toll, toll-free services, and 1-900 inbound long distance. Data services include: access services, Internet access, and combined backbone/user termination.

The statewide platform will allow significant cost containment and resource conservation through the bulk concept of a large user community. The goals and objectives for TEX-AN 2000 are to:

- Provide the telecommunications infrastructure that will significantly contribute to achieving Texas State Government's goal of improving student performance.
- Provide the telecommunications infrastructure that will facilitate the means to use electronic commerce on a wide scale basis with Texas State Government.
- Provide integrated voice, video, and data.
- Provide citizens access to government information and services.
- Provide essential network services to government entities.
- Consolidate agency statewide requirements.
- Provide open interfaces for connectivity.

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[224] Texas General Services Commission, Telecommunications Services Division, *TEX-AN 2000 Services*, (Feb. 14, 2000).

Texas Telecommunications Infrastructure Gateway[225]

Users of the TEX-AN 2000 will access it through the Texas Telecommunications Infrastructure Gateway. The gateway augments the TEX-AN 2000 Telecommunications network with 50+ infrastructure and application nodes. This will support a statewide standards based platform for the coordinated and collaborative delivery of advanced educational, telemedicine/rural health care, and community network services. The gateway will combine the benefits of the core TEX-AN 2000 telecommunications network with the addition of 50+ POP, infrastructure, and application customer connection points. This approach will provide equal access to both urban and rural users.

One of the growth segments that the network will focus on is the area of public education. As a result, GSC has partnered with the Texas Education Agency (TEA) and the Telecommunications Infrastructure Fund Board (TIFB) to yield additional sources of funding for the network.

Benefits for schools

Through the gateway school districts throughout Texas will be able to obtain equitable Internet access and advanced services to all K-12 school children. Texas teachers, administrators, and school children will be able to access the Internet and its benefits without the burden of administering and overseeing the daily maintenance and operation currently required to run district-wide school networks.

The gateway will provide school districts with a comprehensive set of services that will put reliable Internet technology in every school. This will allow teachers to bring efficient and effective education to students and will offer new administrative tools to teachers and school administrators.

Benefits to Telemedicine/Rural Health care

The TEX-AN 2000 seeks to provide Telemedicine and rural health care services to the community with the following goals:

- Provide patient/doctor confidentiality by utilizing standard Internet access offered by the gateway, while maintaining full ability to protect medical data and records through the use of Virtual Private Network and security services.

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[225] Texas Telecommunication Infrastructure Gateway, Texas General Service Commission.

- Make available to healthcare community entities the collective voice, video, data and Internet resources of the TEX-AN 2000 telecommunications network, educational infrastructure and applications, as well as community networking services.

- Facilitate application and platform sharing by providing 50+ standardized POPs across the state for connecting telemedicine to health care facilities.

- Expedite the deployment of advanced telemedicine and healthcare services that provides full equity and ubiquity to both urban and rural communities.

- Provide all users, both urban and rural, access to unprecedented online applications and community tools, while maintaining local control, decision-making, and customization of services on a community-by-community basis.

Current Status

Currently there are one to four demonstration projects that will showcase the multi-service delivery of education, telemedicine/healthcare, and community based network and applications utilizing advanced technologies. The pilots must be able to demonstrate the ability to provide the services to rural locations.

Long-term sustainability

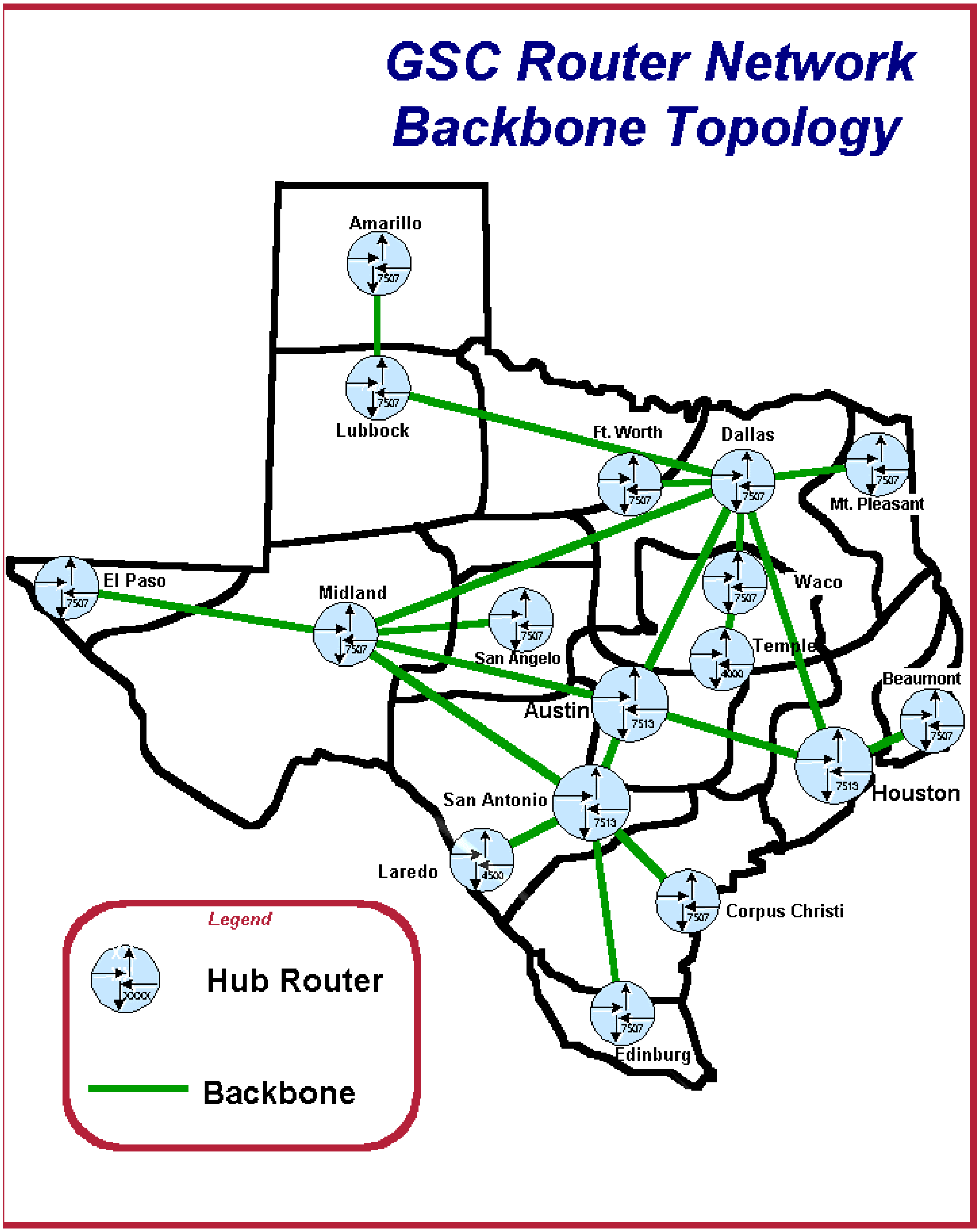
The long-term sustainability of the TEX-AN project is supported through the following mechanisms:

- Grants from the TIF Board.

- Direct appropriations from the Texas Legislature.

- Federal Universal Service Fund grants in support of education and healthcare.

- Direct funding from end users based upon savings realized from existing network solutions.



GSC Router Network
Backbone Topology
Amarillo
Lubbock
Ft. Worth
Dallas
Mt. Pleasant
El Paso
Midland
San Angelo
Waco
Temple
Austin
Beaumont
Houston
San Antonio
Laredo
Corpus Christi
Edinburg
Legend
Hub Router
Backbone

Source: *GSC Router Network Backbone Topology* (visited Oct. 15, 2000) <http://archive.tex-an.net/cur-bbconfig.gif>.

Appendix I: Open Access Debate

Traditionally regulation of the cable system has not occurred at the state level. Currently, cable television is regulated through the FCC and through local municipalities that provide franchise rights to construct the neighborhood infrastructure. This system worked well when the national debate centered principally on rates and content. Now, with the introduction of voice and ISP capabilities, many different levels of government are looking to influence the cable industry. One of the issues surrounding cable modems has been open access, which would allow multiple ISPs to connect with and serve through the cable network, similar to multiple carriers interconnecting with the ILEC. A national debate over open access has spun off from the AT&T Corporation (AT&T) versus City of Portland case in Oregon.

AT&T/TCI Cable (TCI) and Time-Warner Cable offer cable modem Internet access through @Home and Roadrunner respectively.[226] These services are provisioned according to long term contracts between the cable companies and the ISPs. The exclusivity and long-term nature of these contracts concerned some local municipalities who questioned the relationships between the cable companies and the ISPs.

In 1998, AT&T and TCI announced their plan to merge. TCI's franchise agreement with the City of Portland, Oregon, allowed Portland to review the merger. Portland held a series of public meetings where ISPs voiced concern that they would not have equal opportunity to compete for customers. In December 1998, the City of Portland agreed and required open access as a condition of transferring TCI's franchise to AT&T. AT&T/TCI appealed the decision. In June 1999, the District Court sided with the City of Portland. The 9th Circuit Court of Appeals subsequently overruled this decision.

The 9th Circuit Court decided that high-speed access to the Internet over cable was not a 'cable service,' but instead a telecommunications service. However, a federal district court in Richmond, VA, recently found in the Henrico County case that cable modem service is a cable service. This decision is currently on appeal to the 4th Circuit. Additionally, the 11th Circuit has held that cable modem service is neither a cable or telecommunications service.

Several other cities and counties have adopted ordinances requiring open access. To date, Congress has not acted on this issue, but several bills have been introduced on open cable access.[227] However, the FCC has issued a notice of inquiry to determine the regulatory classification of cable modem services.[228]

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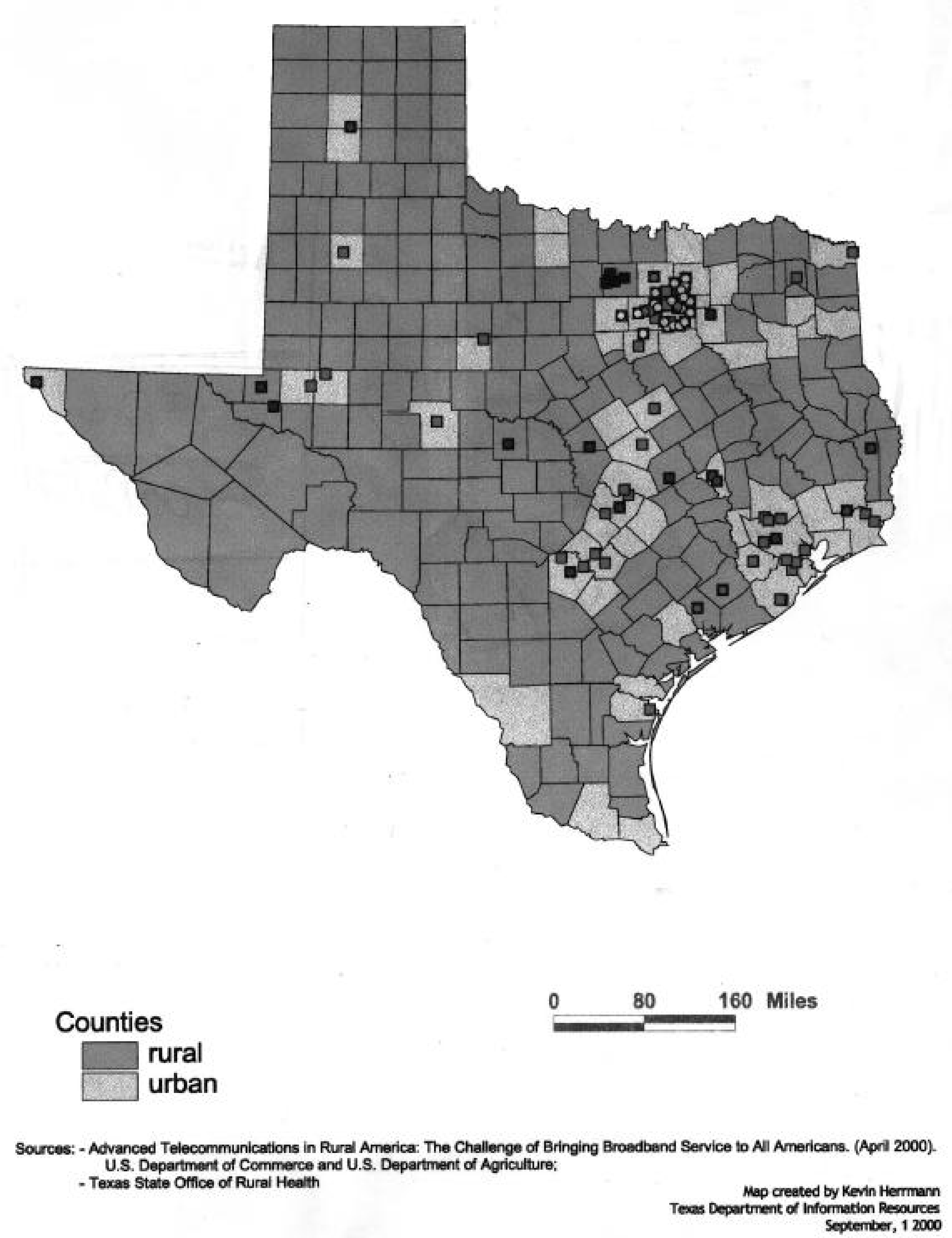
[226] @Home is jointly owned and used be numerous cable operators and other investment groups. Roadrunner is a wholly owned, though separate affiliate, of Time-Warner Communications, the parent company of the local Time-Warner cable operators.

