# Telecommunications Technology and Native American Community-Building

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The community is a core value and basic institution of Native American cultures and societies. Until the last several decades, federal policy had the effect of dispersing, weakening, or dismantling Native communities. The health and well-being of Native Americans suffered as a result. Federal policy now encourages community-building and empowerment, but many Native communities face major socioeconomic challenges—including high unemployment and poverty, physical isolation, poor health, and diminishment or loss of cultural identity.

Telecommunications technologies can make significant contributions to the well-being of Native communities in the areas of education, health care, economic development, environmental protection, and governance. The technology can help strengthen community-building efforts within and between rural Native communities, and make it easier to share the lessons learned. One can envision the use of videoconferencing, computer networking, multimedia, and wireless links on many Indian reservations and in many Native villages and communities in ways that are both acceptable and adaptable to their cultures. Several Native American communities have already recognized the potential and are in various stages of planning and implementing some of the first Native American telecommunications pilot projects. Others have begun forming telecommunications committees to plan for future community-wide infrastructure and policy.

To realize the full potential of telecommunications, however, major hurdles must be overcome. Many Native areas have limited or no telecommunications infrastructure, and lack the leadership, knowledge, training, and funding needed to take advantage of these technological opportunities. And federal policies de-

signed for the majority society may inadvertently overlook distressed rural Native American communities. These communities will need to consider the creation of publicly accessible telecommunications centers and community networks, enabling them to share costs and resources and gain community-wide acceptance.

## TECHNOLOGIES AND INFRASTRUCTURE FOR COMMUNITY-BUILDING

### Key Technologies

Key technologies discussed here include videoconferencing, computer networking, multimedia, and wireless links. It should be noted that more complex technologies are built from combinations and variations of simpler technologies. When technologies are combined in an application (to solve everyday social problems), they form a *system*. Examples include public electronic kiosks used for information dissemination or electronic benefits transfer, and computer information systems, such as a Geographic Information System (GIS), that use specialized software, computers, and databases.

Videoconferencing (also called interactive video) includes both one-way and two-way compressed or full-motion video and two-way audio. The fully interactive approach uses both two-way audio and two-way video, while one-way video combines a single video channel—usually from the speaker to a remote audience—with a regular telephone or speaker phone circuit or the equivalent. Videoconferencing has been in active use for about 15 years. Applications include business conferencing, distance education, and telemedicine. The costs of studio equipment (e.g., cameras and monitors) and transmission equipment (e.g., for uplinks and downlinks on satellites, or landline circuits) are dropping. Desktop videoconferencing uses personal computers or videophones for videoconferences among individuals or small groups.

Computer networking involves the transmission of messages, mail, images, and other information in electronic digital form between computers, regardless of location, connected by a telecommunications link. Computer networking began about 25 years ago in the days of time-shared mainframe computers, and took a grassroots, user-oriented turn about 15 years ago with the advent of the relatively inexpensive microcomputer. Computer networking includes electronic bulletin boards, computer conferencing, list servers (computers that send messages on specified topics to subscribers signed on to the list), and so-called file servers (computers with remotely accessible files of information)—many of which can be accessed on a dial-up basis rather than through a dedicated link.

Computer networks come in all sizes. They span buildings, towns, regions, and countries. Local area networks (LANs), the smallest, are generally located within one building. Computers joined over long distances are called wide area networks (WANs). LANs and WANs can be connected to form internetworks. The largest internetwork today, spanning the globe, is the Internet (see box 2-4). Computer networking, technologies, and users have matured to the point where many private companies are viewing networking as a major business tool and emerging consumer market—well beyond the scientific and research communities that fostered the first computer networks.

Computer software applications manipulate a variety of formats such as numbers (e.g., spreadsheets), words (e.g., word-processing), pictures, sounds, and video. Multimedia is the integration of all these formats in one software application.[1] The user can interact with multimedia programs in flexible ways, for example, by cutting and pasting

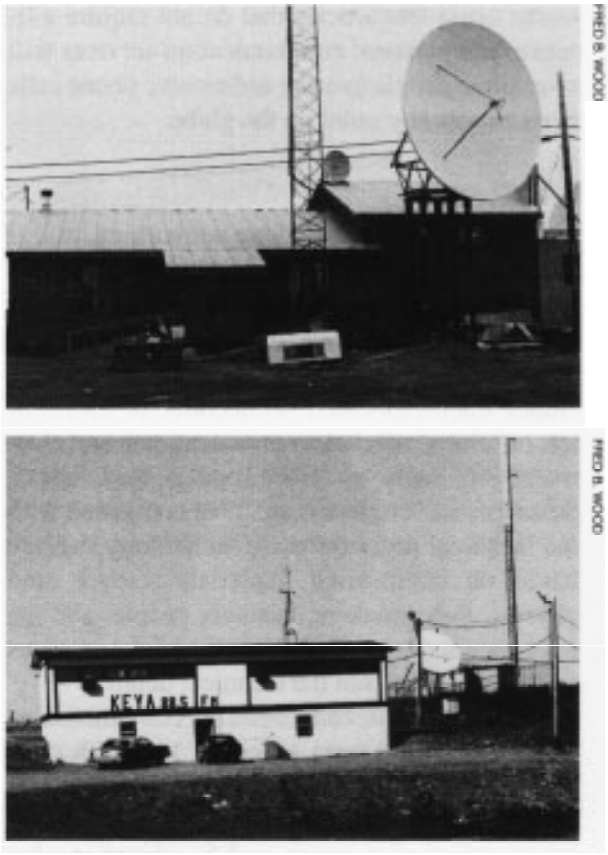
[1]Discussions on hypertext markup language (html)—the language of multimedia home pages on World Wide Web sites (a type of computer file server on the Internet)—are provided in Gary Welz, "New Dimensions: A Multimedia Revolution Is Unfolding on the Net," *Internet World*, March 1995, pp. 31-33, 36; and Mathew Gray and Eric Richard, "Make Multimedia Friendly," *Internet World*, March 1995, pp. 26-28.

together pieces of songs and video clips to create new works. Multimedia applications require microcomputers with special audio and video cards, software called a "viewer" or "player,"[2] and enough memory to store the multimedia files to be viewed.

Microcomputers increasingly use compact disk-read only memories (CD-ROMs) and include an internal CD-ROM reader to accommodate large and/or numerous text, image, or multimedia files. CD-ROMs are based on the same technology as compact disks (CDs), used for music, and videodisks, used for movies. Each CD-ROM, a thin 4.75-inch-diameter disk, can hold about 200,000 pages of text, an hour of audio, or a few minutes of video. Other high-density memory options, in various electronic, magnetic, and optical formats, are being developed and market-tested.

Wireless technologies span a wide frequency range-from the low frequencies used for AM radio to the high frequencies used for satellite and microwave communication. Radio and television broadcasting has been providing Americans with entertainment, education, and information for decades. Satellites have long been used to span the continent and link countries for transmitting phone calls, television programs, and data. Microwave links are used by telephone companies to carry phone calls, and by private companies and public utilities to monitor and manage gas pipelines, railroads, and the electric grid.

Today, the number of wireless applications and markets is exploding as more technologies are developed for the business and consumer markets. Advances in digital technology (replacing older analog techniques), coupled with new markets, have resulted in lower costs and greater access/use by individuals and small businesses. For example,




*lop: Radio station KOTZ serving the Eskimo village of Kotzebue, Alaska. The station originates some programming locally and retransmits national programming picked up from satellite feeds.* ***Bottom:*** *Radio station KEYA serving the Turtle Mountain Indian Reservation, Be/court, North Dakota. Tribal radio stations play a vital role in providing culturally sensitive educational, entertainmant, and news programs.*

**the 26** Native radio stations can use a satellite link to receive Native programming through the American Indian Radio on Satellite (AIROS) project. AIROS subleases a satellite channel from the National Public Radio satellite system. Cellular phones and paging services are adding thousands of users each day; computer companies are developing low-power, short-link wireless net-

[2]For a discussion on file formats, viewers, and players for still-video (image), motion-video, and audio files, see Richard W. Wiggins,''Files Come in Flavors: Finding and Using Viewers and Players," *Internet World,* March 1995, pp. 52-53,55-56.

[3]For discussions of wireless technologies and their role within the larger context of the National Information Infrastructure, see U.S. Congress, Office of Technology Assessment, *Wireless Technologies and the National Information Infrastructure,* in progress.

works using frequencies that do not require a license; and personal communication services will soon allow people to make and receive phone calls from almost any point on the globe.

## Systems

Videoconferencing, computer networking, multimedia, and wireless are generic technologies that can be considered at both the technical and general applications levels. As a rule, the technology base of modern telecommunications and computers includes microfabricated semiconductor electronics, or "chips"; digital communications; and electro-optics such as fiber optics and lasers. Scientists and engineers are most concerned with the technical descriptions of technology that are based on engineering, materials science, and physics. Policymakers, business people, and the public are more interested in general descriptions and applications, not the technical detail.

When specific technologies are combined in an application, they form a *system*. In health care, common systems might include telemedicine, community health information networks, or clinical information systems; and in education, distance learning and interactive multimedia training are examples. Other systems include telecommuting, telemarketing, televillages, electronic democracy, personal communication systems, video-on-demand, and groupware. At the systems level, design principles extend beyond the purely technical aspects to include human preferences and work habits, as well as plans for manufacturing, marketing, installation, and operation.

The "information system" is a generic term for a combination of one or more electronic databases and software to manipulate the information from the database. Information systems may be included in networks of computers or simply in stand-alone computers. The hundreds of different types of information systems include, for example, executive information systems, clinical information systems, online library card catalogs, and accounting systems.[4] Service agencies, in particular, use information systems to track multiple services provided to each client for as long as a lifetime. Some large commercial information systems include airline computer reservation systems, automated teller machines, and real estate multiple-listing services.

Electronic kiosks are essentially microcomputers with user-friendly multimedia software. They are usually located in public places such as libraries, supermarkets, and community centers. Most kiosks tested or in use provide a range of information about federal, state, and/or local government services. Some have limited transactional capability, such as issuing a receipt or short printed document, accepting a credit card payment, or renewing a driver's license. Future kiosks may offer a wide range of informational and transactional services. Several federal, state, and local government agencies are pilot-testing various applications with the intent of eventually using kiosks to deliver many government services electronically.[5]

Electronic benefits transfer (EBT) is the use of cards similar to credit or debit cards to qualify for and receive various government benefits. Several federal and state agencies are pilot-testing and, in some cases, operating EBT systems for the delivery of welfare benefits, food stamps, unemployment compensation, social security payments, and/or child and maternal health support (e.g., the federal Women, Infants, and Children program). EBT might also be used to provide eligible recipients with credit for education and training pro-

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[4]For a discussion of library information systems, see U.S. Congress, Office of Technology Assessment, *Informing the Nation: Federal Information Dissemination in an Electronic Age*, OTA-CIT-396 (Washington, DC: U.S. Government Printing Office, October 1988); and for a discussion of scientific and technical information systems, see U.S. Congress, Office of Technology Assessment, *Helping America Compete: The Role of Federal Scientific and Technical Information*, OTA-CIT-454 (Washington, DC: U.S. Government Printing Office, July 1990).

[5]For further discussion, see U.S. Congress, Office of Technology Assessment, *Making Government Work: Electronic Delivery of Federal Services*, OTA-TCT-578 (Washington, DC: U.S. Government Printing Office, September 1993).

grams, issue health insurance reimbursements, and disburse government grants and contracts, among other services. The current Administration has announced the goal of implementing nationwide EBT to deliver federal benefits within five years.[6]

One system that is important to many Native American tribes and villages is the Geographic Information System. GISs integrate several types of hardware, software, and electronic databases, and are used for a wide variety of geographic information-dependent purposes such as land and natural resource management, demographic modeling, business marketing, and environmental research. Each GIS can be configured to best accomplish a unique set of goals, usually using a specialized database. The major commercial GISs are now converging and are widely applicable to Native American communities.