[227] *See* FEDERAL COMMUNICATIONS COMMISSION, BROADBAND TODAY (Oct. 1999).

AT&T and Time-Warner/America On-line (AOL) have announced that they are working to allow open access to their cable systems. However, their exclusive arrangements with @Home and Roadrunner do not expire until the end of 2002. In addition, AT&T is conducting a technical trial in the Denver area in order to resolve technical and operational issues. Time-Warner/AOL has also announced a trial system and has gone further to state that it will not limit the number of ISPs that will be able to connect to its system.

[228] *See* FEDERAL COMMUNICATIONS COMMISSION, GN DOCKET NO. 00-185, INQUIRY CONCERNING HIGH-SPEED ACCESS TO THE INTERNET OVER CABLE AND OTHER FACILITIES (Sept. 2000).

Appendix J: High-Speed Cable Modem Service



HIGH-SPEED MODEM ROLLOUT IN TEXAS

The following is a list of Texas cities, and associated counties, that have cable modem access to the Internet. The cable provider is also listed. A key identifying the cable providers is included at the bottom of the table.

<u>Urban Cities/Counties</u>

Large Metro (Group 1) Cities/Counties

Addison/Dallas	ATT	Arlington/Tarrant	ATT
Austin/Travis	TWC	Bedford/Tarrant	ATT
Carrollton/Dallas	ATT	Cedar Hill/Dallas	ATT
Colleyville/Tarrant	ATT	Desoto/Dallas	ATT
El Paso/El Paso	TWC	Euless/Tarrant	ATT
Framers Branch/Dallas	ATT	Ft.Worth/Tarrant	CHA
Garland/Dallas	ATT	Grand Prairie/Dallas	ATT
Highland Park/Dallas	CHA	Houston/Harris	TWC
Kingwood/Harris	KNG	Lago Vista/Travis	TWC
Lancaster/Dallas	ATT	Richardson/Dallas	ATT
River Oaks/Tarrant	MAC	Rowlett/Dallas	ATT
San Antonio/Bexar	TWC	Sunnyvale/Dallas	ATT
University Park/Dallas	CHA		

Suburban (Group 2) Counties: Larger Counties near Metro Areas

Allen/Collin	ATT	Angleton/Brazoria	CMA
Conroe/Montgomery	CHA/COX	Denton/Denton	CHA
Flowermound/Denton	ATT	Frisco/Collin	ATT
Georgetown/Williamson	COX	Hutto/Williamson	TWC
McKinney/Collin	ATT	Missouri City/Fort Bend	ETS
Plano/Collin	ATT	Round Rock/Williamson	TWC
Taylor/Williamson	TWC		

Small and Medium Metro (Group 3) Counties: Other Larger Counties

Abilene/Taylor	COX	Amarillo/Potter	COX
Bryan/College Station/Brazos	COX	Burleson/Johnson	MAC
Kileen/Bell	TWC	Lubbock/Lubbock	COX
Midland/Midland	COX	San Angelo/Tom Green	COX
Temple/Bell	TWC	Tyler/Smith	COX
Waco/McLennan	TEC		

Rural Cities/Counties

RURAL (GROUP 1) CITIES/COUNTIES – COUNTY POPULATION OVER 20,000

Alvord/Wise	CCS	Athens/Henderson	COX
Bastrop/Bastrop	TWC	Bridgeport/Wise	CCS
Buda/Hays	TWC	Chico/Wise	CCS
Decatur/Wise	CCS	Dripping Springs	TWC
El Campo/Wharton	MCC	Ingram/Kerr	CCA
Jasper/Jasper	CMA	Kyle/Hays	TWC
Lake Bridgeport/Wise	CCS	Lufkin/Angelina	COX
Luling/Caldwell	TWC	Mineral Wells/Palo Pinto	COX
Mountain City/Hays	TWC	Nacogdoches/Nacogdoches	COX
Paris/Lamar	COX	Rockdale/Milam	CCA
Runaway Bay/Wise	CCS	San Marcos/Hays	TWC
Seguin/Guadalupe	TWC	Smithville/Bastrop	TWC
Sour Lake/Hardin	CMA	Terrell/Kaufman	CCA
Victoria/Victoria	COX	Willow Park/Parker	MAC

RURAL (GROUP 2) CITIES/COUNTIES – COUNTY POPULATION 5,001 – 20,000

Bowie/Montague	CCS	Brady/McCulloch	CCA
Kermit/Winkler	CCA	Lampasas/Lampasas	CCA
Monahans/Ward	CCA		

RURAL (GROUP 3) CITIES/COUNTIES – COUNTY POPULATION 5,000 OR LESS

None

Cable Providers

ATT	AT&T Broadband	**ETC**	En-Touch Systems
CCA	Classic Cable	**JRK**	J. R. King Enterprises
CCS	CommuniCom Services	**KNG**	Kingwood Cablevision
CHA	Charter Communications	**MAC**	Mallard Cablevision, L.L.C.
CMA	Cable Management Associates	**MCC**	Mid-Coast Cable TV, Inc.
COX	Cox Communications	**TWC**	Time Warner Communications

Source: The Texas Cable & Telecommunications Association provided this information. The information was gathered from Industry sources through an informal survey and is representative of actual cable modem deployment in Texas as of June 1, 2000.

Appendix K: Survey Methodologies

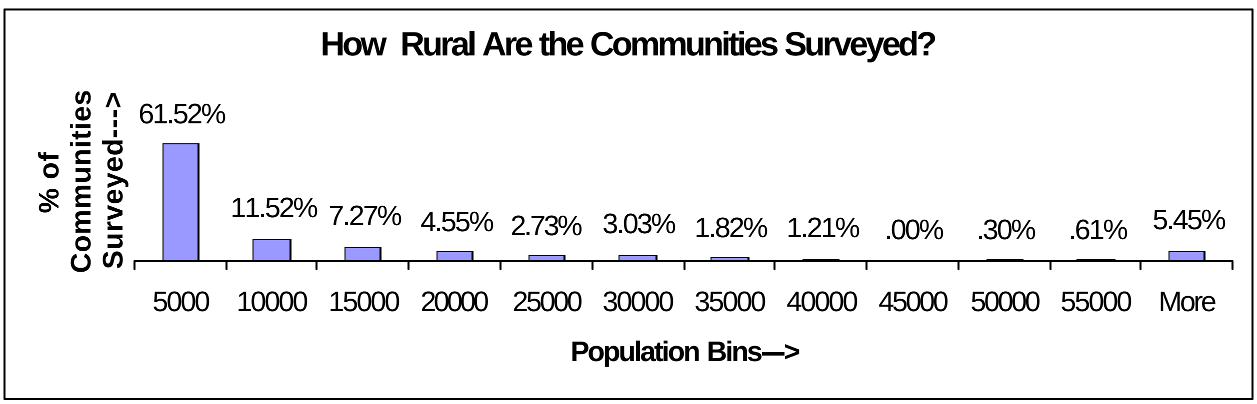
TIPI Survey Methodology

The TIPI Study was conducted in March-April, 2000 using telephone interviews with 1,002 respondents. Of those, 800 comprise a random sample survey of households in Texas, while additional 202 households are exclusively from rural counties. Consequently, 328 respondents (126 from the original sample and 202 from the rural oversample) are from rural areas while 674 respondents are from non-rural regions. In this sample, counties were coded as "rural" if they had no Metropolitan Statistical Area (MSA). This survey used a Computer Assisted Telephone Interviewing (CATI) system to conduct telephone interviews. The questionnaire was constructed largely of closed-ended items. The survey interviewed individuals (in Spanish if necessary) in households over 18 years of age, using last birthday in order to randomly sample within the household. The telephone interview took approximately 14 minutes to administer. The survey used a weighted sample; weights are developed to insure that the sample most accurately reflects the race and ethnic distribution of the Texas population. The weighted sample's ethnic and race composition is intended to represent a population that is 24.4% Hispanic, 11.4% African American, 57.8% Anglo, and 6.3% other groups.

Community Telecommunications Survey Methodology

In most cases, the responses were provided by City Mayors, Directors of Chambers of Commerce, Coordinators of Economic Development, or by City Secretaries. A total of 344 communities representing 163 counties responded to the survey.[229]

The chart below depicts the population profile of the communities surveyed. About 60% of the communities are below 5,000 in population and more than 80% of the communities are below a population of 20,000. The population bands identify rural and most rural communities. The majority of the communities surveyed are rural.



[229] Texas has a total of 243 counties.

Appendix L: TIPI Survey Results

Aspects of Internet Use in Texas

A Report from the Telecommunications and Information Policy Institute
University of Texas, Austin TX 78712
(512) 471-5826; (512) 471-6667
October, 2000

Dr. Sharon Strover, sstrover@mail.utexas.edu

The author gratefully acknowledges the assistance of Lon Berquist and Erin Fitzgerald in the preparation of this report. This study was conducted in conjunction with the Electronic Government Task Force and sponsored jointly by the Texas Department of Information Resources and the Texas Public Utility Commission. Copies are available from TIPI at www.utexas.edu/research/tipi.

Aspects of Internet Use in Texas

Executive Summary

This research project was conceived as a way to assess factors that could influence the use and development of advanced telecommunications services in Texas. Poor telecommunications infrastructure means that people often pay more for services or that they have lower quality or fewer services than those enjoyed by people elsewhere; with respect to the Internet, it may mean that the benefits of network connectivity elude certain communities. Not too surprisingly, infrastructure problems generally occur in rural areas. However, appropriate infrastructure is only part of the picture when it comes to understanding the distribution and use of network-based resources in the state or the country. Peoples' abilities to pay and their abilities to use and interest in the Internet overlay the physical infrastructure. In order to understand why people do and do not use the Internet for example, we must look beyond the simple availability of a connection to it.

This report contributes to an effort by the Texas Public Utility Commission to produce a rural broadband report for the 77th Texas Legislature. Other states as well as the FCC have done similarly over the past few years with a view to determining how to insure that rural areas are not left behind as telecommunications capabilities broaden educational, economic and social opportunities.[230] This study focuses on Texas, and reports on who has access to computers and the Internet, how people use these technologies, their attitudes toward them, the types of connections they have to the Internet, and their interest in broadband services. The prospect of significant numbers of rural Texans not being able to avail themselves of advanced broadband services is one scenario we sought to investigate. A parallel prospect of significant numbers of Texans being disinterested in broadband was likewise a subject here. In both cases, we found that not only are rural Texans using the Internet throughout the state, but also they are as interested in advanced services as are their urban counterparts.

[230] The PUC study, pursuant to PURA 51.001, is called Report to the 77th Legislature on the Availability of Advanced Services in Rural and High Cost Areas and at this writing is not yet published. The FCC's first report on the availability of advanced telecommunications systems is in CC Docket No. 98-146, Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment, pursuant to Section 706 of the Telecommunications Act of 1996 (CC 99-5). The FCC's most recent (August, 2000) report on broadband deployment is Deployment of Advanced Telecommunications Capability: Second Report, available at www.fcc.gov/broadband. The state of North Carolina produced a highly detailed examination of its telecommunications infrastructure, and the Georgia Tech Center for Geographic Information Systems in conjunction with several state agencies produced the Georgia High-Speed Telecommunications Atlas in order to provide useful telecommunications information to the economic development community. See S. French and C. Martin (2000), The Georgia High-Speed Telecommunications Atlas, presentation at the 41ast ACSP Annual Conference, Atlanta, GA; North Carolina Department of Commerce (2000), Commercially Available High-speed Internet Connectivity in North Carolina: Infrastructure and prices.

Understanding why people do and do not use the Internet may indicate what resources would be required to ensure that at least the opportunities to use this new tool are equitably available. Understanding people's practices and concerns around the Internet can enable policymakers to evaluate and structure the most reasonable responses to the need for fast and efficient access. Already several states (Missouri, Iowa, and North Carolina, for example) have undertaken assessments regarding the availability of narrowband and broadband networks for residential and business Internet connectivity. The presence of appropriate networks is an essential ingredient. However, affordability, accessibility, and interest or some perceived benefits also are prerequisites if the Internet is to be a robust and widely used resource.

This study examines (1) who does and does not use the Internet, (2) what sort of Internet connectivity people have, (3) attitudes toward and behaviors in using computers and the Internet for various services, and (4) related issues concerning using advanced telecommunications services. Several rural and nonrural comparisons are offered. Overall, the demand for broadband services in rural Texas and the nature of Texas' digital divide[231] are addressed in this study.

The data for this study came from a survey conducted in March-April, 2000 using telephone interviews with 1,002 respondents. Of those, 800 comprise a random sample survey of households in the state, while an additional 202 households are exclusively from rural counties.[232]

Key findings include the following.

<u>What are the overall computer and Internet use statistics?</u>

- 67% of the random sample (N=800) currently uses computers.
- 60% of that sample uses the Internet.

<u>Who doesn't have access and why?</u>

- People who do not use the Internet tend to be older, poorer, and are more often members of minority groups.

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[231] For information on the digital divide, see the NTIA report, Falling Through the Net III (http://www.ntia.doc.gov/ntiahome/digitaldivide/) for 1998 statistics or the more recent Falling Through the Net: Toward Digital Inclusion, available at http://www.ntia.doc.gov/ntiahome/digitaldivide/; see also the Benton Foundation site (http://www.benton.org/Library/Low-Income/).

[232] Consequently, 328 respondents (126 from the original sample and 202 from the rural oversample) are from rural areas while 674 respondents are from non-rural regions. We interviewed individuals in households over 18 years of age, using last birthday in order to randomly sample within the household. The questionnaire was constructed largely of closed-ended items. The telephone interview used a Computer Assisted Telephone Interviewing (CATI) system and took approximately 14 minutes to administer.

- The main reasons people give for not using the Internet are that they don't use computers, are concerned about kids and the Internet, aren't interested, don't have time or can't afford it.

- About 50% of the population over 60 do not use the Internet and frequently do not use computers.

- Lower income and education levels are associated with not using the Internet.

- Hispanics and African Americans, especially those below the $30-40,000 income threshold, are less likely to use the Internet.

- Being in a rural location seems only slightly to influence Internet use.

- Nevertheless, rural residents report that they have less Internet access and that it is too expensive.

- Those who do not now have household or workplace access to the Internet are most likely to go to libraries or schools to get access rather than to malls or other community centers.

<u>What sort of Internet connectivity do people currently have?</u>

- Most people in Texas connect to the Internet using dial-up modems from home. More people in urban areas have access to cable modems or DSL connections than is the case for rural areas.

- When people using the Internet lack connectivity at home, significantly more rural users than nonrural users gain access using some sort of dail-up connections.

- Rural households are as interested in broadband connectivity as nonrural households.

How can we characterize attitudes toward and behaviors in using/not using computers and the Internet for various purposes?

- People in rural areas report that their access is difficult and costly more often than do people in nonrural areas. Because incomes are generally lower in rural areas, the proportionate cost of using information technology can be expected to be greater.

- The reasons people do not use the Internet have a great deal to do with time and interest and concerns about children. Cost factors (for phone calls, for ISP services) are also important.

- The most favored public access sites were libraries and schools.

Since this survey confirms evidence from other studies that access to the Internet may be slower and more expensive in rural areas, the State should seek to better understand and address problems in rural access that may be necessary to help rural areas obtain the sorts of services that their nonrural neighbors take for granted. These results highlight some possible directions for state efforts:

- Continue to monitor Internet use among the population in order to assess who does and does not use the Internet, and why;

- Continue to monitor the roll out of high-speed options and assess whether or not they are reaching rural areas at the appropriate pace;

- Consider ways to target the population groups using the Internet the least and conduct pilot experiments with different settings, technologies, or interfaces that can address such individuals' hesitations about the Internet and e-government services;

- Consider ways to construct incentives for telecommunications vendors so that broadband capabilities can be delivered more quickly to rural areas whose population densities are relatively low.

Background of the Study

Context

The issue of how we use computers and the Internet intersects social and civic practices, educational opportunities, economic transactions, and how we use government programs and services. Consequently, how people use computers and the Internet, the actual and perceived impediments to accessing the Internet, and interest in broadband services are important considerations.

This study had three question areas:

(1) What percentage of the Texas population uses computers and the Internet? Are there differences in use associated with race, ethnicity, income and education levels, age, or location?

Previous studies have demonstrated that there are systematic differences in computer and Internet use by these background or structural factors.[233] Race, ethnic group membership, income and education levels, age, and whether one lives in a rural area show up repeatedly as important factors. To the extent that differences appear among Texas residents, there may be social as well as economic and political concerns regarding which populations may be the most able and the least able to use the new, Internet-based services; in particular, to the extent that more and more public services and information migrate to an Internet-based mode of delivery, the people who are left out of using such capabilities should not be overlooked. If certain groups do not use computers or the Internet, various public and private services must consider alternative strategies to make them accessible. The State of Texas in particular, with its e-government initiatives, may also consider how it can insure that more people use and feel comfortable with computer- or Internet-based services.

(2) How and where do people connect to the Internet? Are they interested in broadband services?

There is evidence fom other studies that access to the Internet may be slower and costlier in rural areas. With current attention toward broadband services, speed/bandwidth limitations may leave Internet users dissatisfied with using the network for certain purposes. Other questions concern the Internet's predominant English language bias or perceptions about its vulnerability to hackers or the danger some of its content or uses pose to children.

(3) Where do people feel comfortable using computers and the Internet? Amid various strategies to expand the public places where people can use the Internet, which particular sites are most convenient or suitable? For what purposes do the people use the Internet? Why do they NOT use the Internet?

If various services, particularly government services, cannot assume that everyone has a computer or Internet access, then providing widespread access to computers that are linked to the Internet is important. We already have a federal program - E-rate, a part of universal service in the 1996 Telecommunications Act - that has augmented Internet connectivity in schools and libraries, and in Texas we also have the Telecommunications Infrastructure Fund that has targeted underserved K-12 educational institutions, higher education, libraries, and not-for-profit medical facilities for Internet connectivity. Alongside access issues, understanding individuals' uncertainties or concerns about using the Internet also is essential. Where people are comfortable using computers - which places, specifically - and how they interact with Internet-based services may help guide decisions regarding developing infrastructure.

[233] Hoffman, Novak, and Venkatesh (1998). "Diversity on the Internet: The Relationship of Race to Access and Usage" and Jorge Schement (1998) "Thorough Americans: Minorities and New Media," both in Garmer, D., *Investing in Diversity: Advancing Opportunities for Minorities and the Media*. Aspen, CO: Aspen Institute Forum on Diversity and the Media.

The Sample and Procedures

The data for this study are based on a survey conducted in March-April, 2000. This survey used a Computer Assisted Telephone Interviewing (CATI) at the University of Texas' Office of Survey Research system to conduct telephone interviews with 1,002 respondents. Of those, 800 comprise a random sample survey of households in the state, while an additional 202 households represent a sample of people exclusively from rural counties. Consequently, 328 respondents represent people from rural areas while 674 respondents are from non-rural regions. We interviewed individuals (in Spanish and English) over 18 years of age, using last birthday in order to randomly sample within the household. The questionnaire was constructed largely of closed-ended items (see Tab A) and the telephone interview took approximately 14 minutes to administer.

Our analyses include basic percentage reports on the survey responses as well as tables investigating how the factors of race, income and education, age, and rural/nonrural location seem to affect the responses.[234] Because the goal of this study is to get a picture of current Texans' computer and Internet uses, our primary goal is descriptive.

Throughout this report we have analyzed a weighted sample. As explained in Tab B, we developed weights to insure that our sample most accurately reflects the race and ethnic distribution of the Texas population. The Tab also provides details on the demographic (race, ethnic origin, income, education, age, rural v. nonrural) composition of the sample. The weighted sample's ethnic and race composition is intended to represent a population that is 24.4% Hispanic, 11.4% African American, 57.8% Anglo, and 6.3% Other Groups.

Computer and Internet Use

In general terms, a large majority – 67.3% - of the Texas population currently uses a computer at work, home, or elsewhere (Figure 1). Most of the computer users also use the Internet: as Figure 2 illustrates, fully 60.1% of the random sample use computers as well as the Internet, and about 47% access the Internet from home with some regularity; people who have never used either computers or the Internet represent just 17.5% of the sample. This compares favorably with the NTIA survey results in Falling Through the Net: Toward Digital Inclusion. That study reports that half (51%) of U.S. household have computers and that about 42% have home-based Internet access.

[234] When we note that there are "differences" by various age, race/ethnic, education, income or location factors, we refer to statistically significant differences. These have been identified through chi square analyses.

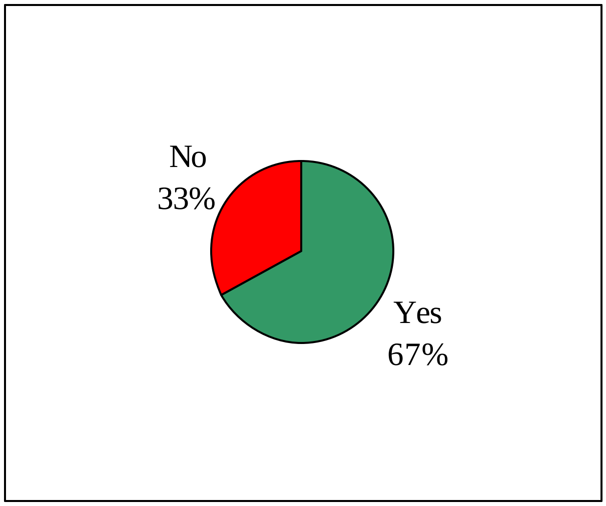


Figure 1 Percentage of Texas Households Currently Using Computers

Throughout this report, we differentiate among different types of people by how they use computers and the Internet. In addition to Internet users, computer users, and nonusers, there also is a group of people who do not use computers regularly or currently but report having used them occasionally (5.7%, called "light computer use"). Another group of people also may use the Internet occasionally (9.5 %, called "light Internet use"). Very few regular computer users have never used the Internet, an indication of the pervasiveness this technology achieved in an extremely brief period of time.

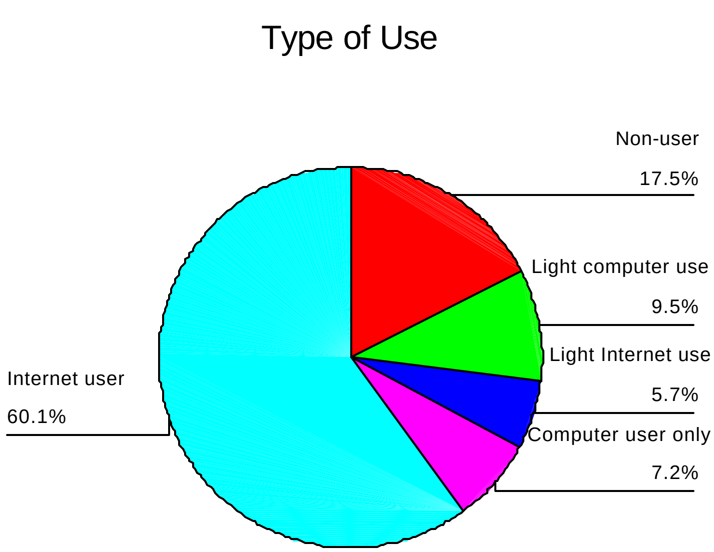


Figure 2 Percentages of User types

Demographic Factors and Internet Use

When we examined the demographic correlates of Internet use, we adjusted our analyses to include only the random portion of the sample (about 800 respondents, weighted). Specific rural/nonrural comparisons are based on the complete population of 1002.

The differences in the ethnic composition of computer and Internet users in Texas are shown in Figure 3. Nearly 68% of the Anglos used the Internet, compared to 45.2% of the Hispanics and 32.8% of the African American members of the sample. The reverse pattern holds for nonusers: 32.8% of the African Americans fall into that category, compared to 28% of the Hispanic members and 14.2% of the Anglo members of the sample.

Among people who routinely use the Internet ("Internet users"), ethnic differences are negligible in terms of the amount of time spent on the Internet (10.6 hours per week for Anglos, 10.8 for Hispanics, and 9.5 for African Americans).

There are predictably higher percentages of people in older age categories who do not use computers or the Internet (Figure 4). About 50% of the people 66 and older used neither, although nearly 26% were in fact computer and Internet users. People under 55 were far more likely to use the Internet than were older people.

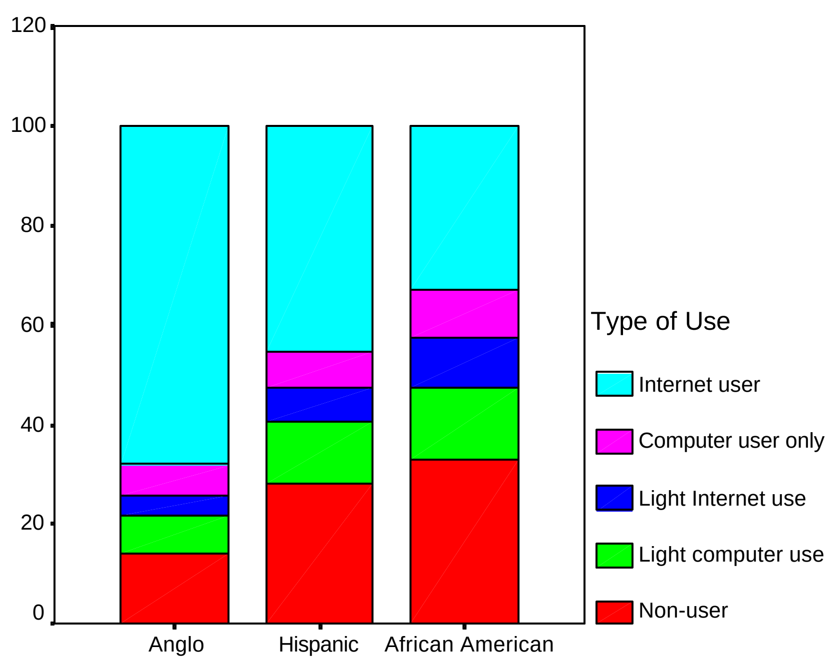


Figure 3 Ethnicity/Race by Type of Use (%)

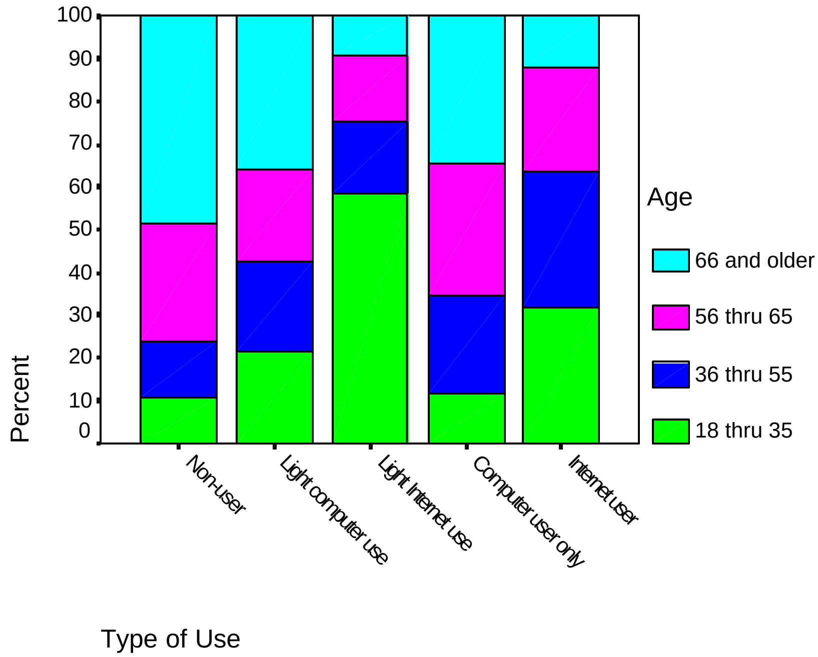


Figure 4 Type of Use by Age

The percentage of the sample that does not use computers or the Internet can generally be characterized as older, poorer, and often members of a minority group. They also tend to be less well educated. Throughout our analyses, the results for income and education were generally very symmetrical: the better-educated and wealthier one is, the more one can be expected to use computers and the Internet. At higher incomes, there are virtually no differences in Internet use by ethnic group, but at lower income levels, ethnic group membership still makes a difference: Anglos in lower income groups use computers and the Internet in greater numbers than do African Americans or Hispanics at the same income level.