## Telecommunications Infrastructure

Potentially large cost-savings could be realized by organizing telecommunications technologies around a community telecommunications center such as a school, library, tribal office, health clinic, or multiservice center. The requisite technologies would be collocated at one or a few centrally accessible community centers, rather than in homes and offices. Such centers could form part of a two-tier technology infrastructure in which a basic low-bandwidth[7] level of telecommunications service is provided to homes and perhaps offices (e.g., telephone,[8] dial-in capability with modem to electronic bulletin boards, and cable, broadcast, or satellite TV/radio), and a more advanced medium-bandwidth level is provided to selected community centers (e.g., computer networking, including access to online information databases, using higher speed modems or direct connections). An even more advanced high-bandwidth level and range of services might be defined for major medical centers, colleges, or businesses; or for geographically centralized Native businesses where additional economies of scale may apply, such as a Native business park, incubator, or enterprise zone.

The telecommunications infrastructure needed to provide a basic level of service to Native American homes will vary depending on geographic, demand, and market considerations. Some of the most remote areas will require wireless technologies. For example, most Alaska Native villages depend on satellite-based delivery because the villages are out of reach of cellular radio or broadcast (except satellite-linked). In the villages, small rural telephone and cable (and some local radio) companies serve the so-called last mile.

Many Native Hawaiian rural communities, by comparison, are linked (or could be linked) by both telephone and cable landlines (provided by large telephone and cable companies or their subsidiaries), with microwave and fiberoptic cable for inter-island hops and satellite links or undersea cable to the mainland. Most of these communities are within current or potential range of broadcast and cellular radio.

American Indian reservations vary in their degree of similarity to remote Alaskan villages and rural Hawaiian communities. Some reservations are within a few miles of major transcontinental

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[6]Ibid.

[7]The term *bandwidth* is a technical word indicating the amount of data, audio, or video information traveling through a conduit in a given time. Fiberoptic cables can carry data at bandwidths a million times larger than copper wire twisted-pairs used for most telephone lines. While the transmission medium has an inherent upper-bandwidth limit, other system components—such as terminal equipment that sends or receives the data, known as modems (modulator-demodulators)—may create bottlenecks in the transmission system.

[8]According to a May-June 1992 poll of seven areas served by Native American public radio stations, telephone penetration was very low. The percentages of households with a telephone were as follows: KIDE, Hoopa, CA (70 percent); KSHI, Zuni, NM (63 percent); WOJB, Hayward, WI (55 percent); KSUT, Ignacio, CO (54 percent); KNNB, Whiteriver, AZ (51 percent); KTDB, Pine Hill, NM (39 percent); and KABR, Alamo, NM (26 percent). *Who Listens to Native American Public Radio*, prepared by Dr. E. B. Eiselein for the CPB Native American Listening Data Project (Kalispell, MT: A & A Research, 1992).

telephone trunk lines, while others depend on rural telephone and cable companies for minimal service. Many Native Americans living in rural areas still do not have basic telephone service because it is too expensive or unavailable. Only four tribes own and operate telephone companies, and a few are considering or are in the process of buying exchanges. There are about 26 tribal radio stations and the number is increasing (see box 3-1 and table 3-1). About 12 tribes own and operate broadcast or cable TV companies (see box 3-2).

At a more aggregated market level, community communication centers could be located in community colleges, high schools, libraries, hospitals or clinics, and tribal/village government offices. The smallest Native communities may be able to justify only one or two centers, most likely located at an educational and/or health care facility. Larger communities may be able to set up a "community network"[9] that links the various schools, health clinics, multiservice centers, tribal offices, and the like. The key is to aggregate demand to make the communication centers or community networks as cost-effective and affordable as possible.

Opportunities to apply key technologies and systems in Native American communities exist in education and research, health care, economic development, environmental protection, and governance.

## EDUCATION AND RESEARCH

Educators, researchers, and educational administrators are learning and developing new concepts for telecommunications-based education systems, including telecourses via videoconference or radio/television broadcast, CD-ROM databases, online databases, interactive multimedia training, software applications such as computer art and desktop publishing, electronic student records, and school/campus information systems.[10] The key technologies—videoconferencing, computer networking, multimedia, and wireless links—underlie these systems. While some of these systems (e.g., electronic student records and college/university information systems) have been widely deployed throughout the United States, others (e.g., telecourses and interactive multimedia training) are still under development and/or unaffordable. Pilot projects are testing their effectiveness and efficiency and gauging their affordibility. Native American education professionals will want to do the same—based on their own criteria for effectiveness, efficiency, and affordability.

### Videoconferencing

Videoconferencing could be used for distance learning for K-12, university, vocational, trade, and adult education.[11] Schools in smaller tribes, villages, and communities rarely have the critical mass of students, let alone the resources, to offer a full range of courses. Videoconferencing could be used to supplement onsite offerings and help diversify the curriculum, and as a vehicle for continuing teacher education. The American Indian Higher Education Consortium (AIHEC) has these goals, among others, in mind for tribal colleges

[9]Sources of information about community networking include the National Public Telecomputing Network, Moreland Hill, OH, info@nptn.org; Center for Civic Networking, Washington, DC, rciville@civicnet.org; and The Morino Institute, Reston, VA, info@morino.org. The Morino Institute also has a comprehensive inventory of public-access networks at their World Wide Web site, http://www.morino.org/.

[10]For general discussions of telecommunications and other technologies for education, see U.S. Congress, Office of Technology Assessment, *Linking for Learning: A New Course for Education*, OTA-SET-430 (Washington, DC: U.S. Government Printing Office, November 1989); and U.S. Congress, Office of Technology Assessment, *Teachers and Technology*, OTA-EHR-616 (Washington, DC: U.S. Government Printing Office, April 1995).

[11]One distance-learning electronic mailing list is DEOS-L, the Distance Education Online Symposium (The Pennsylvania State University). To subscribe, send an e-mail message to listserv@psuvm.psu.edu. Also, Usenet News has the alt.education.distance newsgroup.

## BOX 3-1: Slow Growth of Native Radio

*in the Sioux language, radio is described as words that fly through the air "-Frank Blythe*

Today, there are 11,767 radio stations in the United States)[1] with 93 offering regular native programming (typically one to three hours per week).[2] But "Native Radio" is considered to be the 25 to 30 predominantly Native-owned and -operated stations, only four of which are commercial, whose primary mission is to deliver native programming-largely local news, Native-relevant Information, Native-language programming, and Native-produced music, information, talk shows, and news.

Since the first Native Radio station began broadcasting in 1971, Native Radio has slowly but steadily grown in Indian Country (see table 3-1). Why did it take so long? Largely, Indian tribes were uninformed, discouraged, and battling unemployment and poverty. Most Native stations required startup funds from state or federal grants, as well as technical assistance and Institutions for training managers, broadcasters, and programmers. Lastly, the stations needed ongoing funding for operations and development of Native programming. They had Iittle experience in any of these areas.

Today, however, the situation has changed. native stations have learned the business. They are supported by volunteers, fund drives, underwriting by corporations and foundations, federal grants, and training programs set up in local schools. Operating costs, Including salaries, are frequently paid by school boards or tribal councils. The Institution of "Native Radio" has gone national with the formation of the indigenous Communications Association (ICA) and the ability to deliver Native programming nationwide through the American Indian Radio on Satellite (AIROS) project—a joint effort of ICA and the Native American Public Broadcasting Consortium (NAPBC), Native programming is further supported by the NAPBC and Pacific Islanders in Communication, in turn supported by the Corporation for Public Broadcasting (CPB)

There IS now a pipeline of up-and-coming young native radio managers, broadcasters, technicians, and programmers. Six more stations wiII begin broadcasting within a year The experiences of once Isolated radio stations are now being shared through the ICA. The future, however, is still uncertain Most stations feel they are barely surviving. The problems are not changing lack of money, Inadequate staffing and training,[3] lack of Native-language skills, lack of native programming, tribal interference, poor facilities and equipment, and in some cases, competition. "Lack of money" is an understatement. Most of these stations serve some of the most Isolated areas of the country where poverty is the rule, in 1971, the Navajo Pine HiII (station KTDB) community had only a 2 percent telephone penetration rate and, because of the lack of electricity, KTDB distributed 500 portable radios. Electricity just came to the Navajo Alamo reservation (station KABR) in 1982 and telephones in 1986.

Despite the problems, native visionaries are planning for the future, With help from ICA, stations are finding new ways to raise money, especially from tribal governments, and are applying for more grants The ICA Itself, with the expiration of supporting grants from CPB, must find new support to survive What little native programming that does exist is now widely available through NAPBC's library. Stations are striving to upgrade facilities to Implement new Digital Audio Broadcasting and Tape (DAB and DAT) technology, as well as to install dishes to receive broadcasts through AIROS (currently 15 stations have dishes). native broadcasters are questioning their role in the National Information Infrastructure (Nil). While radio broadcast is generally overlooked in the Nll debate, it is very Important for rural reservations, especially those areas without phones or electricity or access to any other information source.

SOURCES Off Ice of Technology Assessment, 1995, with information from Michael C Keith, *Signals in the Air: Native Broadcasting in America* (Westport, CT: Praeger Publishers, 1995), and Michael C Keith, Communication Department, Boston College, Boston MA, personal communications, February 1995

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[1] *Broadcasting and Cab/e,* Mar 6, 1995, p 73

[2] A total of 93 stations reported offering Native programming in 1992 *Broadcasting and Cab/e Yearbook (New* Providence NJ: R.R. Bowker, 1994), p B575

[3] The Alaska Public Radio Network's Indigenous Broadcast Center IS the only national training center specifically for Native Americans

## TABLE 3-1: Characteristics of Noncommercial Native Radio Stations

| Station | First aired | Location | Power | Population | Language | Supporters |
|---|---|---|---|---|---|---|
| KYUK | 1971 | Bethel, AK | | **4,500** | Yup'ik | State, CPB |
| KTDB | 1972 | Pine Hill, NM | | **2,000** | Navajo | School Board |
| KOTZ | 1973 | Kotzebue, AK | 10 KW | | Inupiaq | Village |
| KEYA | 1975 | Belcourt, ND | 19 KW | 10,000 | Etwaychik | Tribe |
| KDLG | 1975 | (Nushagak Bay) AK | 10 KW | | Yup'ik | School Board |
| KBRW | 1975 | Barrow, AK | 10 KW | | Inupiaq | Local, state, CPB, DoC-NTIA, Corp. |
| KSUT | 1976 | Ignacio, CO | **450 W** | 2,300+ | Ute | Tribe, College |
| KINI | 1978 | (Rosebud) SD | **57** KW | | Lakota | Owned by Catholic Mission |
| KSHI* | 1978 | Zuni, NM | **100 W** | **10,000** | Zuni | Tribe, CPB |
| KIDE* | 1980 | Hoopa, CA | 195 W | 1,800+ | Hoopa | Tribe, DoC-NTIA |
| KSKO# | 1981 | McGrath, AK | **10** KW | **5,000** | -None- | |
| WOJB | 1982 | Hayward, WI | 100 KW | **3,800** | Ojibwe | Tribe |
| KNNB | 1982 | Whiteriver, AZ | 630 W | **11,000** | Apache | Tribe, HUD, DoC-NTIA |
| KILI | 1983 | Porcupine, SD | 100 KW | **37,400** | Lakota | |
| KMHA | 1983 | New Town, ND | 100 KW | **3,000** | Mandan | Tribe |
| KABR | 1983 | Alamo, NM | Low | **1,300** | Navajo | School Board, DoC-NTIA, DoED-OIE |
| CKON | 1984 | (Akwesasne) NY | **350 w** | | Mohawk | Some Advertising, Canada |
| KCIE | 1990 | Dulce, NM | **100 w** | | Apache | |
| KGHR^ | | Tuba City, AZ | 100 **w** | 16,000 | Navajo | School Board, DoC-NTIA |
| KCUK | 1990 | Chevak, AK | **10 w** | | Cup'ik | School Board, State, Fed. |

*KDLG repeater stations:*

| | |
|---|---|
| KSDP | Sandpoint, AK |
| KIAL | Unalaska-Dutch Harbor, AK |
| KUHB | Saint Paul-Pribilof Islands, AK |
| KNSA | Unalakleet, AK |

*Other repeaters or translators:*

KBRW reported having 5 translators via satellite.
KSUT reported having 6 translators.
KSKO reported 2 repeaters.

NOTES

A "repeater" rebroadcasts a signal at the same frequency, while a "translator" rebroadcasts at a different frequency
Language refers to any amount of Native language programming
Supporters is an Incomplete list and does not imply amount or type of support

| | |
|---|---|
| () | Names in parenthesis are reservations<br>Only radio in region |
| #<br>^ | KSKO may alternate majority control of its governing body from Native to Anglo<br>KGHR is owned by the high school board and operated by high school students<br>(It is a National Public Radio repeater station from KNAU in Flagstaff, AZ ) |
| DoC-NTIA | U S Department of Commerce, National Telecommunications and Information Administration (Public Telecommunications Facilities Program) |
| CPB | Corporation for Public Broadcasting |
| HUD | U S Department of Housing and Urban Development |
| DoED-OIE | U S Department of Education, Off Ice of Indian Education |
| Corp. | Specifically Shell 011, ARCO, and BP Exploration |
| Fed | Unspecified federal grant |

SOURCES: Office of Technology Assessment, 1995, with Information from Michael C Keith, *Signals in the Air: Native Broadcasting in America* (Westport, CT: Praeger Publishers, 1995); E.B. Eiselein, *Who Listens to native American Public Radio?, Report of the CPB Native American Listening Data Project* (Kalispell, MT: A&A Research, June 1992), and Michael C Keith, Communication Department, Boston College, Boston, MA, personal communications, February 1995

## BOX 3-2: Native Television

While Native radio has hobbled along since 1971 (see box 3-l), Native television is virtually nonexistent. The primary barrier to participation is high costs, but lack of experience and training is also a problem Some Native Americans are also wary of television's potential to culturally assimilate and erode Native values. This fear is lessened when stations are Native-owned and broadcast some measure of native programming

Michael C Keith, in the course of his research on native broadcasting, identified only a few native owned and -operated TV and cable stations. As sketched below, these stations (and a few others identified by the Off Ice of Technology Assessment) serve specific communities and offer Native programmin—glocal news, Native-relevant information, Native-language programming, and Native-produced music, information, talk shows, and news

### Cable TV Stations

- *Navajo Nation TV 5* (Arizona)
  Programming: Public Broadcasting System (PBS) programming and five hours weekly of Navajo-language features
  Plans to offer signal on UHF band to avoid cable hookup. Currently has 5,000 subscribers
- *Sioux Satellite Cable (serving* Lower Brule and West Brule Reservations, South Dakota)
  Programming Locally produced information, children's shows, and Native-language features
  Founded in 1991 Broadcasts five days per week
- Cherokee *Cable Vision* (Eastern Band of Cherokee Reservation, North Carolina)
  Programming. Monthly live telecast of tribal council meeting. People call in during the meeting
- *Blackfeet Tribe TV* (Montana)
- WSBC Seminole *Cable TV* (Florida)
- *Choctaw Cable WHTV* (Mississippi Band of Choctaw Indians, Pearl River Reservation, Mississippi)
  Programming. Affiliated with The Learning Channel and carries live coverage of tribal events and American Indian-oriented news and documentaries. in the process of expanding to SIX other Choctaw reservations nearby

### Over-the-Air TV Stations

- *KYUK in Bethel, Alaska*
  Programming English and Yup'ik-language programming for a mixed audience.
- *Navajo Nation "Purple Cow" TV* (serving Rock Point Reservation)
  Programming PBS and two hours per week of news, documentary, and educational training features produced by students and staff at the Sauer and Rock Point Community Schools
  Founded in 1987 Plans to build new studios with help of schools and the Navajo Nation

Other Native-owned and -operated TV stations have been supported by grants from the Commerce Department's National Telecommunications and Information Administration (NTIA), through NTIA's Pub-Iic Telecommunications Facilities Program (PTFP),[1] One of the largest PTFP awards is the American Indian Higher Education Consortium (AIHEC) distance-learning network, which links 29 U.S.-based tribal colleges using satellites. Many native American PTFP public television grantees are participants in the AIHEC grant The PTFP awards Include

### PTFP Grants for Over-the-Air Public Television

- Three grants (1984, 1985, 1986) to *Navajo Community College (Arizona)* to establish a system of SIX low-power television stations to transmit locally produced programming (AIHEC member)

*(continued)*

[1] National Telecommunications and Information Administration, "PTFP Native American Awards July 1994 "

## BOX 3-2: Native Television (Cont'd.)

- A 1982 grant to *Ojibwa Community College* (Michigan) to construct a translator to bring public television to the Keweenaw Bay Indian Reservation
- A 1982 grant to *Dull Knife Community College (Montana)* to establish a low-power television station to serve the Cheyenne Reservation. A 1985 grant provided a translator. (AIHEC member)
- A 1986 grant to *Salish-Kootenal College (Montana)* to establish a low-power television station to bring a PBS signal to the Flathead Indian Reservation via the Rural Television Service, Inc. (RTS) based in Carson City, Nevada A 1992 grant activated a translator to extend the signal to the Reservation communities of Arlee, Evaro, and Dixon (AIHEC member)
- Note SKC TV today is a UHF station offering PBS service to most of the Flathead reservation, but soon wiIl face competition from the University of Montana, Missoula, which plans to construct a full-power VHF PBS station with an NTIA/PTFP grant
- A 1985 grant to *Browning Public Schools (Montana)* to establish a low-power television station to bring a PBS signal to the Blackfeet Reservation via the RTS system
- A 1985 grant to the *Mescalero Apache Tribe (New Mexico)* to establish two low-power television stations to bring a PBS signal to that reservation via the RTS system. A 1989 grant Improved studio equipment for local programming.
- Three grants to *Rogers State College (Oklahoma)* to construct (1 985), improve (1 988), and extend PTV service to the native American population of northeast Oklahoma with greater transmission power (1990)

**PTFP Awards for Nonbroadcast Television**

- A 1980 grant *to Metlakatla Indian Reservation (Alaska)* for a video production studio to produce Native programming for the local cable TV
- A 1992 grant to *Northern Arizona University* for duplex microwave distance- learning systems from the Flagstaff campus to *Mojave Community College, Mojave Indian Reservation (Arizona)* and Northland Pioneer Community College, connected to learning centers at the *Fort Apache Reservation* A 1993 grant extended the system to two towns on the *Navajo Reservation* and to one location on the *Hopi Reservation*
- Grants in 1979 and 1982 to *Eastern Band of Cherokee Indians (North Carolina)* to construct a cable TV system for the reservation
- A 1993 grant to *Standing Rock College (North Dakota)* to activate a distance-learning system interconnected via telephone lines between its main campus, a remote-learning center on the Reservation, and the University of North Dakota (AIHEC member)

Based on this Information, OTA estimates that there are at least six Native-owned and -operated cable TV stations and about the same number of over-the-air, low-power television stations

SOURCES Off Ice of Technology Assessment 1995, with information from Michael C Keith, *Signals in the Air: Native Broadcasting in America* (Westport CT: Praeger Publishers 1995), and Michael C Keith, Communication Department, Boston College, Boston, MA personal communication February 1995

(see box 3-3). With a three-year National Telecommunications and Information Administration planning grant and a follow-on demonstration grant, AIHEC plans to deploy and demonstrate a videoconferencing system using satellite technology. If successful, this technology could be extended to Native American K-12 schools, and to non-Native colleges and universities with Native American populations.[12] AIHEC is also considering a role for the network as part of tribal commu-

[12]Facts and figures on 200 colleges and universities with Native American students have been compiled for the first time in *AISES Annual College Guide for American Indians 1994-1995* (Boulder, CO: American Indian Science and Engineering Society, 1994).

## BOX 3-3: The AIHEC Distance-Learning Network

- The American Indian Higher Education Consortium (AIHEC) comprises 29 tribal colleges Three are four-year institutions and the rest are two-year community colleges The colleges are located in 12 states distributed as follows, Montana (7), North Dakota (5), South Dakota (4), New Mexico (3), Wisconsin (2), Minnesota (2), and one college each in Michigan, Nebraska, Kansas, Washington, California, and Arizona.
- Over FY 1992-94, Congress made available to the Commerce Department's National Telecommunications and Information Administration (NTIA) a total of $1 million ($250,000 in 1992 and again in 1993, and $500,000 in 1994) to help AIHEC plan how best to use telecommunications technologies to fulfill its mission The project takes the form of a cooperate agreement between NTIA and AIHEC and is being administered by NTIA's Public Telecommunications Facilities Program.
- Consultants for the AIHEC planning grant include Nebraska ETV in Lincoln, the native American Public Broadcasting Consortium (NAPBC), and two experts in telecommunications. Nebraska ETV developed and operates the AG*SAT Network and cofounded the SERC Network. NAPBC has experience in radio and television production as well as program acquisition and distribution Moreover, NAPBC has a strong reputation working with and for Native American public broadcasting. The expert individuals have experience in developing distance-learning networks that are successfully up and running.
- The first-year report recommended that that the first phase of equipment purchase should consist of a C/Ku-Band satellite receive-only antenna and classroom video equipment for each AIHEC school and the AIHEC Washington, DC, headquarters The estimated cost IS $600,000. The second-year report recommended that each school be equipped with a Very Small Aperture Terminal (VSAT) satellite uplink/downlink with a compressed video attachment and a video origination classroom Furthermore, a network-switching center would presumably complete the AIHEC network. This equipment would cost $39 million, phased in over four years
- When fully Implemented, the AIHEC network wiII allow AIHEC to help Native Americans participate in the emerging National Information Infrastructure in the future, the AIHEC network might also be used as an on-ramp to computer networks such as the Internet
- in spring 1995, AIHEC expanded the scope of the project to include assisting tribal colleges in the development of local telecommunications infrastructure. With AIHEC and tribal college help, communities can more broadly deploy and use computer networks.

SOURCE: Office of Technology Assessment, 1995, with information from "The AIHEC Telecommunications Development Project, June 29, 1994, " unpublished document, "American Indian Higher Education Consortium Telecommunications Network: Building Our Future as a People Through Telecommunications" (pamphlet), and Gary Garrison, Telecommunications Project Manager, AIHEC, Lincoln, NE, private communications, March 1995

nity communications centers located at tribal colleges.

Moreover, if videoconferencing partnerships could be formed between tribal and non-Native colleges, learning and research could be enhanced in a multitude of academic areas, including anthropology, linguistics, Native American studies, alternative medicine, and subsistence/sustainable economics. Universities with Native populations might want relevant educational programming and real-time courses produced and taught by Native Americans, such as the AIHEC system could provide. And tribal colleges might seek to broaden the range of their offerings with courses provided by large universities.