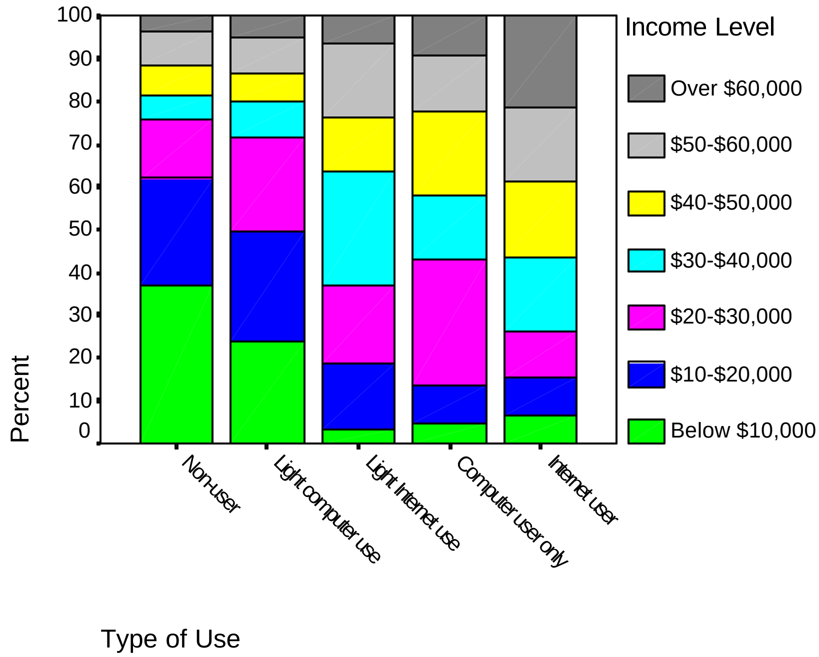


Figure 5 Type of Use by Income

As income and education increase, so do computer and Internet use. Figure 5 indicates that people making less than $10,000 represent the largest cluster of people who use neither computers nor the Internet. At incomes over $30-$40,000, Internet use is very common; the results for high and lower levels of education follow a similar pattern, with more highly educated people using the Internet more commonly than those less well educated. As Figure 6 demonstrates, most Internet users have had some education beyond high school, while the nonusers are disproportionately composed of people who did not complete high school.

Ethnic group, age, income and education differences all appear to differentiate these user groups from each other. These differences have been chronicled in the NTIA reports as well. The most recent report notes that the period from 1998-2000 was one of rapid uptake of new technologies among most groups of Americans, regardless of demographic factors. For example, it reports that the disparity between men and women using the Internet has all but disappeared, and that the gap between households in rural areas and households nationwide that access the Internet has narrowed to 2.6 percentage points (NTIA, Falling through the Net: Toward Digital Inclusion, 2000, pp. xv-xvi). The Internet access gap between rural and nonrural areas in Texas is closer to 5 percentage points in the current study.

The national level data from the NTIA's 1999 study (based on 1998 data) reported that membership in ethnic and racial minority groups and in lower income and education groups, living in a rural location and being a female head of household meant that one was less likely to use computers or the Internet;[235] many of those same divisions across race and ethnic groups persisted and even grew across the following two years (1998-2000), although absolute levels of both computer and Internet use rose tremendously across all groups. Texas' "digital divide" conforms to national trends in all of these respects save the findings on rural location: here, the Texas study suggests that the penetration of computers and Internet use generally is higher for rural residents than studies undertaken by the NTIA have found, even though there is a larger gap between rural and nonrural populations. However, as will be evident later, there are still some important differences between rural and nonrural segments of the population. For example, in comparing those two groups, we find that the rural population spends somewhat less time on the Internet, and also undertakes fewer commercial or financial transactions on the Internet. This is explored further in later pages.

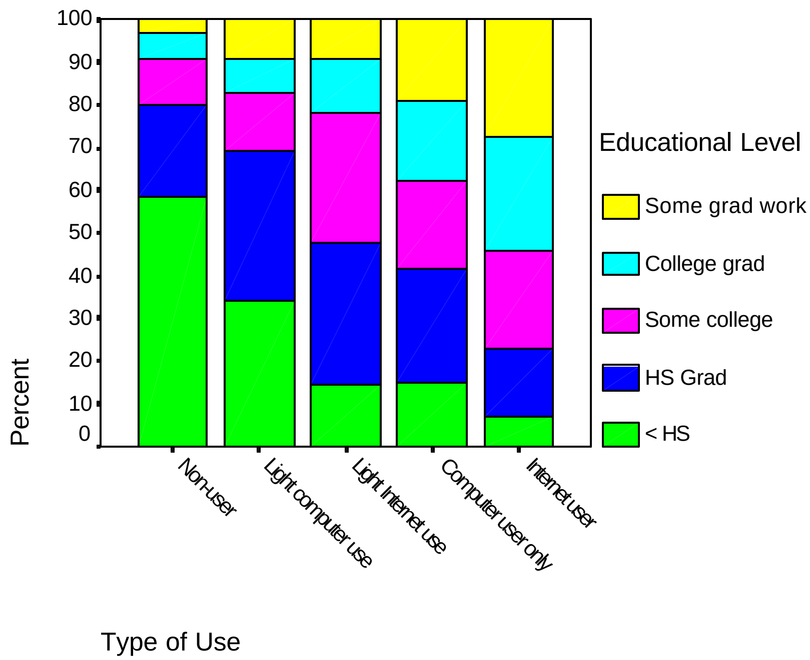


Figure 6 Type of Use by Education

Rural/Nonrural Comparisons in Internet Use

There is concern nationwide about the effects of less well-developed telecommunications infrastructure in rural areas. A study jointly sponsored by the NTIA and the Rural Utilities Service titled Advanced Telecommunications in Rural America (April 2000) raised several issues pertaining to the availability of advanced telecommunications facilities in rural areas, noting that deployment of such facilities in rural areas lags that in urban areas. In the current study, we sought to compare rural versus nonrural respondents' behaviors and

[235] The Department of Commerce has sponsored four surveys to date, and the one released in 1999 is based on 1998 data while the most recent report, released in October 2000, is based on August 2000 data.

attitudes with respect to their use of computers and the Internet.[236] Various analyses compared the two sets of respondents.[237]

As noted above, this study's results differ from earlier national studies in the finding that people in rural areas are only somewhat less likely to use the Internet than are people in metropolitan areas: 55% of rural respondents in Texas use the Internet compared to 60.2% of nonrural respondents (Figure 7). The Texas figures are in between national findings from 1998 and late 2000.

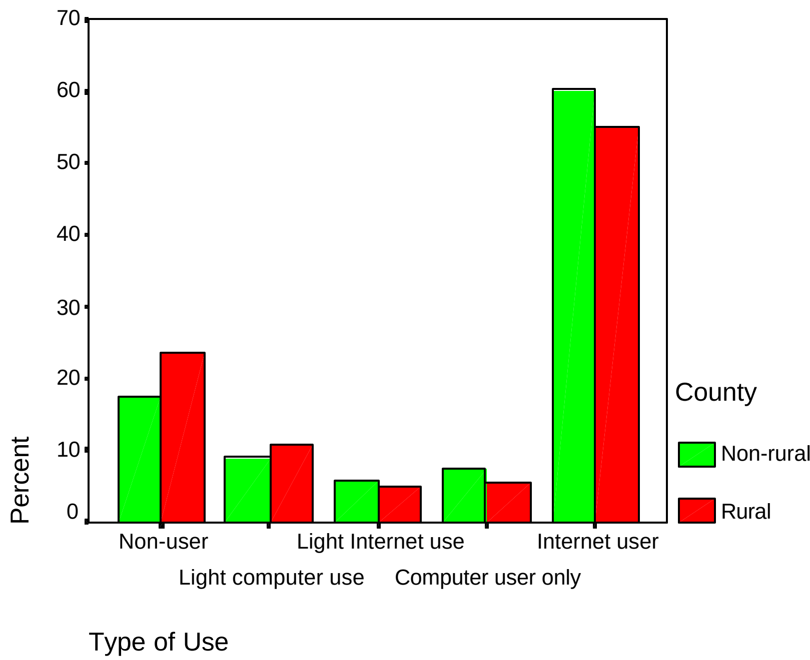


Figure 7 Rural and Nonrural Computer & Internet use

[236] Counties were coded as "rural" if they had no Metropolitan Statistical Area (See the Appendix for more details on defining rural). Out of 1,002 respondents, 328 are from rural counties and 674 are located in non-rural counties.

[237] Comparisons were done with the two groups, one rural and the other nonrural (including central cities and suburbs) using the weighting factors. All other analyses were done only with the random sample of 800 people.

Access and Connectivity

Points of Access

Most of the people in this sample report using computers at home. Using computers at work, where Internet access often is faster, is less frequent than home use, a finding opposite that reported in some national studies.

Within the random sample, of the people who use computers...

- 83.4% use them at home
- 67.8% use them at work
- 24.9% use them at school
- 30.8% use them at a friend's house
- 24.5% use them at libraries

As noted above, most computer users are also Internet users. Home is the predominant place for connecting to the Internet. In the full sample, the places Texans access the Internet include:

- Home, 79% of Internet users
- Work, 53% of Internet users
- Libraries, 22% of Internet users
- Other places, 9% of Internet users

Table 8 below shows that rural and nonrural respondents both access the Internet from home more often than they do from work; this item asked people how often they access the Internet from various sites, on a 1-5 scale with 1 being "never."

Table 8 Rural/nonrural Mean frequencies in accessing the Internet

Mean Frequency of Accessing the Internet

County		Home	Work	Library	Other
Rural	Mean	3.4090	2.3865	1.3952	1.1899
	N	214	215	214	215
Non-rural	Mean	3.4256	2.6801	1.4142	1.1926
	N	503	500	500	500

When we examine these sites by ethnic groups, it is clear that minorities lag Anglos in accessing the Internet at home and at work, but they use the library a little more frequently than do Anglos (Figure 9). People at higher income levels also use the Internet more frequently at home and at work, while the library is a more important place for people at lower income levels, although home use still far exceeds library Internet use for people at lower income levels.

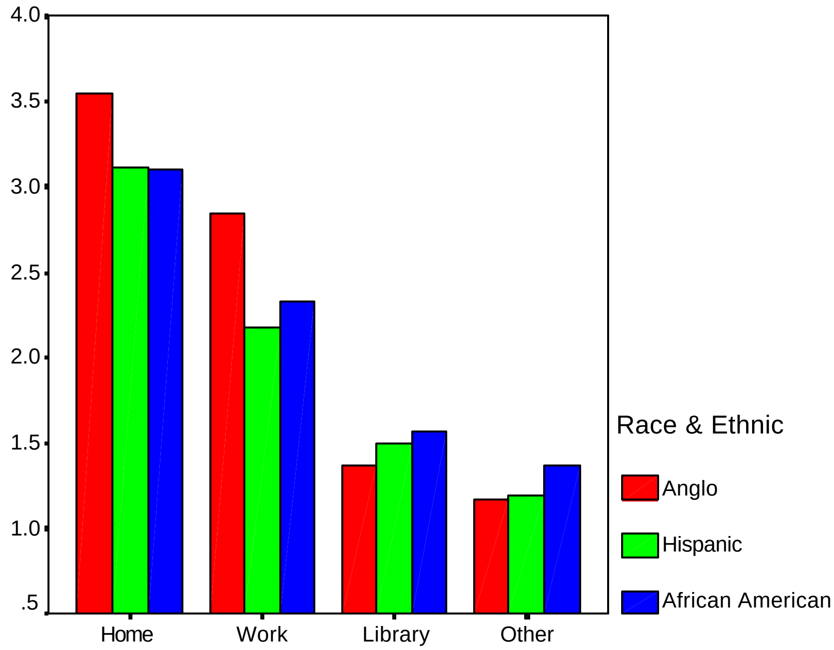


Figure 9 Average Frequency of Using Internet Access Sites by Ethnicity

Types of Connections, Satisfaction with Speed

People who access the Internet from home were asked what type of Internet connection they had. Non-home users were asked about the connection they used from the place they most commonly access the Internet. Dial-up modems are clearly the dominant method of connecting to the Internet, with predictably greater reliance on them for rural households (Table 10). Rural respondents use broadband technologies (cable modems, DSL) less often than do urban respondents, 6% compared to 12.4%.[238]

Table 10 Most frequently used home connection by rural/nonrural

		County	
		Rural	Non-rural
Type of connection	Dialup modem	80.8%	77.2%
	Cable modem	5.4%	7.9%
	DSL	.6%	4.5%
	Other	1.8%	1.2%
	DK	11.4%	8.7%
	RF		.5%
Total		167 100.0%	403 100.0%

[238] DSL, or digital subscriber line, and cable modems, are the two most widely available broadband Internet access technologies in the U.S. The FCC has defined broadband as any connection faster than 200 Kbps in both up- and downstream modes.

People accessing the Internet from outside the home also showed some reliance on dial-up modems, particularly in rural areas (Table 11). We should point out, however, that large proportions of the sample did not know how they were connected to the Internet, as represented in the "Don't Know" cells.

Table 11 Connection Type Outside of Home

		County	
		Rural	Non-rural
Type of connection most used	Dialup modem	35.4%	23.2%
	Internal network	31.3%	30.3%
	Cable modem		2.0%
	DSL	4.2%	6.1%
	Other		1.0%
	DK	29.2%	37.4%

Most Internet users were satisfied with the speed of their connection: only 17.7% of the sample said they were not satisfied. About 57% stated they were "satisfied" and another 20.9% stated they were very satisfied (Table 12). However, at the same time, most of the sample also stated they were interested or very interested in a broadband connection (Table 13). There was no substantial difference between rural and nonrural members of the sample on this point.

Table 12 Satisfaction with Speed

		County		
		Rural	Non-rural	Total
How satisfied with speed	Not at all satisfied	14.9%	17.3%	16.6%
	Satisfied	65.6%	56.9%	59.5%
	Very satisfied	15.3%	21.7%	19.8%
	DK	4.2%	3.6%	3.8%
	RF		.6%	.4%
Total		215 100.0%	503 100.0%	718 100.0%

Table 13 Rural v. Nonrural Interest in Broadband

		County		Total
		Rural	Non-rural	
How interested in high speed connection	Not at all interested	38.3%	38.1%	38.2%
	Interested	26.8%	25.2%	25.7%
	Very interested	28.2%	28.8%	28.6%
	DK	6.4%	7.8%	7.3%
	RF	.3%	.1%	.2%
Total		100.0%	100.0%	100.0%

There are slight differences in how rural as opposed to nonrural Texans believe they would use the Internet if they had high-speed connections. As shown below (Table 14), "surfing the web," telecommuting, and downloading video were the most frequently cited possible uses of broadband access for both rural and nonrural respondents, with somewhat more rural respondents being interested in telecommuting, downloading video files, and doing news-related research.

Table 14 Uses of High-speed Connections by Rural/Nonrural

		County	
		Rural	Non-rural
Use high speed connection for...	Surfing the web	40.8%	45.4%
	Telecommuting	13.6%	12.4%
	Downloading video	10.9%	6.8%
	Commercial	6.5%	4.9%
	Personal Finance	1.6%	1.9%
	Communication-Email	3.8%	3.5%
	Shopping-shopping	1.1%	1.4%
	News-research	6.0%	3.8%
	School related		3.5%
	Entertainment	1.1%	1.4%
	Everything	5.4%	5.7%
	Other	2.7%	4.1%
	DK	6.5%	4.6%
	RF		.8%
Total		184 100.0%	370 100.0%

Respondents were asked how much they would be willing to pay for high-speed Internet access. While most of the sample declined to respond, the 373 who did respond suggested a mean price of $25.50 per month for high-speed service, quite a bit less than the going rate of about $40 per month for cable modem or DSL service in Texas.

Attitudes and Behaviors Regarding the Internet

Perceptions about Access

Beyond whether or not one has Internet access is the issue of the cost – whether financial or travel–and-wait time at a public site – of that access. To investigate this we asked people how easy it was for them to access the Internet. Table 15 suggests that rural respondents believe they have a more difficult time gaining access than do nonrural members of the population. About 22.6% of the rural group strongly disagree or disagree that they have easy access, compared to about 18% of the nonrural group. That said, most of the entire sample did agree or strongly agree that access was easy.

Table 15 Agree/disagree with *I have easy access to the Internet* by rural/nonrural

		County	
		Rural	Non-rural
I have easy access to the Internet	Strongly disagree	15.9%	9.9%
	Disagree	6.7%	8.2%
	Neither agree nor	11.0%	8.3%
	Agree	24.1%	27.7%
	Strongly agree	38.1%	41.2%
	DK	4.0%	4.6%
	RF	.3%	
Total		100.0%	100.0%

Some of the reasons access may be perceived to be less than "easy" could include cost or transportation difficulties if one is accessing the Internet from someplace other than home or work.

Cost and Access

Ideas about the Internet's usefulness, its cost, and its effectiveness factor into how willing people are to avail themselves of the technology's benefits, and these interact with people's ideas about how easy their access is. Privacy concerns, language problems, and cost may negatively influence people's interest in the Internet. For example, we found that about 65% of the entire random sample agreed or strongly agreed that they were worried about privacy on the Internet. This was true across all age, income and education groups. African Americans were particularly worried about the privacy aspects of the Internet: 64.2% of them agreed they were worried about privacy compared to 44.7 of the Anglo and 45.8% of the Hispanic groups.

Overall, 67% of the sample agreed or strongly agreed that they had easy access to the Internet, as noted above (Figure 16). Predictably, younger age groups, nonrural residents and higher income and education groups especially agreed with that statement. African Americans and Anglos agreed with this statement more than did the Hispanics in the sample. As another side to the access issue, Hispanics also agreed more often than did Anglos or African Americans that the Internet was too expensive: 34% of the Hispanics agreed it was too expensive compared to 26% of the African Americans and 19% of the Anglos.

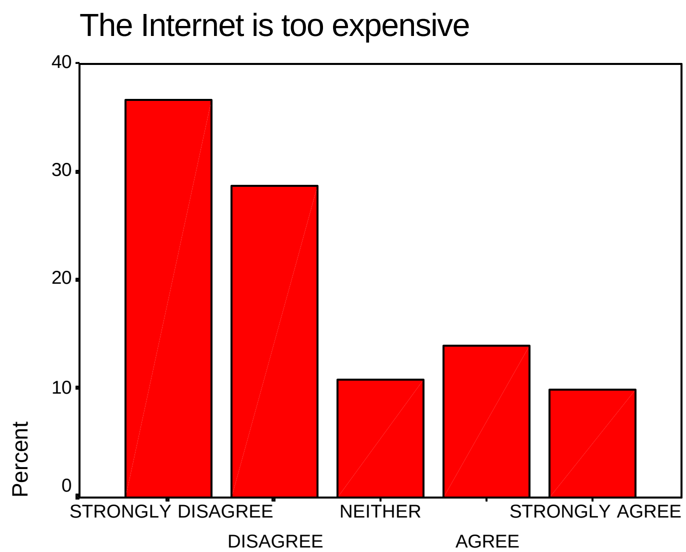


Figure 16 Percent Agree/Disagree that "The Internet is too expensive for people like me."

Rural residents also significantly differed from nonrural residents on the matter of expense: 30% agreed or strongly agreed it was too expensive versus 21% among nonrural residents (Table 17).

Table 17 Agreement with "*The Internet is too expensive for people like me*."

		County		
		Rural	Non-rural	Total
Too expensive	Strongly disagree	29.6%	34.1%	32.6%
	Disagree	22.3%	25.3%	24.4%
	Neither agree nor	8.4%	10.1%	9.5%
	Agree	14.5%	11.9%	12.8%
	Strongly agree	15.1%	8.8%	10.8%
	DK	10.1%	9.8%	9.9%
Total		100.0%	100.0%	100.0%

Reasons for Not Using the Internet

The reasons for not using the Internet are varied. We report results for two groups of people, those who do not use the Internet from home, and those who do not use the Internet at all. For both groups, predictably, the leading reason is associated with not using or having a home computer. Among people who used the Internet but did not have home connections, the reasons for not having Internet access at home show some differences between rural and nonrural households (Table 18).

Table 18 Reasons for Not Using the Internet from Home

REASONS	% Rural	% Nonrural
No home computer	72.9	57.6
Can use it elsewhere	66.7	71.0
Do not use it often enough	41.7	40.0
Concerns about children	37.5	27.3
Phone bill would be too high	18.4	16.0
ISP bill would be too high	12.5	15.0
Need special equipment	4.2	2.0

Beyond the absence of a home computer, these results illustrate that people have concerns about children using the Internet and, in the case of people using the Internet from non-home sites, that they can use a computer elsewhere. Some individuals also reported that phone bills or ISP charges were too high, although the difference for rural and nonrural households was small. The largest difference between the two groups concerns worries about children and the Internet, the rural respondents being more concerned than their urban counterparts.

Rural/nonrural differences in reasons for not using the Internet at all emphasize (1) that rural respondents did not have computers, (2) that concerns for children and the Internet were more prominent for rural households, and (3) that rural residents found they did not have enough time to use the Internet (Table 19).

Table 19 Reasons for Not Using the Internet by Rural/Nonrural

REASONS	% Rural	% Nonrural
Don’t use computers	57.6	43.3
Concerns over kids	50.8	42.5
Not interested	33.9	39.1
Not enough time	40.7	28.9
Phone bill too high	25.4	22.8
ISP charge too high	22.0	12.5
Too difficult	10.3	13.4
Need special equipment	8.5	3.1

Table 20 highlights the differences across ethnic groups that stand out in terms of why people do not use the Internet. For example, it appears that Hispanics and African Americans identify some of the cost factors (ISP and phone charges) as impediments more than do Anglos, and they also agree that the Internet is “too difficult” for them disproportionately more often. Not having enough time also appears to be a more significant factor for members of minority groups. The Hispanic members of the sample did not claim "lack of interest" in the Internet as often as did the other groups.

Table 20 Race/Ethnic Group by Reasons for Not Using the Internet

REASONS for Not Using the Internet	%Anglo	%Hispanic	%African Americans
Don't use computers	48.4	42.3	59.4
Not Interested	46.2	13.5	59.4
Concern about kids	44.1	47.1	50.0
Not enough time	26.9	36.5	43.8
Phone bill too high	17.2	36.5	18.8
ISP charge too high	11.8	19.2	18.8
Too difficult	5.4	19.2	19.4
Need special equipment	5.4	0	9.4

Uses of the Internet

Another aspect of rural Internet use concerns how much time rural residents spend on the Internet. If the Internet connection is slower, it makes sense that rural residents might spend less time on the Internet simply because connecting and downloading take too long. As Figure 21 suggests, rural Texans do in fact spend less time on the Internet than their nonrural counterparts, and they also use the Internet for fewer commercial transactions, perhaps another function of overall time spent with the medium as well as their assessment of its utility or trustworthiness for those purposes.

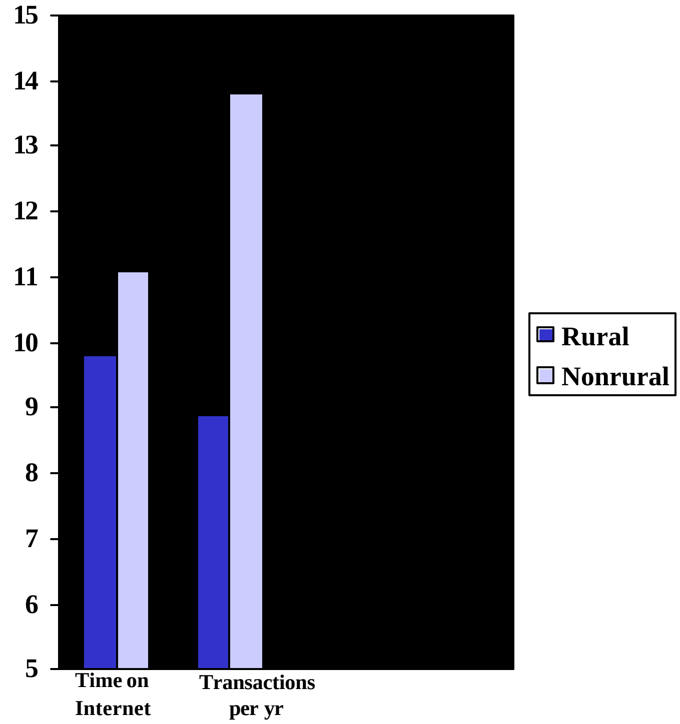


Figure 21 Time on Internet and Transactions per Year by Rural/Nonrural

Probable Access Sites for Using the Internet

One possible solution particularly pertinent to having important public institutions move toward making services available online concerns locating points of public access to the Internet in alternative places. Since many of those who are not now using the Internet will begin to do so soon, it is important to note where they might seek access, and to enhance the opportunities for them to use these tools. This is particularly important for the State as it tries to convince current nonusers to find access so that e-government services can be more effective.

When asked how likely they would be to use the Internet at four different places - a mall, a community service site, a public library and a K-12 school - relatively few people said they would consider public access at a mall, which is one scenario for expanded public use that some have suggested. Likewise, relatively few people said they would consider using public access to the Internet at a community site such as a recreation center, another scenario for expanded public access with which some towns have experimented. However, more were interested in this option than in Internet access at malls. People also said they were not likely to go to schools as a place to access the Internet. Adults may view such sites as places for children rather than adults, and this sample includes only adults

More people said they were likelier to consider using public access to the Internet at a library, indicating that these are seen as likely or appropriate, friendly places for public access. Indeed, many libraries already provide public Internet access, and people may be aware of that already. Figure 22 reports the ratings on how likely each site is as a point of public Internet access, where "1" is not at all likely and "5" is very likely.