Tribal colleges also might want to participate in nationally available videoconferences. For example, the JASON project—administered by the JASON Foundation for Education but supported by an alliance of public, private, government, and nonprofit institutions—allows school children to observe scientific researchers working in remote geographic areas and ask them questions during real-time videoconferences. Founded in 1989 by the discoverer of the *R.M.S. Titanic*, Dr. Robert Ballard, the JASON Project hopes to achieve high


***Left:*** *Students using a personal computer laboratory at the Little Big Horn College on the Crow Indian Reservation, Crow Agency Montana.* ***Rlght:*** *The Little Big Horn College encourages students to use computers for doing class projects and homework. AJl students have access to computer laboratories.*

visibility among scientists, educators, and students throughout the United States and participating countries.[13]

Videoconferencing has wide potential for Native Americans' education. Successful projects are under way in, for example, the North Slope Borough School District in northernmost Alaska, the Lower Yukon and Kuskokwim School Districts in the delta region of Alaska, and the University of Hawaii's community college system.

## ■ Computer Networking

Computer networking is becoming a key research tool for students and faculty to access various remote databases and documents, exchange draft materials for collegial review, or arrange participation in academic conferences. These applications should be equally helpful in the Native American educational and research environment, especially for exchanging information with other Native American researchers and for accessing the growing number of electronic bulletin boards, file servers, and list servers on Native American topics (see appendix A for a more detailed discussion).

Electronic mail and, to a lesser extent, desktop computer conferencing are becoming more commonplace as a complement to traditional teaching methods, and allow students as young as 3rd grade to reach out electronically to other communities and even nations. These systems offer real potential for helping Native students indifferent tribes,

[13] The JASON Project maintains several list server discussion groups, a Gopher server, and a World Wide Web home page (http: //seawifs.gsfc.naaa.gov/scripts/JASON.html). Until 1995, interactive satellite broadcasts were watched from Primary Interactive Network Sites (PINS) such as NASA-AMES Research Center, Denver Museum of Natural History, Maui High Performance Computing Center, Bell Museum of Natural History in Minnesota, The Williams Companies in Oklahoma, University of Wisconsin in Milwaukee, and the National Geographic Center, as well as several other sites. This year, for the first time, people around the world were able to participate in the JASON VI Expedition live via the Internet (videoconferencing on the Internet uses MBONE technology).

villages, and communities to interact electronically with each other and perhaps become computer pen pals, especially if travel to other areas and meeting face-to-face is prohibitively expensive.

The Bureau of Indian Affairs (BIA) has, for many years, operated the Educational Native American Network (ENAN). ENAN allows teachers, BIA Office of Indian Education Programs officials, and students to communicate using electronic mail. ENAN was created to serve the BIA school system as a communications hub to facilitate math/science curricula development and discussions on applications of educational technology. ENAN is accessible either by dialing in or through a direct connection to the Internet (using remote login, also called Telnet). The majority of ENAN users do not have direct connections, and thus they dial in to ENAN using a modem. Low-quality phone lines frequently cause a major problem; they may slow transmission speeds or be entirely ineffective for accessing the network.

ENAN has several pilot projects to offer more advanced services. In some cases, it serves as an Internet provider by offering SLIP/PPP connectivity (Serial Line Interface Protocol/Point-to-Point Protocol, a service that allows computers to become Internet nodes with nondigital telephone lines). Access with SLIP/PPP is critical in order to use World Wide Web browsers such as Mosaic and Netscape, and more exotic applications such as Internet Relay Chat (IRC). In the near future, ENAN will be able to offer Internet access through Integrated Services Digital Network (ISDN) lines, digital lines offered by telephone companies. Moreover, ENAN now maintains an Internet World Wide Web home page.[14] Finally, ENAN is helping to develop new technology by serving as a Beta tester for eSoft company's Internet Protocol Adapter (IPAD), a networking technology.

ENAN is a four-person operation with advanced technical capability, but without adequate resources (or a mandate) to provide technical assistance to tribes. Nevertheless, it has allowed many educators and students to become familiar with the technology and has encouraged planning for future development of computer networking. ENAN provides as much technical assistance as it can with its limited resources. Unfortunately, the queue for technical assistance is long.

The American Indian Science and Engineering Society (AISES), a national Native American student and professional organization with chapters at colleges and universities nationwide, maintains the AISES Information System (AIS) and AISESnet for its members.[15] AIS, by arrangement with New Mexico Technet, an Internet provider, is a "1-800" dial-in "on-ramp" to the Internet for which AISES members are allocated 10 hours per month free use. AIS supports such well-known Internet applications as Gopher (menu-based user interface to electronic databases), Telnet (to log in to other computers), electronic mail (e-mail), and dial-up capability to bulletin board services (BBSs). It does not, however, support a World Wide Web browser such as Mosaic. AISESnet, in contrast to AIS, is an Internet-accessible Gopher server with information such as a resume database, four moderated discussion groups (also called list servers), and a World Wide Web home page.[16] AISESnet is not an on-ramp, but a destination for information and an electronic forum for discussion.

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[14]The ENAN World Wide Web home page can be accessed at http://oiep.unm.edu:/enan/home.html.

[15]Emo Notah, Computer Technician, American Indian Science and Engineering Society, Boulder, CO, personal communication, April 1995.

[16]The AISESnet discussion groups can be subscribed to by sending an e-mail request to listproc@listserv.umt.edu with the message "subscribe <list name> <your name>" in the body. There are four lists—AISESnet_General, AISESnet_Discussion, AISESnet_Drum, and AISESnet_Alcohol. AISESnet_Alcohol is an anonymous list; e-mail addresses of participants are not revealed. The AISESnet World Wide Web home page can be accessed at http://bioc02.uthscsa.edu/aisesnet.html.

The National Science Foundation (NSF), long a supporter of telecommunications infrastructure for science and education, funded a Native American Telecommunications Forum[17] where, for the first time, telecommunications issues and strategies were explored by a group of Native American experts and advocates. NSF has, in addition, awarded the Electronic Pathways Alliance a planning grant to develop a national Native American center for telecommunications technical assistance.

Another NSF program related to Native Americans is the All Nations Alliance for Minority Participation (AMP), administered by Montana State University. AMP awards have been made to Fond-Du-Lac Community College (Minnesota) to encourage students to attain undergraduate and graduate degrees in computer science and engineering, and to Sinte Gleska University (South Dakota) to develop teacher leadership in mathematics and science education for more than 1,000 American Indian elementary students. NSF also supports the Rural Systemic Initiatives (RSI), all but one of which directly involve or impact Native Americans. RSI grants have been awarded to the "four corners" Navajo reservation region of Utah, Colorado, Arizona, and New Mexico (the UCAN project); the Alaska Federation of Natives; and a group of California and Nevada tribes. In all, between FY 1991 and FY 1994, NSF has provided more than $6 million in direct support to 12 tribally controlled colleges.[18]

The National Aeronautics and Space Administration (NASA), another independent federal science and technology agency, supports a few projects that benefit Native Americans. Foremost is the American Indian Science and Technology Education Consortium initiative that has created partnerships between six off-reservation universities—including Oklahoma State University, which has a large Native American student body—and five tribal colleges. The goals are to help the universities serve the tribal colleges as a resource for institution-building, and to develop culturally relevant model programs for math/science education for Native American students of all ages from preschool to graduate school. The telecommunications goals are to create an online database, accessible through the Internet, for curriculum models and to provide Internet access and computers to the tribal colleges. Another NASA project connects the Sequoyah High School and the W.W. Keeler Complex of the Cherokee Nation of Oklahoma to the Internet through the NASA Science Internet. The Cherokee Nation plans to develop a network for all its offices in a 14-county area.

The Department of Defense (DOD) recently expanded the Infrastructure Support Program for HBCUs/MIs (Historically Black Colleges and Universities/Minority Institutions) to include tribal colleges. This program, funded at about $15 million per year since 1992, received another $10 million in 1995 to extend grants and contracts to tribal and women's colleges. This program is managed by the Army Research Office, but includes funds from the Air Force Office of Scientific Research, Office of Naval Research, and Advanced Research Projects Agency. The program is intended to promote collaborative research in major laboratories; strengthen programs in engineering, science, and math; fund instrumentation purchases; and provide technical assistance to enhance the ability of minority institutions to successfully compete for future DOD funding.

The National Indian Policy Center, at George Washington University in Washington, DC, uses computer networks to disseminate commissioned Native American research and policy analysis reports, as well as other information such as census

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[17] *First Native American Telecommunications Forum: Final Report*, prepared for the National Science Foundation (Bernalillo, NM: Americans for Indian Opportunity, February 1994).

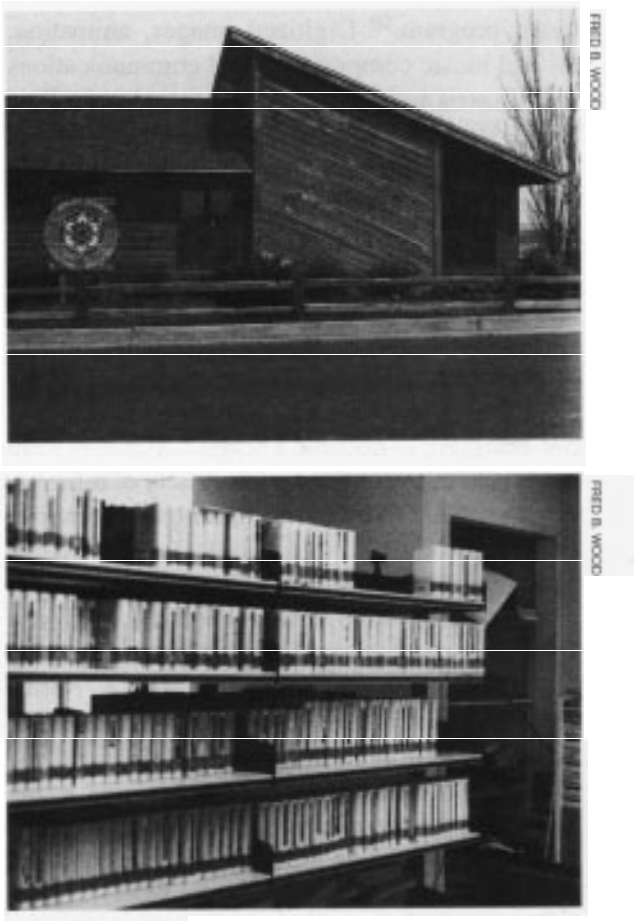
[18] Nora Sabelli, Program Director, Networking Infrastructure for Education, National Science Foundation, Washington, DC, personal communication, April 1995.

data and treaties. One of the center's purposes is "to serve as an information clearinghouse for Native Americans."[19] This online database is funded by the Administration for Native Americans (Department of Health and Human Services).

Overall, Native students, teachers, researchers, and educational leaders are embracing computer networking and other new educational technologies with good results. Many K-12 schools, community colleges, and libraries have received pilot-project funds for computer networking. However, on the downside, funding is inadequate to allow the majority of schools, and noninstitutional educators in general, to participate. And Native policies for use and access are generally nonexistent. Moreover, without proper supervision and informed use, Native educators are concerned that computer networking could expose Native youth to undesirable and potentially harmful information (e.g., exposure to personal lifestyles and perspectives that run counter to Native values, as is the case with some television shows).

## ■ Multimedia

Multimedia offer potential for recording and presenting Native cultures, histories, and concepts of health and wellness, and for representing and explaining Native communities and peoples. The development of multimedia software by and for Native Americans, overall, is in the very early stages. The potential market is likely to be significant, based on results of pilot tests and experience to date. K-12 and community college students and teachers have demonstrated their ability to effectively use computers and computer software when given the opportunity (i.e., equipment, time, encouragement, and training). This appears to be the case across the spectrum of American Indian, Alaska Native, and Native Hawaiian communities that have experimented with computers in the classroom.




*Top: Applied Science Building at the Oglala Lakota College on the Pine Ridge Indian Reservation, Kyle, South Dakota. This building houses the colleges instructional technology* **center** *Bottom: Videotape collection available to teachers and students at the Oglala Lakota College.*

For example, Apple Computer funded the Pine Ridge High School on the Pine Ridge Reservation and the Nazlini Boarding School on the Navajo Reservation through its Crossroads Educational

[19] The other two purposes to commission Native American research and policy analysis, and to sponsor seminars and conferences on issues of concern to American Indians and Alaska Natives. Research grants are awarded in seven areas: cultural rights and resources, economic development, education, health and human services, law and administration of justice, natural resources and environmental protection, and tribal governance. National Indian Policy Center pamphlet Washington, DC, 1994.

Grant program.[20] Digitized images, animation, art and music composition, and communications with Austria and Australia became reality for Pine Ridge High School students after they received Apple computers and network access. The Oglala students shared pow-wow dancing, Lakota legends, and video introductions of themselves with computer pen pals. Students could find information for essays using a multimedia encyclopedia. One student wrote a summary of Darwin's theory of evolution. Another student used multimedia computer art to show two dolphins swimming and one emerging to become a seagull. Students were motivated to search for a wide variety of information to include in their own multimedia compositions.

The positive experience of these Native Americans, ranging from grade-schoolers to thirty-somethings (not unusual in tribal colleges), is indicative of the future potential for Native American multimedia. If Native Americans are to have a major role in the actual development and marketing of Native American multimedia, a concerted entrepreneurial initiative (with education, training, and funding elements) will be needed.

## HEALTH CARE

Health care professionals are learning and developing new concepts for telecommunications-based health care systems, including telemedicine,[21]community health information networks, electronic patient records, clinical information systems, and electronic claims-processing. These systems are still in development and their full potential is unknown. However, pilot projects indicate that a profound change could occur in the delivery of health care via telecommunications over the next decade.[22] Native American health care professionals have their own concepts for Native health. They will want to pursue the development of health care delivery systems that are culturally acceptable and adaptable to the groups they serve.

### Videoconferencing

Telemedicine is broadly defined as the use of information technology to deliver medical services and information between sites. Two-way videoconferencing is a key technology component of telemedicine systems. Telemedicine combines videoconferencing with the informational capabilities of computers. The remote location of many Native communities means that medical and health care services are limited. Primary health care provided to Indian reservations, Alaska Native villages, and Native Hawaiian communities through remote health clinics and small hospitals has improved in recent years. Access to medical specialists, however, continues to be limited.

Telemedicine could facilitate remote consultations between onsite providers and specialists at major medical centers in metropolitan areas, supported by the electronic transmission of diagnostic x-rays, magnetic resonance imaging (MRI) scans, and the like (known as teleradiology). It also could increase the opportunities for medical and health personnel at remote locations to participate in continuing medical education without having to leave their communities. These benefits might also extend to family health counselors, social workers, nutritionists, and other professionals working in the community to help improve Native American health. To be cost-effective, a videoconferencing facility might be shared for medical, social, and educational purposes.

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[20]Cindy Hamilton, "Combining High-Tech with Lakota Legend: Pine Ridge Students Utilize Computers To Communicate Their Culture," *Winds of Change*, summer 1993, pp. 34-36.

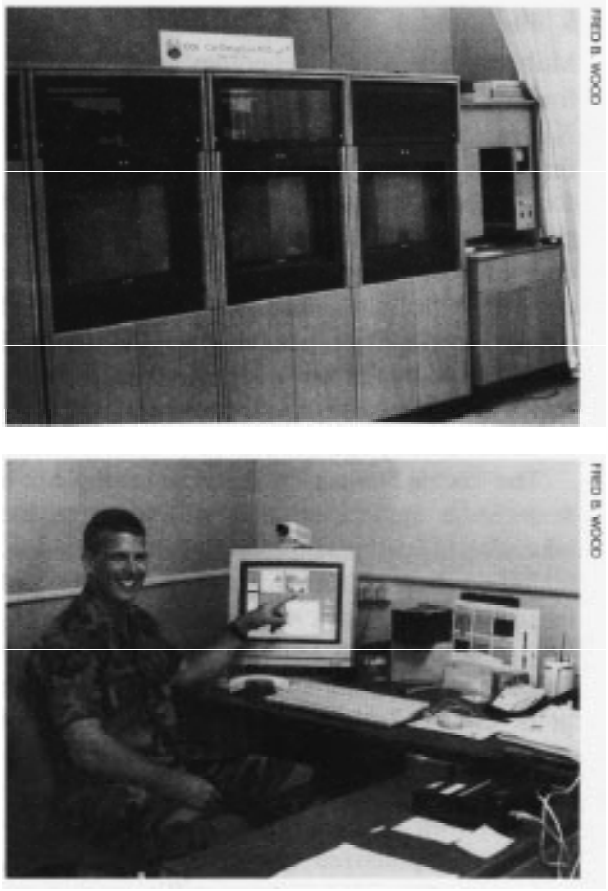
[21]Jane Preston, M.D., F.A.P.A., *The Telemedicine Handbook: Improving Health Care with Interactive Video* (Austin, TX: Telemedicine Interactive Consultative Services, Inc., 1994).

[22]For discussions about telecommunications and information technologies in health care, see U.S. Congress, Office of Technology Assessment, *Information Technology and the Health Care System*, in progress; and James S. Logan and David G. Swartz, *Aberdeen Area Indian Health Service: Telemedicine Assessment Final Report* (Oklahoma City, OK: Logan & Associates, Inc., Mar. 30, 1995).

A good example of shared use of telecommunications infrastructure is the Distance Delivery Consortium headquartered in Bethel, Alaska. The consortium is a partnership of medical, educational, and governmental organizations and telecommunications companies with the shared objective of developing effective telecommunications applications, such as telemedicine and distance learning, in this part of rural Alaska. Distance-learning applications include high school courses, health education, and teacher in-service training. The Yukon-Kuskokwim Health Corp. hopes that telecommunications will play a key role in promoting preventive health and community wellness strategies.

## ■ Computer Networking

Computer networking is another key component of telemedicine in general, and of community health information networks, computerized patient records, clinical information systems, and electronic claims-processing in particular. Computer networks can be used to exchange patient records among various providers and locations; conduct remote searches of medical and health databases; file health insurance claims (e.g., using electronic data interchange); and receive payments for medical services and insurance reimbursements (e.g., using electronic funds transfer).[23] These applications are being extensively researched in the general health care community, and seem particularly appropriate for Native health care facilities located considerable distances from tertiary care providers, medical specialists and researchers, and insurance companies. Computer networking potentially offers an effective means to collect and exchange information on Native health perspectives and practices. The use of computerized patient records for Native Americans would require attention to the same privacy and security concerns raised by medical consumer advocacy groups.[24]




***Top:*** *Videoconferencing room at Tripler Army Medical Center Honolulu. The U.S. Army and Department of Veterans Affairs, in collaboration with the University of Hawaii School of Medicine, intend to use telecommunications to improve patient care for military personnel and veterans throughout the Pacific Basin-including Oahu, the neighbor islands, Guam, and American Samoa. Bottom: Prototype desktop videoconferencing system at Tripler Army Medical Center*

Like other areas of technology discussed, it will be helpful for Native American groups to participate in the wide range of current or future pilot tests and demonstrations. In this way, the potential benefits and problems can be understood from a Native American perspective.

[23] Ibid,

[24] For a discussion, see U.S. Congress, Office of Technology Assessment, *Protecting Privacy in Computerized Medical Information,* OTA-TCT-576 (Washington, DC: U.S. Government Printing Office, September 1993).

## Multimedia

Multimedia is a key technology in medical information and training systems that could benefit Native Americans. For example, multimedia offers the potential to record and present detailed information on the human body, simulate medical procedures, model human physiology, and use computer-aided design tools to design prosthetic devices. With multimedia software, computerized patient records could include images, videos, and audio recordings as well as text to describe a patient's symptoms, diagnoses, treatment, and overall health history and condition.

The Visible Human Project is an example of a multimedia application that will improve the education of health care professionals nationwide, including Native American professionals and those that serve Native Americans. This project is funded through the federal High Performance Computing and Communications Program as one of its "Grand Challenges." The project will create an electronic "image library" of three-dimensional images of the male and female body that will be accessible through computers and computer networks. Computerized tomography (CT), MRI, and cryosection images at one millimeter separation will be stored on 70 to 80 CD-ROMs and will likely be available via the Internet.[25]

## Wireless

Many Native American telemedicine systems will need to use wireless technologies to meet the demands of weather, terrain, and remote locations. Videoconferencing and computer networking depend on microwave and satellite links to reach the most remote facilities. In the future, personal communications systems may play an important role.

One of the earliest telemedicine demonstrations (started in 1972), Space Technology Applied to Rural Papago Advanced Health Care (STARPAHC),[26] linked a medical van to two hospitals via analog two-way microwave television and audio transmissions. STARPAHC was a joint project of NASA, Lockheed Missiles and Space Co. (now Lockheed/Martin), Indian Health Service (IHS), Department of Health, Education and Welfare (now Health and Human Services), and the Papago Tribe (now Tohono O'Odham). The lessons learned for telemedicine were the necessity for advanced planning, including early development of an evaluation plan, clear definition of objectives, and the active involvement of the community.[27]

A recent telemedicine project carried out by the IHS and NASA used satellite technology to link one IHS facility on the Pine Ridge Reservation (Oglala Sioux) in South Dakota with the Mayo Clinic in Rochester, Minnesota. The objectives were twofold: "1) to determine the technical requirements for a large group practice to provide professional education and clinical consulting services to a geographically-remote Indian reservation, and 2) to determine whether these services are perceived as useful by the health care professionals, the community health representatives,

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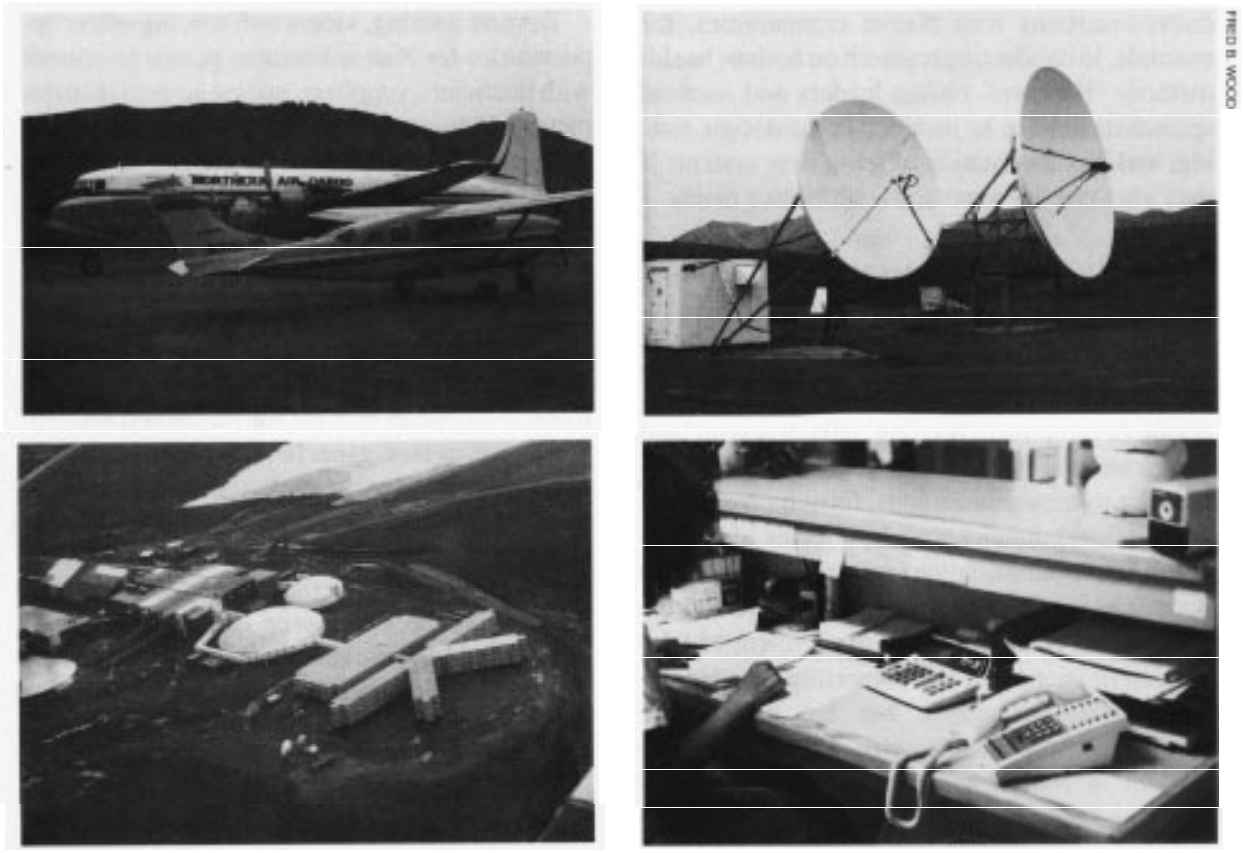
[25]National Library of Medicine, "The Visible Human Project," Fact Sheet, April 1993.