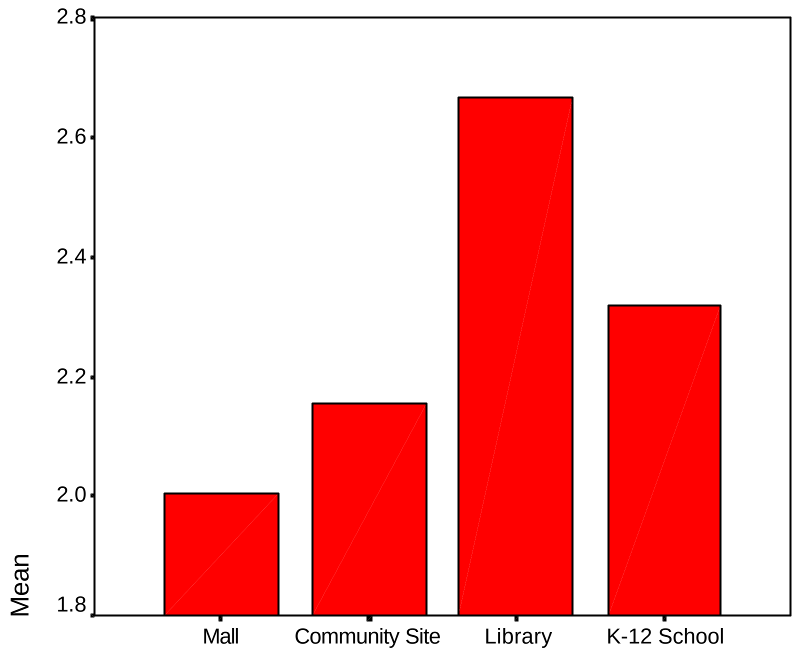


Figure 22 Mean Likelihood of Using the Internet by Site

Expectations for the Internet

People who did not use the Internet were asked to rate their perceived usefulness of different sorts of services, "based on what they might have heard about the Internet." Figure 23 reports the average ratings on usefulness, where "1" means not at all useful and "5" means extremely useful.

Family communication and undertaking school or homework research are the two most highly rated applications among these nonusers. There were no demographic (age, race/ethnicity, income, education, location) differences on the former, although on the latter question younger people were more likely to highly rate the usefulness of doing school research.

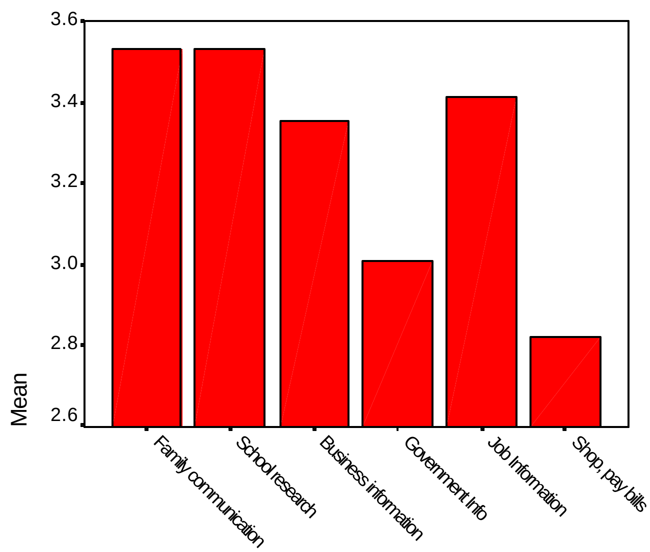


Figure 23 Mean Nonuser Ratings on Internet Uses

The high family communication use conforms to findings in other studies that consistently show that email is the most common use of the Internet. Lower rated uses like obtaining business or government information also showed no differences across the various subgroups within the population. Both of these were rated as "useful" or "very useful." Job information uses of the Internet received relatively high ratings, although Hispanics or African Americans rated it higher than did Anglos. Younger age groups and people in lower income groups also thought it would be more useful for job information. Finally, using the Internet to shop or pay bills received the lowest ratings. The more highly educated groups rated it less useful for these purposes than did other income categories.

Overall, these ratings suggest that nonusers believe the Internet could be useful for them, and they suggest that there are no or few difficulties regarding perceptions around how using the Internet could be beneficial for various tasks.

Conclusions

There is a wide base of home computer and Internet users around the state. Various programs - local, state and federal -are broadening access to computers and the Internet at public spots such as libraries as well. These are important prerequisites to insuring parity in telecommunications services throughout the state.

However, some difficulties clearly exist. Some disparities with respect to access to computers and the Internet need to be addressed. For example, this study illustrates that although computer and Internet use among Texans is at high overall levels, income and education, race and ethnic origin, and age factors differentiate how or whether one uses these technologies. Older people, poorer people, and members of minority groups show lower use of computers and the Internet, and these populations are for numerous reasons possibly the least able to avail themselves of government-provided services even without the aid of technologies. While location in rural Texas appears to be a less significant variable than other studies have shown, it still interacts with other demographic factors to intensify access problems.

In this study rural residents report that they do not have easy Internet access and that it is too expensive, even though the actual reported use statistics show only modest differences between rural and nonrural people in using computers or the Internet. This result may indicate that because incomes in rural areas are generally lower, using the Internet costs proportionately more for this population. At same time, rural households have the same interest in having a broadband connection to the Internet as do nonrural residents. That people in rural areas spend less time on the Internet and also engage in fewer commercial transactions on it may reflect some perceived "inutilities" with the types of connections rural households have; if speeds are slow, commercial transactions (which sometimes require more time, graphics, or other features that slower connections render difficult) and extended web searches for products or services may not be attractive.

The issue for many individuals is access: an important reason for not using the Internet is not having a computer. The costs of computers and the Internet cannot be dismissed. However, beyond access is the issue of how individuals perceive computers' or the Internet's relevance to their lives, and particularly how they would respond to government services that were delivered on the Internet. For example, many older people, even at higher income levels, are not Internet users. A generational and cultural gap exists that makes using computers and the Internet seem too difficult or simply something that does not evoke interest or for which people do not have time. When people do not have to use computers through school or work, which is the case for most retired people and less well educated people, it is understandable that the Internet might be seen as irrelevant. When the sorts of resources, information and entertainment on the Internet are similarly foreign for cultural reasons, lack of interest in the medium is a logical result. Simple lack of interest in the Internet or perceived difficulty with it discourages the prospects for a broadly used Internet. In addition, this study shows that people appear to be concerned about children's access to the Internet, although other studies amply document adults' belief that children need to be computer literate and adept with the Internet.

Tab A: Survey Questionnaire

The TIPI Survey questionnaire is available upon request; however, due to its length it has not been included with this report.

Tab B: Survey and Analysis Procedure Details

The Weighted Sample

In our unadjusted sample, 20.1 percent of the sample was Hispanic, eight percent was African American, and about 64.8 percent were Anglo, with the remainder of the sample falling into the categories of Asian (1.9%), American Indiana, Aleut and Pacific Islanders. (The latter groups are too few for any meaningful statistical analyses and they have been removed from most procedures.). Our rural sample was somewhat more Anglo (72.3%) with fewer Hispanics (15.3%) and African Americans (8.9%)

State statistics according to the Texas Workforce Commission as of July, 1999 show a state population of 19,925,577, and 75.2% are White (including Hispanics), 11.9% are Black, with American Indians, Eskimos, Aleuts, Asian and Pacific Islanders and "other races" comprising an additional 12.9%. About 25.5% of the people in Texas are Hispanic (an ethnic rather than a racial designation).[239] To compensate for underrepresenting the Black and Hispanic populations in this sample, throughout our analyses we have used a weighted sample. The weighted sample approximates these groups' representation in the state: in the weighted sample, 24.4 % of the people are Hispanic, 11.4% Black and 57.8% Anglo.

Defining Rural

Survey Sampling Inc. supplied codes for counties using designations of rural and nonrural. (Survey Sampling Inc. provided the random digit dial sample for survey to the University of Texas' Office of Survey Research, which gathered the data.) Rural is defined as a county that lacks a Metropolitan Statistical Area or MSA. MSA Central Cities for Texas are listed below.

MSA	Population (1999 Estimate)
Abilene	127,952
Amarillo	212,549
Austin-San Marcos	1,121,092
Beaumont-Port Arthur	379,677
Brazoria	228,166
Brownsville-Harlingen-SanBenito	317,781
Bryan-College Station	143,436
Corpus Christi	382,540
Dallas	3,264,588
El Paso	694,666

[239] The Texas Workforce Commission site at http://www.twc.state.tx.us is the source for July 1999 population estimates.

Fort Worth-Arlington	1,604,741
Galveston-Texas City	245,185
Houston	3,967,587
Killeen-Temple	307,610
Laredo	198,287
Longview-Marshall	210,285
Lubbock	234,689
McAllen-Edinburg-Mission	527,726
Odessa-Midland	245,938
San Angelo	105,648
San Antonio	1,543,383
Sherman-Denison	103,676
Texarkana	82,727
Tyler	168,888
Victoria	84,019
Waco	204,589
Wichita Falls	138,804

Source: Texas State Data Center < http://txsdc.tamu.edu/tpepp/1998_txpopest_msa.html >

MSA Central Cities are defined by the Office of Management and Budget. Most MSAs have Central Cities, although a few do not. Many MSAs have more than one Central City. The geographic extent of each Central City relies on the Census definition of "place" since "city" is a nontechnical term that means different things in different contexts. Places, as defined by the Census Bureau, include legally incorporated cities, towns, villages and boroughs, as well as Census Designated Places which are densely settled concentrations of population identifiable by a name but not legally incorporated.

Demographics of the sample

The following sections add additional detail about the demographic characteristics of the sample. All results are based on the weighted random sample except those pertaining to rural v. nonrural differences. Those results compare all rural households with all nonrural households using the entire weighted sample.

Ethnicity and Race

In our unadjusted sample, 20.1 percent of the sample was Hispanic, eight percent was African American, and about 64.8 percent were Anglo, with the remainder of the sample falling into the categories of Asian (1.9%), American Indiana, Aleut and Pacific Islanders. (The latter groups are too few for any meaningful statistical analyses and they have been removed from most procedures.). Our rural sample was somewhat more Anglo (72.3%) with fewer Hispanics (15.3%) and African Americans (8.9%)

State statistics according to the Texas Workforce Commission as of July, 1999 show a state population of 19,925,577, and 75.2% are White (including Hispanics), 11.9% are Black, with American Indians, Eskimos, Aleuts, Asian and Pacific Islanders and “other races” comprising an additional 12.9%. About 25.5% of the people in Texas are Hispanic (an ethnic rather than a racial designation).[240] To compensate for underrepresenting the Black and Hispanic populations in this sample, throughout our analyses we have used a weighted sample. The weighted sample approximates these groups’ representation in the state: in the weighted sample, 24.4 % of the people are Hispanic, 11.4% Black and 57.8% Anglo. As the Figure below illustrates, the rural population is disproportionately Anglo.

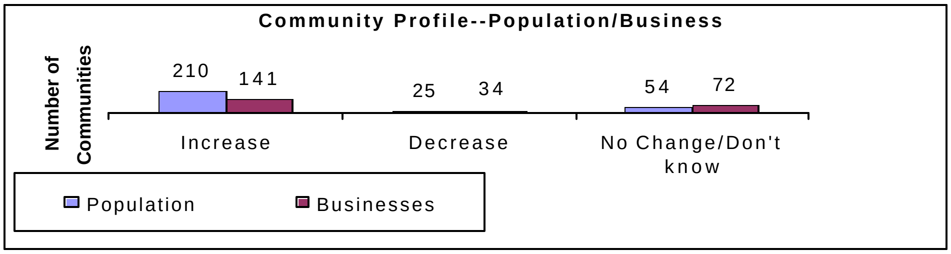
Because the size of the "other" category (American Indian, Aleuts, Asian and Pacific Islanders) was too low for most statistical analyses, it was generally dropped from our procedures.

[240] The Texas Workforce Commission site at http://www.twc.state.tx.us is the source for July 1999 population estimates.

Appendix M: Community Telecommunications Survey Results

Population and Business Trends

After examining the survey data, displayed in the figure below, it can be concluded that rural communities in Texas are increasing in size.



Sector Analysis

The survey identified sectors of the economy as growing, declining, or stable. For instance, in the tourism sector, 69% of the Texas communities responding indicated that the tourism industry is growing; about 1% indicated that it is declining; and about 30% indicated that it is stable. Agriculture is the sector with the highest state of decline, followed by forest products. In a majority of the communities, tourism, high technology, and manufacturing are either growing or are stable.

Sector	Grow	Stable	Decline
Tourism	69%	30%	1%
High Technology	68%	31%	1%
Manufacturing	60%	38%	2%
Services	59%	37%	4%
Wholesale/Retail Sales	59%	33%	9%
Education	58%	40%	2%
Health	42%	51%	7%
Forest products	25%	51%	24%
Government	24%	74%	2%
Agriculture	11%	54%	35%

Telecommunications Infrastructure and Economic Development

Cable is available in 93% of the responding communities, followed by wireless and EAS/ELC services in 88% of the responding communities. Only 11% of the communities responding indicated that a need for EAS/ELC services.

Types of Telecommunication Communities Desire

The survey explored the telecommunications infrastructure that is currently not available in the community, but is required to attract businesses. Not surprisingly, rural communities have a strong need for high-speed Internet access. This surpasses even their need for higher quality of services. Only a small percentage of the responding communities' desire enhanced services like voicemail. The survey also reaffirms that the rural communities' need for high-speed Internet access beyond what is provided by local ISPs. Rural communities are equally interested in being on the cutting edge of Internet technology as their urban counterparts.

Telecommunications Infrastructure Desired	Number of Communities
Fiber Optic or Other High Capacity Lines	92
High-speed Internet Access	88
Higher Quality of Services	66
Internet Backbone Access	41
Voicemail	34
Local Internet	28
Cell Phone	19
Call Forwarding	15
Call Waiting	12

Access to Information Resources

The survey evaluated the availability of public telecommunications resources. Because the response rate to this particular section of the survey was low, is not clear if this measure is credible.