[26]R. Bashshur, *Technology Serves the People: The Story of a Co-operative Telemedicine Project by NASA, the Indian Health Service, and the Papago People* (Tucson, AZ: Indian Health Service, 1979).

[27]"Through active participation in the STARPAHC project, the Papago have demonstrated a very serious interest in what this technology can offer their people. The tribal representatives who were members of the Executive Health Staff diligently participated in all the preparatory design meetings pertaining to this project, learning the basic terminology to deal intelligently with each issue put before them on the discussion table, be it related to the design of the mobile health unit, power generation for the relay stations, or the broadband/narrowband choices in transmission and display equipment. . . . The Papago insisted on, and they achieved, an explicit acknowledgment of their own primary health objectives, namely, to live as a people in harmony with nature, as the primary objective of STARPAHC. The evaluation plan developed for STARPAHC recognized the Papago objective as the project's basic objective." Ibid., p. 55.




***Top left:*** *Aircraft parked at the Red Dog Mine,* about *IOO air miles above the Arctic Circle. The dirt airstrip and propeller-driven planes are typical of remote Alaska locations that are otherwise inaccessible.* ***Bottom left:*** *Red Dog Mine,* a *joint venture of an Alaska Native corporation and a private company* ***Top right:*** *Satellite dishes at the Red Dog Mine. All telecommunications must be via satellite; land line connections are not feasible.* ***Bottom right:*** *The Red Dog Mine is heavily dependent on telecommunications for administrative, inventory scheduling, ordering, payroll, personnel, and other purposes.*

and the patients of the reservation."[28] Based on a questionnaire filled out by employees of the Pine Ridge Hospital, community health representatives, and Mayo Clinic participants, the project was considered technologically successful, feasible, and useful. Costs could be reduced by using the telecommunications line for both health education and patient care. Other savings might accrue by using telemedicine to identify patients who could be treated in Pine Ridge rather than in a distant medical facility, which would incur transportation costs. Indirect savings might accrue through more effective and efficient treatment plans, and through early identification of health problems. The lessons of this project were not meant to be generally applicable to all tribes. Even for the Oglala Sioux tribe, affordability, regulatory, and political barriers to permanent deployment were not addressed.

Native Americans on reservations and in Alaska villages will require special use of wireless links to reach the most remote locations. Wireless computer networking could offer Native American communities access to free or low-cost medical and health information databases. Health institutions around the country may benefit from better

28 Thomas E. Kottke, Leonard Little Finder, Mary Alice Trapp, and Laurel Panser, "The Pine Ridge Indian Reservation/ Mayo Clinic / NASA Telemedicine Project: A Feasibility Study;" abstract, *Second International Conference on the Medical Aspects of Telemedicine and Second Annual Mayo Telemedicine Symposium,* Apr. 6-7, 1995, p. 2.

communications with Native communities, for example, in conducting research on holistic health methods. However, Native leaders and medical specialists need to be included in the design, testing, and implementation of these new systems if they are to be accepted and meet Native needs.

## ECONOMIC DEVELOPMENT AND ENVIRONMENTAL PROTECTION

Businesses, entrepreneurs, community services, and government offices—in areas such as economic development, housing, infrastructure, land use, or environmental protection—are increasingly using telecommunications, forming or encouraging telecommunications businesses, or developing telecommunications infrastructure. Native American communities are generally behind the mainstream economy in the deployment of telecommunications and the ownership of telecommunications companies, but are increasingly aware of the potential benefits. Economic development in Native American communities, villages, and tribes is generally predicated on a requirement to protect the environment and honor the earth. Geographic Information Systems allow Native American communities to take care of their land and natural resources in culturally relevant and sustainable ways. In general, Native American businesses and regulators can emulate or adapt mainstream uses of telecommunications.

### Videoconferencing

Videoconferencing could be a useful tool to Native Americans for job-related training and career exploration. A videoconferencing capability in Native communities would help to open up access to the already extensive teletraining opportunities in numerous job, career, and skill areas. Native American groups may be able to negotiate more favorable package rates when acting collectively. Also, Native groups may be able to collectively achieve a critical mass that can support the development or adaptation of training materials specifically for Native Americans.

Beyond training, videoconferencing offers opportunities for Native business people to consult with financiers, suppliers, and customers in major metropolitan areas (and potentially overseas) as part of Native product development, financing, and marketing efforts.

### Computer Networking

Computer networking is rapidly becoming an important tool of successful businesses in the major metropolitan areas and telework centers. This is likely to be true as well for Native-owned and -operated businesses, especially those located in remote areas. Illustrative applications include tracking private-sector business opportunities using computerized trading, sales, and marketing databases; monitoring government contracting opportunities via the *Commerce Business Daily* and other federal agency announcements available online; exchanging market leads with other Native enterprises; identifying venture capital, banking, and government funding sources for minority enterprises; and marketing Native products and services over the rapidly growing electronic enterprise networks.

Effective use of computer networking by Native business people would require significant training on both the conceptual and technical levels. Providing affordable access to the technology and resolving intellectual property issues (e.g., copyright and trademark protection) that concern electronic entrepreneurs would also need to be addressed.

Many other tribal businesses may want to use an information system or establish a local area network to support company operations. Commercial systems for small businesses without in-house technical expertise are increasingly available at declining costs. Tribal companies may also consider connecting to wide area networks, such as the Internet, for electronic commerce or telemarketing. While this currently requires technical assistance, in the future it should be as easy as establishing and using a telephone connection—given a modern telecommunications infrastructure.

Computer networking,[29]especially the Internet, has become an increasingly important business tool in the last few years. The exchange of business forms using electronic data interchange is widely available, including on the Internet. Hundreds of businesses now have multimedia home pages on the Internet that advertise their wares and services or provide online consulting. The number of commercial domains (a *domain* is a local area network with at least one host computer connected to the Internet) on the Internet is now greater than 25,000 and is increasing by about 1,000 per month.[30] The strongest growth is coming from computer, publishing, and financial companies. As a result of enormous growth and a high profile, people across the United States are asking how they can get on the Internet (see box 3-4). The answer is not straightforward because the Internet industry is changing rapidly, and is still quite complex for the layperson.[31]

Importantly, several major electronic commerce and digital cash projects currently under way are working on privacy and security problems[32] as well as marketing concerns. For example, CommerceNet[33] in California's Silicon Valley is a government-sponsored project of Enterprise Integration Technologies, with participation by WestRen, the operator of the Bay Area Regional Research Network (BARRNET), and Stanford University. Similarly, the Microelectronics and Computer Technology Corp. (MCC), a government-supported consortium of approximately 80 companies, is developing the Enterprise Integration Network (EINet), a business network that will run applications over the Internet. The high-speed data networking services will be provided by Sprint. Directory, encryption, and eventually electronic funds transfer services will be available.

## CD-ROM Databases

CD-ROM optical storage allows more than 200,000 pages of text or 10,000 images to be stored on one 4.75-inch-diameter disk. Large numbers of historical, legal, business, and other records can be archived more easily and made available using CD-ROM technology for storage.

For example, the Zuni Tribe in New Mexico, in conjunction with the Institute for the North American West, has proposed the Zuni Watershed CD-ROM Project. It would make about 70,000 pages of reports and maps and 500 historical photographs available to Zuni planners, managers, officials, and students.[34] Between 1970 and 1990, the Pueblo of Zuni collected historical documents and expert testimony to support its bid to recover aboriginal lands illegally taken, as well as for compensation for the severe soil erosion caused by logging, over-grazing, and other activities detrimental to the Zuni watershed. In 1990, based largely on these documents, the Zuni Tribe

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[29]For a broad discussion on the potential and challenges of telecommunications and information technologies for U.S. business and the economy, see U.S. Congress, Office of Technology Assessment, *Electronic Enterprises: Looking to the Future*, OTA-TCT-600 (Washington, DC: U.S. Government Printing Office, May 1994).

[30]"Commercial Domains Break 25,000 Mark," *The Internet Letter*, vol. 2, No. 3, Dec. 1, 1994.

[31]For a discussion about electronic commerce on the Internet, establishing a World Wide Web presence, and accessing the World Wide Web, see Larry Press, "Commercialization of the Internet," *Communications of the ACM*, vol. 37, No. 11, November 1994, pp. 17-21.

[32]See U.S. Congress, Office of Technology Assessment, *Information Security and Privacy in Network Environments*, OTA-TCT-606 (Washington, DC: U.S. Government Printing Office, September 1994) and *Issue Update on Information Security and Privacy in Network Environments*, OTA-BP-ITC-147 (Washington, DC: U.S. Government Printing Office, June 1995).

[33]A general discussion of the future of electronic commerce is presented in Jeff Ubois, "Wheels of Commerce: An Interview with CommerceNet's Cathy J. Medich and Jay M. Tenenbaum," *Internet World*, April 1995, pp. 62-64, 66, 68.

[34]Roger Anyon, Director, Heritage and Historic Preservation Office, Pueblo of Zuni, Zuni, NM, fax to Office of Technology Assessment, U.S. Congress, Washington, DC, Oct. 14, 1994.

## BOX 3-4: How Do Native Americans Get Internet Access?

'(How do we get Internet access?" This IS a question being heard with Increasing frequency in Indian Country. The answer is not simple. The foremost requirement is having an Internet access or service provider nearby. Required hardware includes a computer and a modem for a regular phone line, or a terminal adapter for a digital line such as Switch 56 or Integrated Services Digital Network, or a direct connection through a local area network (LAN) or campuswide network. Required software includes communications software and at least one applications software package, for example, for electronic mail, file transfers, remote log-in to another computer, or browsing menus and home pages. in some situations, applications software will be on the Internet provider's computer to which your computer is connected. This is the case for commercial services such as America Online, Prodigy, and CompuServe The exact hardware and software required will depend on the Internet provider and data-rate limitations imposed by noisy phone lines. There are numerous books and magazines that guide Internet beginners[1]; however, finding a computer-savvy friend helps significantly, See box 2-4 for a description of the Internet.

Commercial provision of Internet access began sometime after 1985. in that year, the National Science Foundation (NSF) encouraged the Internet to expand beyond university- and laboratory-based networks A few years later, plans were made to privatize the regional Internet networks and the NSF backbone All NSF subsidies to the backbone ended in April 1995 The transition has not been smooth, a competitive shakeout is in progress even as the market is emerging. Costs, pricing strategies, future needs, and the regulatory environment are all uncertain. Currently, rates and services vary considerably. A barrier to affordability occurs when the user requires a long-distance, rather than a local phone call to reach the Internet host computer, as is the case in many rural areas.