Telecommunications Resources	Number of Communities
Distance Education Programs	125
Access to Statewide Telecom Network (Tex-An)	34
Community Internet Center	53
Telemedicine Programs	27

Availability of Internet Services & Means of Internet Access

About 93.6% of the responding communities have Internet access. This data is comparable with data from other current research. Of the communities with access, 83% have local access, 11% have access via 1-800 services, and 13% use long distance services.[241]

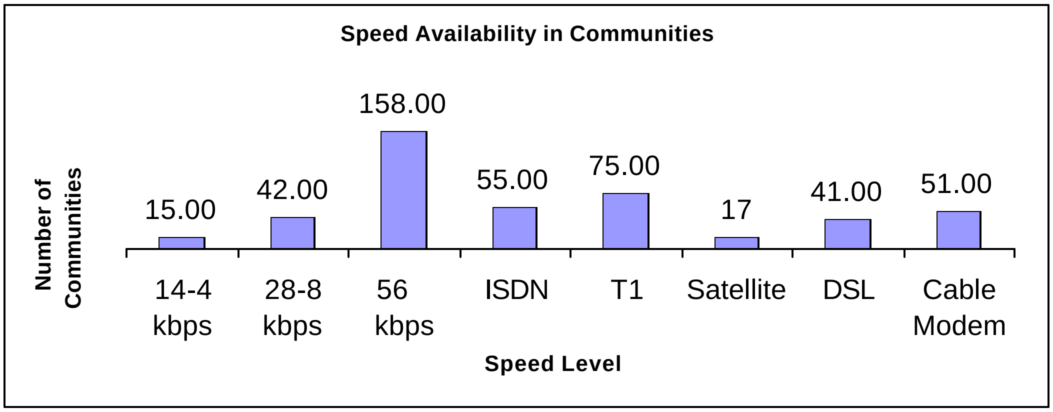
[241] It should be noted that the total percentage does not add up to 100% because some communities may have more than one way to access the Internet.

Internet Service Satisfaction

When responding, with "1" being poor and "5" being excellent, most communities were at least satisfied with their ISPs.

Speed at Which Internet is Available

At least 50% of the responding communities are at accessing the Internet at speeds of 56 Kbps or better.



Location of Internet Access Points

Survey results indicate that the majority of responding communities have Internet access at schools and libraries. In addition, training in the use of the Internet is available in an overwhelming majority of schools and libraries as well.

Availability in Public Locations	**% of Communities**
Library	60%
K-12	58%
College Campus	22%
Community Center	9%
Other	3%
Mall	2%

Locations	Availability of Training in Use of Internet	
	Yes	**No**
K-12 School	94%	6%
Community College	81%	13%
University	67%	33%
Community Center	20%	80%

Dependency of Industry/Activity on the Internet

Responding communities indicated the importance of the Internet to the community for the activities listed in the below table. Keeping in contact with friends and family through electronic mail appears to be the most critical use of the Internet.

Activities	Critical	Very Important	Important	Somewhat Important	Not Important
Communicating via Email	27%	39%	24%	7%	3%
Children Learning	19%	40%	22%	12%	7%
Research	17%	36%	24%	12%	8%
Marketing	15%	28%	25%	17%	15%
Providing Community Info	15%	32%	25%	15%	13%
Providing Emergency Communication	15%	25%	20%	22%	18%
Providing Government Services	12%	26%	28%	21%	13%
Adult Learning	11%	30%	30%	17%	11%
Delivering Health Care	8%	24%	24%	23%	20%
Selling Services or Products	7%	25%	28%	26%	13%
Buying Services or Products	5%	29%	33%	24%	9%

Community Web Pages

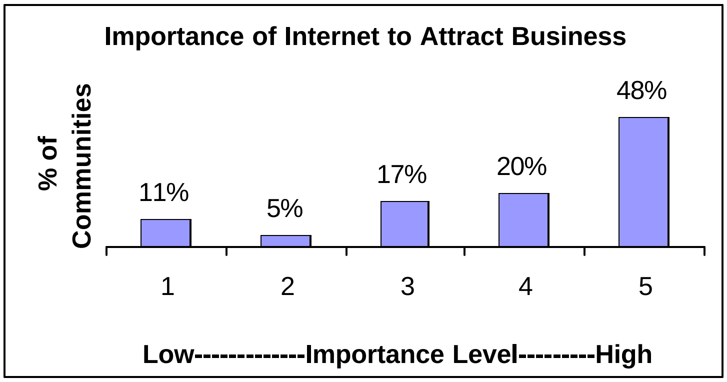
Of the responding communities, 197 have a community web page, 129 do not. Of those with a community web page, 180 use the web page for disseminating information, 65 for marketing, and 14 for sales.

Community Awareness of the TIF Fund

State funding assists 245 of the responding communities. Of those, 184 were familiar with the Telecommunications Infrastructure Fund (TIF), 140 receive TIF funding, and 139 have unmet community needs.

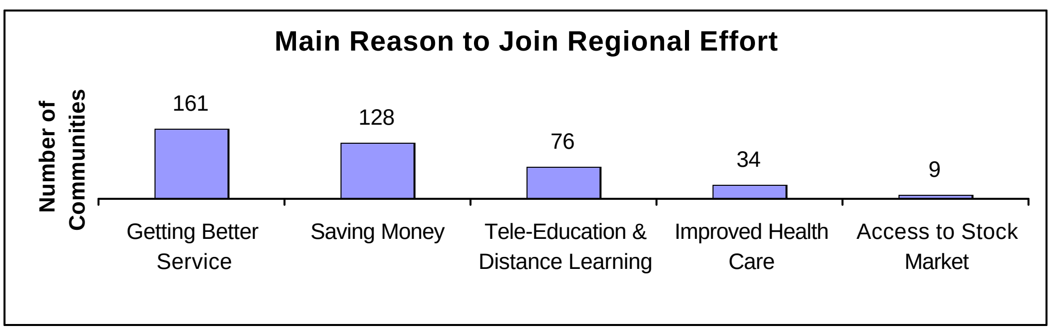
Importance of the Internet

Responding communities believe that high quality telecommunications infrastructure is very important to attracting business to the community.



Motivation to Join Regional Effort

The majority of responding communities would consider joining a regional effort to buy telecommunication services in order to receive better service or to save money.



Appendix N: State and Federal Policies that Encourage Advanced Services Deployment

Numerous state and federal policies that affect the deployment of advanced telecommunications services in rural and high cost areas of Texas have already been implemented. In addition, new laws and programs are currently being proposed at the state and federal legislatures. This chapter is a summary of several established and proposed programs that support or could support the provision of advanced services in rural and high cost areas.

Texas Policies and Laws

<u>Distance Learning and Information Sharing</u>

Incumbent local exchange carriers (ILECs) in Texas are required to include a reduced rate for telecommunications services that are related to distance learning and information sharing programs that are conducted by educational institutions and libraries. The reduced rate is equal to 75% of the otherwise applicable rate.[242]

<u>Internet Access</u>

An electing telecommunications company with more than five million access lines is required, on request of an educational institution or library, to make available a toll-free connection or toll-free dialing arrangement that the institution or library may use to obtain access to the Internet in which toll-free access would otherwise be unavailable.[243]

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[242] Public Utility Regulatory Act, TEX UTIL. CODE ANN. §§57.021-57.025 (Vernon 1998 & Supp. 2000) (PURA).

[243] PURA §58.263; *See* Appendix B of this Report for a listing of exchanges in which toll-free access to the Internet is not available.

Rural Development Task Force

Agriculture Commissioner Susan Combs has gathered representatives from all sectors of agriculture to serve on seven advisory committees for the Texas Department of Agriculture. Commissioner Combs created a task force specifically to address problems and identify issues to be addressed in rural areas. This group is made up of economic development professionals, industry representatives, trade associations, agribusinesses, researchers, government agency representatives and field experts. The task force works on issues such as business and industry growth, economics, access to technology, water quality and availability, transportation, and overall community development. Currently, task force members are researching and addressing access to telecommunications services. The group has also recently created an excellent resource for anyone involved in organizing or starting up an economic development program, as well as those with established programs, called A Bright Future for Rural Communities: A Guide to Economic Development.

The Finance and Agribusiness Development Division of the Texas Department of Agriculture, in cooperation with public and private partners, is dedicated to economic development by increasing rural and agribusiness development opportunities. The programs can help a rural community working to improve telecommunications infrastructure. The programs will also help identify financial resources, grant searches, and Texas Agricultural Finance Authority (TAFA) lending. Further information, including a copy of A Guide to Economic Development, can be found at http://www.agr.state.tx.us/ecco/economic_development/rdtf.htm.

Senate Bill 560

Senate Bill 560, passed during the 76th Legislative Session, added several competitive provisions to the Public Utility Regulatory Act (PURA). Section 55.014 addresses the provision of advanced services. Beginning September 1, 2001, the section requires, upon a bona fide request, any telecommunications company that provides advanced services within urban service areas of Texas to provide rural areas of Texas serviced by the company advanced services at reasonably comparable prices, terms, and conditions within 15 months of the request.[244]

Section 56.028 requires the PUC to provide reimbursement to non-electing local exchange carriers through the Texas Universal Service Fund (TUSF) for reduced rates for intraLATA interexchange high capacity (1.544 Mbps) service for schools, libraries, and non-profit organizations.[245]

[244] *Rulemaking to Address the Provision of Advanced Services by Electing Companies, COA or SPCIA Holders in Rural Service Areas*, Project No. 21175 (pending.)

[245] *See* P.U.C. SUBST. R. 26.410.

TEX-AN and the State Network

The State of Texas is the largest single telecommunications customer in the state and one of the largest in the nation. Prior to legislative mandate, many state agencies were making concerted efforts to link regional state offices with one another and with the Capitol Complex. As a result, the 75th Texas Legislature required the Telecommunications Planning Group (TPG) to develop a plan for a state telecommunications network with the goal of achieving a single, centralized telecommunications network for state government.[246] TPG understood that the legislative intent of building the TEX-AN 2000 network, a consolidated state government telecommunications network, was to address both bandwidth and statewide connectivity. The previous TEX-AN III network consolidated the state agencies' and universities' telecommunications bandwidth on a single network. That network addressed the bulk procurement of services in order to reduce state costs. However, the TEX-AN 2000 network is capable of efficiently meeting the future application bandwidth requirements of state government and incorporates a new high-speed, fiber-technology-based infrastructure, incorporating technologies such as SONET or ATM (Asynchronous Transfer Mode). As a result, the TEX-AN 2000 is a comprehensive set of telecommunications-related contracts awarded by the General Services Commission (GSC) that services all of the state government's telecommunications needs.[247]

Further information regarding TEX-AN 2000 can be found at http://www.tex-an.net. In addition, the Legislature requires the TPG to report biennially to the Legislature on the status of the current plan for a state telecommunications network and on the progress state government has made toward accomplishing the goals of the plan. This report is available at http://www.dir.state.tx.us/TPG/2000/index.html.

Texas Capital Access Fund

The Texas Capital Access Fund (TCAF) was established to increase the availability of financing for businesses and nonprofit organizations that face barriers in accessing capital. Through the use of the TCAF, businesses that might otherwise fall outside the guidelines of conventional lending may still have the opportunity to receive financing. The essential element of the program is a reserve account established at the lending institution to act as a credit enhancement, inducing the financial institution to make a loan. Use of proceeds may include working capital or the purchase, construction, or lease of capital assets, including buildings and equipment used by the business. To be eligible, a borrower must be a small business (100 or fewer employees), a medium business (100 to 500 employees), or a nonprofit organization, and domiciled in Texas or having at least 51% of its employees located in Texas. Further

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[246] *See* TEX. GOV'T CODE ANN. § 2054.204 (Vernon 2000).

[247] *See* Appendix G of this Report for further discussion and a current map of the TEX-AN network.

information regarding the TCAF can be found at http://www.tded.state.tx.us/TexasCapitalAccess.

Texas Capital Fund Infrastructure Development Program

The Texas Capital Fund Infrastructure Development Program is an economic development tool designed to provide financial resources to non-entitlement communities. Funds from this program can be utilized for public infrastructure needed to assist a business, which commits to create and/or retain permanent jobs, primarily for low and moderate-income persons. Grants may be provided for construction of the first-time/initial public infrastructure of telephone and fiber optic lines. The minimum award is $50,000 and the maximum is $750,000 inclusive of administration costs. The award may not exceed 50 percent of the total project costs. Further information regarding the program can be found at http://www.tded.state.tx.us/TexasCapitalFund/tcf-infr.htm.

Texas Infrastructure Fund

The Texas Infrastructure Fund (TIF) was created by House Bill 2128 during the 74th Legislative Session.[248] The mission of TIF is to help Texas deploy an advanced telecommunications infrastructure by stimulating universal and scaleable connectivity for public schools, higher education, public libraries, and nonprofit healthcare facilities. TIF also effects technology training programs and encourages quality content that strengthens education, healthcare, and libraries in Texas. Priority is given to rural and under-served populations. TIF is supported by funds collected through a surcharge on Texas customers' telecommunications bills. The charge is a set percentage of intrastate access usage.

TIF is governed by a nine-member board of directors that is charged with disbursing approximately $1.5 billion in revenues through loans and a formal grant program. As of the end of fiscal year 1999, the TIF Board had funded: 2300 public school grants; 562 of 578 rural school districts; 227 school districts for distance learning; 57 of the 57 community colleges; 67 of the 75 universities; 592 of the 789 public libraries and branches; 410 of the 742 public and not-for-profit healthcare facilities; and 26 collaborative model projects. A typical TIF grant averages $75,000 and funds telecommunications equipment, wiring, servers, computers, distance learning equipment, printers, and related peripherals. Further information regarding TIF can be found at http://www.tifb.state.tx.us.