Today, there are public and private providers of Internet, including.

- the original Internet regional networks,
- some online consumer services such as America Online, Prodigy, and CompuServe (these currently provide electronic mail through the Internet, but plan to offer Internet browser services),
- numerous community networks such as the Blacks burg Electronic Village, Virginia; Taos Telecom - munity, New Mexico, Big Sky Telegraph, Montana, Prairienet, Illinois, and Boulder Community Network, Colorado,

*(continued)*

[1] *See, e.g., The Internet Unleashed* (Indianapolis, IN: Prentice Hall Computer Publishing, 1994) See also *Internet World, Wired* or *Boardwatch* magazines

settled its claim for damages against the United States for $25 million.

The primary goal of the CD-ROM project is to make the document collection available to those involved in sustainable development, history, and culture of the Zuni Tribe. A secondary goal is to create a model for other tribes interested in using CD-ROM technology to make historical and other tribal records available.

## Geographic Information Systems

Many tribes today are concerned with sustainable land development, environmental protection, and obtaining accurate land records.[35] To plan for

[35] For tribes, whose entire place in the federal system is based on the historical question of land—who owns it and who has given it up or has had it taken—land records are crucial and GIS is a much-needed and valuable tool." Phil lip Martin, Chief, Mississippi Band of Choctaw Indians. Philadelphia, MS, fax to Office of Technology Assessment, U.S. Congress, Washington. DC, May 2, 1995.

## BOX 3-4: How Do Native Americans Get Internet Access? (Cont'd.)

- utility, [2] cable, [3] and software [4] companies;
- government programs such as the Extension Indian Reservation Program (Department of Agriculture, Extension Service), ETAnet (Department of Labor, Employment and Training Administration), and the Tribal Technical Assistance Program (Department of Transportation, Federal Highway Administration),
- local and long-distance phone companies, and
- hundreds of Internet resellers.

Several mergers and buyouts among commercial providers are currently under way. For example, in November 1994, America Online bought Advanced Network Services, a joint venture established by MCI, IBM, and the University of Michigan to operate the NSFNet and sell Internet access to organizations At about the same time, MCI announced a service that combines Internet access, electronic mail, and electronic shopping. BBN Internet Services Corp. recently bought Nearnet and BARRNET, regional Internet service providers in the northeast and San Francisco Bay Area, respectively.[5] The market is likely to be quite volatile over the next few years.

How one gets Internet access depends on whether the user IS an individual or organization, small or large business, public or private, and so forth. Most large educational Institutions, government agencies, and businesses are creating their own local area networks that are, in turn, being connected to the Internet. Primary and secondary schools are slowly getting Internet access, some through a grant or service subsidy from the telephone company. North Carolina has a statewide initiative to hook up all schools government offices, health care clinics, and research facilities The key is to find a person or organization with similar needs and circumstances, and follow in their footsteps.

SOURCE Off Ice of Technology Assessment, 1995

[2] "Electric Company Plans Unlimited T-1 Internet Access at $1995 a Month, " *The Internet Letter,* Feb. 1, 1995, pp. 1-2

[3] John McQuillan, "Reinventing the Internet for Broadband?" *Business Communications Review,* March 1995, pp. 12,14

[4] "Microsoft Plans Wide Range of Internet Services Microsoft Network To Provide Billing in 19 Currencies, " *The Internet Letter,* Feb. 1, 1995, p 3

[5] Reports of mergers from Joanne Cummings and Fred S Knight, "Internet Service Providers To Ride a Familiar Roller Coaster, " *Business Communications Review,* January 1995, pp. 67-68

business development, housing developments, utilities, environmental protection, parks, and wildlife areas, the tribes first require detailed maps of their reservations, including information on natural resources and terrain. Many reservations, trust lands, and Native Hawaiian homelands are poorly mapped out and have uncertain boundaries. The last comprehensive reservation survey measurements were made in 1949 by the Bureau of Land Management. Geographic Information Systems can play a key role in assisting tribes, Alaska Native villages, and Native Hawaiians with their own land management responsibilities.

Today, about 50 tribes run their own GISs and have formed a consortium, the Intertribal GIS Council, to share their concerns and knowledge. Most of these tribes received early exposure, consulting services, and training through the BIA's Geographic Data Service Center (GDSC) .[36] The tribes can buy GIS software at government rates.

[36] Information from interviews with the four-person staff and contractors at the BIA Geographic Data Service Center in Lakewood. CO, Nov. 18, 1994.

Basic GIS technology is now more user-friendly and can run on many types of computers. Advanced GISs require faster computers, more memory, and high-bandwidth networking. While this makes GIS more useful, it also adds considerably to the cost.

Tribes are struggling with long-distance, dial-in charges and looking for affordable ways to implement wide area networks to keep the costs of GIS networking down. Some tribes are dependent on a single person who is knowledgeable enough to make use of and maintain a tribal GIS. But if that person should leave, the tribe must train or hire another person—not always easy to do. Although GDSC policy encourages tribes to be self-sufficient, smaller tribes frequently fall back on GDSC training and consulting.[37]

One type of useful data is remotely sensed imaging using satellite or airborne imagers, coupled with coordinate information from a Global Positioning System. Acquiring such information can be expensive, but if important enough, even small tribes might pay.[38]

John Goes In Center, president of Innovative GIS Solutions, develops GISs for Native Americans. His experiences indicate that most GISs lack a "cultural layer of data" that Native Americans want.[39] Moreover, he believes that GISs are not being fully used because of a lack of culturally relevant needs assessments and problems getting traditional tribe members and tribal councils to recognize the potential. Tribes are understandably reluctant to invest in technology whose benefits are not clearly understood.

## Telecommunications Infrastructure

Native-owned telecommunications and other technology-based companies are an important source of economic development and job creation.[40] Many such companies today are as easily located on a reservation as in a city. For example, a Turtle Mountain tribal company in North Dakota, Uniband, Inc., has contracts with the Treasury Department, Internal Revenue Service, Indian Health Service, and North Dakota Fish and Game Department to develop electronic information systems and perform data entry and network management. Companies such as Uniband are creating new market demands for an advanced telecommunications infrastructure.

Gaming operations also drive the development of telecommunications infrastructure. The Oneida Indian Nation of New York,[41] for example, uses computer networks and information systems for managing its gaming enterprises, and is investing some earnings in advanced communications to serve community needs such as health care, education, cultural centers, and other business enterprises. The new business enterprises, in turn,

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[37]Beth Wenstrom, Cartographer, Land Titles and Records Office, Bureau of Indian Affairs, Sacramento, CA, personal communication, May 1995.

[38]Gary Emery, GIS Analyst, Forestry Division, Hoopa Valley Tribal Council, Hoopa, CA, personal communications, May 1995. For background discussions, see OTA, *Helping America Compete: The Role of Federal Scientific and Technical Information*, op. cit., footnote 4; U.S. Congress, Office of Technology Assessment, *Remotely Sensed Data from Space: Distribution, Pricing, and Applications*, Background Paper (Washington, DC: Office of Technology Assessment, July 1992); and U.S. Congress, Office of Technology Assessment, *Remotely Sensed Data: Technology, Management, and Markets*, OTA-ISS-604 (Washington, DC: U.S. Government Printing Office, September 1994).

[39]As expressed in a presentation given at the 1994 National Congress of American Indians conference in Denver, CO, Nov. 13-18, 1994.

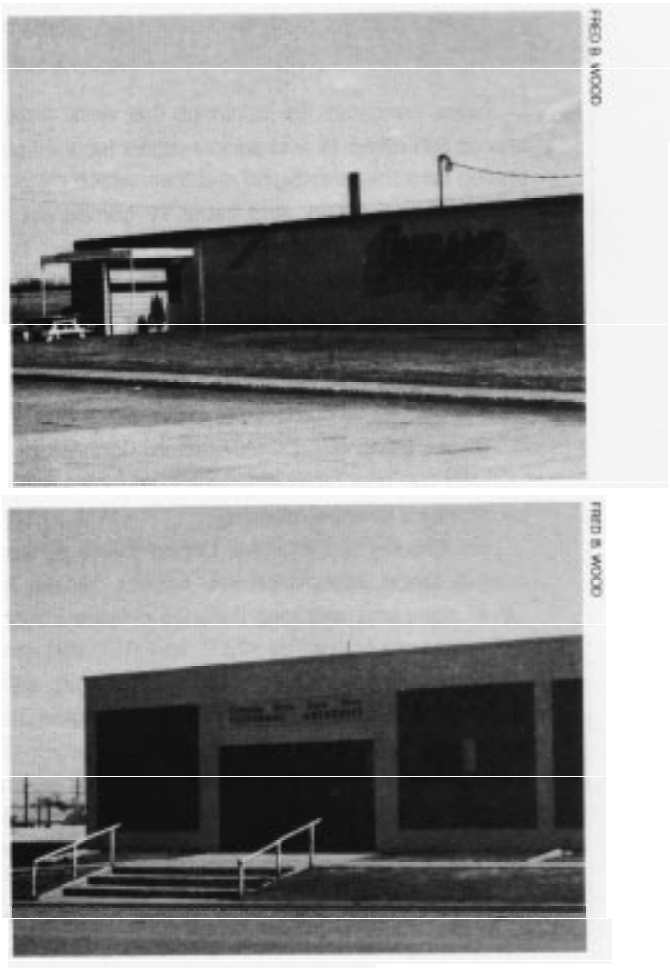
[40]See, for example, a discussion of five industries identified to present immediate, feasible opportunities for Indian reservations: manufacturing (including telecommunications equipment), telecommunications and information services, and three industries that are heavy users of telecommunications and information technologies (environmental services, tourism, and retail) in National Center for American Indian Enterprise Development, *Growing Market Opportunities for Indian Reservation Enterprises*, prepared by UIDA Consulting Group (Mesa, AZ: April 1991).

[41]The Oneida Indian Nation of New York was the first Indian Nation to establish a home page at http://nysernet.org/oneida/. This home page chronicles the ongoing community development, including its community-wide use of computer networking.

further drive infrastructure development with additional needs for computer networking, telemarketing, and information systems.

Other gaming operations have driven demand for satellite broadcasts and "1-800" telephone service capability. For example, in 1991, MegaBingo was broadcast live via satellite every evening for 15 minutes from the Creek Nation Bingo Hall in Tulsa, Oklahoma, to 47 sites in 10 states and 31 reservations.[42] The Coeur D'Alene Tribe in Idaho is waiting for approval to conduct a lottery with toll-free "1-800" calls from 36 states and the District of Columbia (where lotteries are legal). Payments would be made via credit cards.[43] The major investor, Denver-based Unistar Entertainment, Inc., is paying for a lottery office on the reservation to be equipped with high-speed computers, fiberoptic phone lines, and perhaps a microwave radio hookup.[44]

Several Native entrepreneurs have developed small software development and computer/network consulting companies. For example, Jim Bradley (Tlingit) has developed two telecommunications companies-United Native American Network (UNAN), a nonprofit corporation with a Native American board of directors, and United Native American Telecommunications (UNAT), a for-profit sole proprietorship (see box 3-5). Although the market for services on reservations is currently limited, these businesses have telecommunications, software, and computer engineering expertise that will be assets if markets develop in the future. Many Native entrepreneurs want to move back to the reservation and are looking for opportunities to serve Native American communities. Some could develop telework and information businesses similar to Uniband, provided the telecommunications infrastructure is available.




***Top:*** *Uniband, a data processing company located on the Turtle Mountain Indian Reservation, North Dakota.* ***Bottom:*** *Cheyenne River Sioux Tribe Telephone Authority in Eagle Butte, South Dakota.*

Others, such as UNAN or UNAT, can provide or drive the infrastructure.