Texas Leverage Fund

The Texas Leverage Fund (TLF) is an economic development bank offering an added source of financing to communities that have passed the economic development sales tax. The

[248] PURA §§57.041-57.051.

Texas Department of Economic Development may loan funds directly to a local Industrial Development Corporation (IDC) to finance eligible projects. Sales tax revenues pledged by the IDC need only be sufficient to cover projected annual debt service at the required debt service coverage ratio specified in the Texas Leverage Fund Program Guidelines. This allows cities to leverage their economic development sales tax and to pursue additional projects.

Loan proceeds must be used to pay eligible "costs" of "projects" as defined by the Development Corporation Act of 1979 (the Act), as amended. Under Section 4A of the Act, examples of eligible costs include land, buildings, machinery and equipment for manufacturing and industrial operations. Under Section 4B of the Act, examples of eligible costs include sports, athletic, entertainment and public park purposes and events. Further information regarding the Texas Leverage Fund can be found at http://www.tded.state.tx.us/TexasLeverageFund.

Texas Universal Service Fund

During the 75th Legislative Session, the PUC was directed to create a Texas Universal Service Fund (TUSF) with the purpose of implementing a competitively neutral mechanism to enable all residents of Texas to obtain basic local telecommunications services needed to communicate with other residents, businesses, and governmental entities.[249] As a result of changes in pricing policies in the transition to a competitive marketplace, targeted financial support may be needed to provision and price basic local telecommunications services in a manner to allow universal access to customers. The TUSF assists telecommunications providers in providing basic local telecommunications services at reasonable rates to customers in high cost and rural areas and to qualifying low-income and disabled customers. The TUSF is funded by a percentage of all retail receipts paid by telecommunications providers. The TUSF currently totals $549 million per year.

The TUSF supports the following programs: Link Up, reduces the installation charges for eligible low-income customers; Tel-Assistance, lowers basic monthly rates by 65 percent for low-income customers; Telecommunications Relay Service, funds a statewide telecommunications relay service that allows individuals with speech or hearing disabilities to communicate using specialized devices and operator translations; Specialized Equipment Distribution, provides specialized equipment for deaf and hard-of-hearing individuals at an affordable cost; and the Small and Rural ILEC Service Plan, helps small and rural phone companies provide affordable telephone service to customers who live in areas that are unusually expensive to serve.[250]

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[249] PURA §§56.021-56.028.

[250] PUBLIC UTILITY CONNECTION (Texas Public Utility Commission, Austin, TX) Winter 1999.

The federal government also has a Universal Service Fund (USF). It is separate from the TUSF and finances similar services as well as helping educational institutions, libraries, and medical facilities obtain telecommunications services, and access the Internet. Some have contended that universal service funding, on both the state and federal levels, should include broadband connections. The impact of this change in assumption would be very significant on the size of both the TUSF and the federal USF. Further information regarding the federal USF can be found at http://www.fcc.gov/ccb/universal_service/welcome.html.

Federal Policies and Laws

Federal Communications Commission

The FCC has made several commitments in order to encourage advanced services deployment. The FCC is currently examining its rules to ensure that competitors are able to access remote terminals. The FCC has also continued its commitment to the e-rate and is considering reviewing its program to determine whether it is being maximally used to promote high-speed connections in schools, libraries, and the surrounding communities.[251] The FCC will consider making more spectrum available for both licensed and unlicensed broadband services. Moreover, the FCC committed to streamlining the equipment approval process for wireless and customer premise equipment with advanced telecommunications capability. Lastly, the FCC has initiated a proceeding on the issue of whether to establish a national policy to mandate access by multiple ISPs to a cable company's platform.

Proposed Legislation

Loans

On March 28, 2000, Senator Dorgan (ND) introduced the Rural Broadband Enhancement Act (S. 2307/H.R. 4122) which authorizes three billion dollars, over five years, for a revolving loan fund. The fund would provide capital for low interest loans to finance the

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[251] *FCC Issues Report on the Availability of High-Speed and Advanced Telecommunications Services* (visited Oct. 23, 2000) <http://www.fcc.gov/Bureaus/Common_Carrier/News_Releases/2000/nrcc0040.html>.

development of high-speed rural infrastructure. The proposed bill was referred to the Senate Committee on Commerce, Science, and Transportation on March 28, 2000.

On July 27, 2000, Representative Minge (MN) introduced the Comprehensive Rural Telecommunications Act (H.R. 5069) which authorizes money for tele-work centers, authorizes the National Telecommunications and Information Administrative Organization (NTIA) to give low interest loans for rural high-speed infrastructure development, alters federal USF to enhance its availability for high-speed services, and offers tax credits for building out high-speed infrastructure. The proposed bill was referred to the House Committee on Commerce Subcommittee on Telecommunications, Trade, and Consumer Protection on August 8, 2000.

Tax Credits

On February 8, 2000, Representative Rogan (CA) introduced the National Free Public Internet Access Act of 2000 (H.R. 3598) which gives a 100% tax credit for funds spent "to acquire any computer" used exclusively in providing Internet access without charge to the general public. The proposed bill was referred to the House Committee on Ways and Means on February 8, 2000.

On March 29, 2000, Senator Rockefeller (WV) introduced the Rural Telecommunications Modernization Act of 2000 (S. 2321) which creates tax credits over three years for companies who install broadband networks in rural areas. The bill designates rural as any area that does not have a Census designated place with population higher than 25,000 within 10 miles. The company could receive a 10% tax credit for three years for connections of 1.5 Mbps downstream and 0.5 Mbps upstream or a 15% tax credit for three years if the connection is capable of 10 Mbps downstream. The proposed bill was referred to the Senate Finance Committee on March 29, 2000.

On June 8, 2000, Senator Moynihan (NY) introduced the Broadband Internet Access Act of 2000 (S. 2698/ H.R. 4728) which creates a temporary two tiered tax credit for the deployment of broadband services to areas the market is not serving. Tier 1 (Current Generation Broadband Credit) offers a 10% tax credit for the deployment of 1.5 Mbps services to subscribers in low-income and rural areas. Tier 2 (Next Generation Broadband Credit) provides a 20% tax credit for deployment of 22 Mbps services to these subscribers and other residential customers. The proposed bill was referred to the Senate Finance Committee on June 8, 2000.

On July 14, 2000, Representative Watts (OK) introduced the Community Renewal and New Markets Act (H.R. 4923) which extends tax credits to carriers that build high-speed Internet networks. The proposed bill was placed on Senate Legislative Calendar under General Orders on September 5, 2000.

On October 3, 2000, Senator Roth (DE), Chairman of the Senate Finance Committee, introduced the Community Renewal and New Markets Act of 2000 (S. 3152) which provides $1.3 billion in tax credits to companies for the deployment of advanced broadband networks. The proposed bill was placed on the Senate Legislative Calendar the same day.

Other

On July 1, 1999, Representative Tauzin (LA) introduced the Freedom and Broadband Deployment Act of 1999 (H.R. 2420) which generally prohibits the FCC and each state from regulating the rates, charges, terms or conditions for, or entry into the provision of, any high-speed data service or Internet access service, or to regulate the facilities used in the provision of such service. The proposed bill prohibits the FCC from requiring an ILEC to provide unbundled access to any network elements used in the provision of any high-speed data service, other than those elements described in FCC regulations; or to offer for resale at wholesale rates any high-speed data service. In exchange, the proposed bill requires each ILEC to provide Internet users with the ability to subscribe to and have access to any ISP that interconnects with such carrier's high-speed data service; to facilitate interconnection with any ISP with the right to acquire necessary facilities and services or the ability to collocate equipment. The proposed bill was referred to the House Committee on Commerce Subcommittee on Telecommunications, Trade, and Consumer Protection on July 21, 1999.

On April 27, 2000, Senator Burns (MT) introduced the Universal Service Support Act (S. 2476) which lifts the federal USF cap for rural telephone companies to improve their systems and offer their customers reasonable telephone rates. The proposed bill was referred to the Senate Committee on Commerce, Science and Transportation on the same day.

On July 20, 2000, Senator Brownback (KS) introduced the Broadband Regulatory Relief Act of 2000 (S. 2902) which requires an ILEC or affiliate to make available advanced service to 80 percent of its telephone exchange service customers in a state within three years where such services can be provided using an industry-approved standard and existing loop facilities; and to make available advanced service to 100 percent of its telephone exchange service customers in a state within five years of that date, or within 30 days of a bona fide request by any such customer where such services can be provided using an industry-approved standard and existing loop facilities. In exchange, the ILECs receive pricing flexibility. The proposed bill was referred to the Senate Committee on Commerce, Science and Transportation on July 20, 2000. Hearings regarding the proposed bill were held on July 26, 2000.

<u>Rural Health Care Program</u>

Under the federal USF, the Rural Health Care Program provides reduced rates to rural health care providers for telecommunications services related to the use of tele-medicine and tele-health. Support is also available for limited long distance charges for accessing the Internet. The level of support is calculated individually and depends on the health care provider's location and the type of service chosen. Health care providers can use the support to save on a service it already has, upgrade, or install new service. Further information regarding the Rural Health Care Program can be found at http://www.rhc.universalservice.org.

Rural Utilities Service

The U.S. Department of Agriculture Rural Utilities Service (RUS) offers several programs supporting the improvement of utilities in rural areas. In conjunction with the Rural Telephone Bank, RUS Telecommunications Program lends money to finance the improvement, expansion, construction, or acquisition of telecommunications facilities in rural areas. Eligible telecommunications service must be provided to the largest practical number of rural subscribers (i.e., area coverage) and not duplicate existing facilities of another telecommunications company. Rural areas are defined by RUS as any area that does not include a city with a population greater than 5,000. Further information regarding RUS Telecommunications Program can be found at http://www.usda.gov/rus/telephone/telephon.htm.

The RUS Distance Learning and Tele-Medicine Grant and Loan Program (DLT) was created to encourage, improve, and make affordable the use of telecommunications, computer networks, and related technology for rural communities to improve access to educational and/or medical services. Since its inception in 1993, demand for the DLT program has been enormous. Through fiscal year 1999, the DLT program has funded 306 projects in 44 states and two US territories totaling $83 million. For fiscal year 2000, the DLT program is capitalized with $20 million in grant funds of which $13 million has been allocated to the competitive grant program. In addition to the competitive grant program, the DLT program also has loan and grant combination financing and loan financing available. For fiscal year 2000, $130 million is available in the loan program and $7 million in grants is being paired with $70 million in loans in the combination-financing program. Further information regarding DLT can be found at http://www.usda.gov/rus/dlt/dlml.htm.

SBC/ Ameritech Merger

On October 8, 1999, the FCC approved the merger of SBC Communications, Inc. and Ameritech Corporation subject to Competition-Enhancing Conditions. One of the Conditions required SBC and Ameritech to create one or more separate affiliates to provide all advanced services in the combined SBC/Ameritech region.[252] Another condition required the nondiscriminatory rollout of xDSL services. This condition provided that at least 10% of all wire centers where the separate affiliate provides xDSL service are low-income rural/urban wire centers. This helps ensure that advanced services are available to some of the least competitive

[252] Southwestern Bell Telephone Company's advanced services affiliate is Advanced Solutions, Inc. (ASI).

market segments and to low-income consumers. Further information regarding the merger can be found at http://www.fcc.gov/ccb/Mergers/SBC_Ameritech/welcome.html.

Schools and Libraries Program & E-Rate

Under the federal USF, eligible schools, libraries, and consortia that include eligible schools and libraries, may apply for discounts on eligible telecommunications services, Internet access, and internal connections.[253] Funded at up to $2.25 billion annually, the E-Rate provides discounts of 20% to 90% on the cost of telecommunications, Internet access, and network wiring within school and library buildings. The discounts are paid directly to the companies that provide schools and libraries with these technology services.

The E-Rate is administered by the Schools and Libraries Division of the Universal Service Administrative Company (the federal USF administrator). The school/library produces a plan, acquires quotes from carriers, and then the discounts are paid directly to the carrier.[254] Further information regarding the Schools and Libraries program and E-Rate can be found at http://www.sl.universalservice.org.[255]

Section 706 of the Federal Telecommunications Act of 1996

The Federal Telecommunications Act of 1996 called for the "reasonable and timely" deployment of advanced telecommunications services and protects ILECs from being required to provide advanced services to their competitors (CLECs) at a wholesale rate. It achieves this by allowing the ILEC to create an advanced services subsidiary, which is to be treated like a CLEC, but possesses the advanced services operations of the corporation.[256]

Technologies Opportunities Program

The Technology Opportunities Program (TOP), formerly known as the Telecommunications and Information Infrastructure Assistance Program, is a highly competitive, merit-based grant program that brings the benefits of an advanced national information infrastructure to communities throughout the United States. TOP grants have played an important role in realizing the vision of an information society by demonstrating practical applications of new telecommunications and information technologies to serve the public

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[253] 47 C.F.R. §§ 54.502, 54.503 (1996).

[254] Andy Carvin, *The E-Rate in America: A Tale of Four Cities* (visited Feb. 27, 2000) <http:// www.benton.org/>.

[255] *See* P.U.C. SUBST. R. 26.216.

[256] For example, SBC Corporation created Advanced Solutions, Inc. (ASI) as the advanced services spin off from Southwestern Bell Telephone Company.

interest. TOP conducts an annual grant competition, using a merit-based peer review process. Approximately $12.5 million will be available for grants in fiscal year 2000. The President requested $45 million for TOP in his fiscal year 2001 budget request. Further information regarding TOP can be found at http://www.ntia.doc.gov/otiahome/top/index.html.

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