Industries such as banking and insurance also drive the development of telecommunications infrastructure to support computer networking and information systems. For example, the Native Indian Alliance Insurance Company[45] serves only

[42] National Center for American Indian Enterpricse Development, op. cit., footnote 40, p. 71.

[43] See Bunny Anquoe, "Attomeys General Attack Lottery" and "Gaming War of Words Continues on the Hill,'' *Indian Country Today,* Apr. 6, 1995.

[44] "Coeur D'Alene's Lottery Plans Attract Investment Partners," *Fort Apache Scout,* Apr. 14, 1995.

[45] Darrel A. Fitz, President, Native Indian Alliance Insurance Co., Anadarko, OK, at the National Congress of American Indians conference. Denver, CO, personal communication, Oct. 17, 1994.

## BOX 3-5: UNAN and UNAT—Native American Telecommunications Entrepreneurship

Telecommunications industries that were once separate are converging as each abandons older analog technologies and adopts digital technologies For example, telephone companies are replacing analog switches with digital switches, which allow the companies to offer fast data communications and computer networking And cable TV companies now have the technology to offer new digital phone services Cellular phone, radio, and broadcast TV industries are currently developing digital technologies for the future, Within the past decade, new companies have formed to offer computer online services, electronic databases, videoconferencing, paging services, and access to computer networks such as the Internet The legislative and regulatory arenas for telecommunications Industries are likewise changing and converging. Congress is trying to create a smooth transition to a level regulatory playing field for all competitors in the digital age.

Amidst these telecommunications technology and regulatory changes, Jim Bradley (Tlingit) has founded two telecommunications companies that could serve as models for Native American telecommunications entrepreneurship.

Jim Bradley first founded United Native American Telecommunications (UNAT), which today offers long-distance, interLATA (Local Access Transfer Area), and local telephone and data communications. UNAT competes with Iong-distance providers such as AT&T and MCI, Alaska providers including Alascom (recently bought by AT&T) and GCI, and some local telephone companies (here, UNAT operates as a Competitive Access Provider). UNAT has a long-distance, common-carrier license from the Federal Communications Commission, a Washington State Public Utilities Commission Intrastate license, and an Alaska business license. Its Alaska business derives mostly from Department of Defense contracts UNAT is also providing telecommunications Internationally, for example, in Botswana. Although it is a sole proprietorship, the company policy broadly promotes native American telecommunications, it actively hires Native Americans and provides scholarships and training to students who aspire to careers in telecommunications.

Bradley's second business, United Native American Network (UNAN), is a 501 c nonprofit corporation offering videoconferencing and computer networking services to Native American educational and health organizations It IS financed with 25 percent of the profits from UNAT and has an all-Indian board of directors A new facility under construction (close to the Swinomish, Skagit, and Lummi Indian reservations in Washington State) will house six distance-learning production studios and a videoconferencing room UNAN aspires to be an Information hub and telecommunications services resource for all Native American educators and health care providers, including social services such as substance abuse prevention programs. Some specific goals include developing a computerized patient records' database and Interactive distance-learnlng programs for adult education Both UNAT and UNAN were founded and operate without federal grants or loans.

SOURCE: Office of Technology Assessment, 1995, with information from Jim Bradley, President and CEO, United native American Telecommunications, Burlington, WA, personal communications, April 1995

tribes, and underwrites auto and burial insurance o meet the regulations and cultural needs of each tribe. The company plans to use computer networking for marketing and transactional purposes, and will likely use flexible computer software configurations to tailor information systems to company specifications.

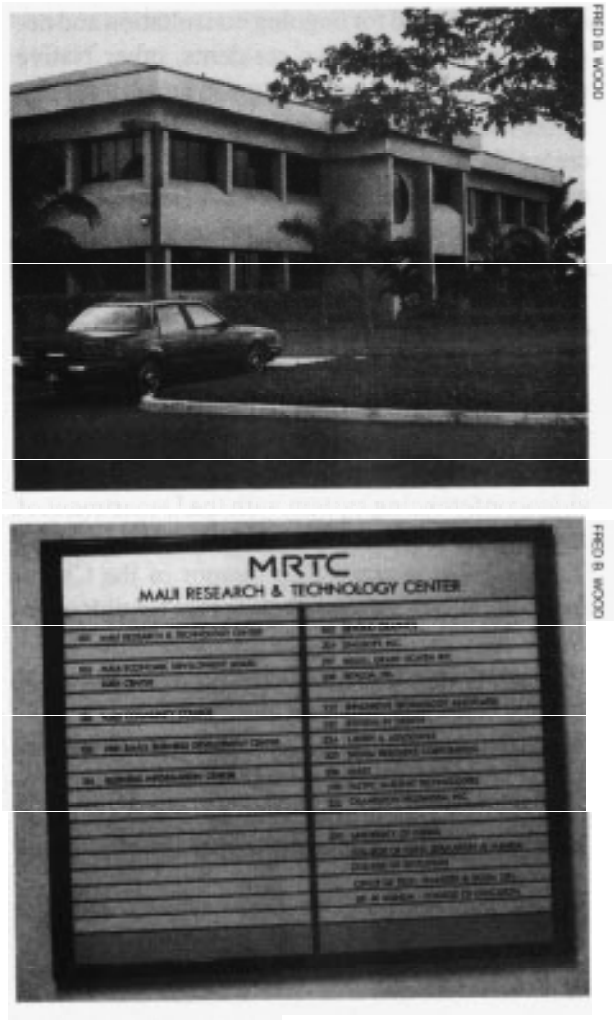
There is currently a chicken-and-egg dilemma on many reservations regarding the supply and demand of data communications. Commercial providers will not invest in infrastructure until there is demand, and demand will not develop in the absence of supply. One solution is for Native tribes/villages/communities to work closely or partner

with telecommunications companies or to form their own companies or cooperatives to develop local telecommunications infrastructure.

## -GOVERNANCE

Tribal governments, including Alaska Native village governments, vary widely in form and function. Some carry out limited activities and rely heavily on state and federal governments. Others are variously responsible for: roads, water, sewer, electricity, housing, telecommunications, law enforcement, courts, emergency services, social services, education, health care, environmental protection, and economic development. Whatever the level of activity, tribal governments are engaged in maintaining govemment-to-govemment relationships with federal and state governments; working to uphold prior treaties and laws; and developing future laws and agreements. Current issues that Native American governments are pursuing at the federal and/or state levels include federal/state recognition; jurisdiction for taxation and criminal prosecution; recovery of lands taken pursuant to broken treaties; religious freedom; control over lands and resources held in trust; education, health care, and social services; the regulation of gaming; land use such as hunting, fishing, and grazing; and water rights.

Tribal governments are beginning to recognize and assume responsibility to plan for, encourage, and regulate the myriad uses of telecommunications in their communities. They are following the lead of many state and local governments that are developing telecommunications infrastructure, using or supporting new telecommunications applications for governance and commmunity-building, and regulating telecommunications. Projects include, for example, statewide high-bandwidth telecommunications infrastructure for schools, health facilities, and government offices; electronic town halls; online dissemination of regulations and codes; telecommuting centers; and police information systems.




***Top:*** *Maui Research and Technology Center located in Kihei on Maui Island, Hawaii. Bottom: MRTC houses the Maui Supercomputing Center, various economic development and educational offices, and several small business start-up companies. MRTC is a partnership of the federal, state, and county governments and the private sector.*

### ■ Videoconferencing

As Native tribes, villages, and communities assume greater responsibility for their own gover-

nance,[46] the need for ongoing consultation and negotiation with their own residents, other Native groups, and federal and state government agencies is likewise growing. Videoconferencing could increase the level of communications—without incurring excessive additional cost (relative to the costs of traveling)—among various Native leaders and groups.

Videoconferencing could help Native groups participate more frequently and effectively in various federal agency proceedings, meetings, hearings, and the like. For example, the Cherokee Nation is advocating either a tribal or government-led initiative or partnership to implement a videoconferencing system with the Department of the Interior's Office of Self-Governance (OSG). The Self-Governance Coordinator of the Cherokee Nation sees a cost-effective role for videoconferencing in communicating with the OSG. "Tribes and the Office of Self-Governance need to meet at least monthly, but also as needed to solve imminent problems. A typical meeting will include about six tribal people and three government people. Videoconferencing could save significant travel time and expenses for these meetings."[47]

At a minimum, for videoconferencing to be successful: 1) Native leaders and citizens must be comfortable using the electronic medium to complement the face-to-face in-person meetings that traditionally are preferred; and 2) videoconferencing must be affordable and cost-effective.

## Computer Networking

Computer networking is growing at the federal, state,[48] and local levels of government. Numerous applications seem relevant to Native governments, including electronic mail among Native leaders and with citizens; timely access to notices of federal and state agency hearings, meetings, and rulemakings relevant to Native concerns; access to a wide range of federal environmental, energy, statistical, criminal justice, and other databases[49] that bear on areas of tribal or village government; filing of federal and state taxation and financial documents (e.g., using electronic data interchange); payment/receipt of funds (e.g., using electronic funds transfer); and, most importantly, delivery of federal services via Native governments and Native service-providers (e.g., using electronic benefits transfer).

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[46]For a discussion of traditional and modern tribal governments, see Sharon O'Brien, *American Indian Tribal Governments* (Norman, OK: University of Oklahoma Press, 1989). The policy of "self-determination" was formalized and strengthened with passage of the Indian Self-Determination and Education Assistance Act, Public Law 93-638, Jan. 4, 1975, "an Act to provide maximum Indian participation in the Government and education of the Indian people; to provide for the full participation of Indian tribes in programs and services conducted by the Federal Government for Indians . . ." The Indian Self-Determination and Education Assistance Act Amendments of 1988, Public Law 100-472, amended the original act by adding a new title, as follows: "Title III—Tribal Self-Governance Demonstration Project." In the first year, 20 tribes were authorized, for not more than five years, to plan, conduct, consolidate, and administer programs, services and functions authorized under previous acts, thus exerting considerable tribal control over federal Indian programs. The Indian Self-Determination Act Amendments of 1994, Public Law 103-413, again amended the original act by adding "Title IV—Tribal Self-Governance," which made the demonstration project permanent (20 new tribes are selected each year to participate).

[47]Charles Head, Self-Governance Coordinator, Cherokee Nation, Tahlequah, OK, personal communication, May 9, 1995.

[48]For example, California now makes all state legislative information—the Constitution, bills, laws, amendments, agendas, votes, etc.—available via an FTP server (leginfo.public.ca.gov) on the Internet. "California Legislative Information Now Online Without Cost," *Boardwatch*, April/May 1994, p. 78.

[49]For example, the National Indian Policy Center (NIPC) maintains online information such as treaties on a George Washington University file server (Gopher and World Wide Web) whose Internet address is gwis.circ.gwu.edu. The successive menu choices to get to the NIPC are first, "Centers, Institutes, and Research at GWU," followed by "Centers and Institutes," and finally, "National Indian Policy Center."

Internet networking is becoming a critical component of governance and grassroots democracy.[50] Several federal Internet sites—including the Library of Congress's "Thomas"[51]system, the Government Printing Office's "GPO Access," and two sites maintained by the House of Representatives[52]—carry key federal documents such as the *Federal Register, U.S. Code*, *Code of Federal Regulations, Congressional Record*, and congressional bills. Many colleges, universities, and nonprofit organizations maintain other Internet sites with useful free information related to governance. For example, Project Vote Smart, a grassroots democracy organization with 35,000 volunteers, makes available—by Internet and dial-in electronic bulletin boards—the public statements and voting records of political candidates.[53]

Native governments vary widely in their current use of computers and computer networking. A few tribes are already operating at levels of computerization comparable to that of the most advanced state or local governments. However, many tribes and villages would require considerable improvements in technology and training—and, in many cases, a shift in perception about the role of computers—to make effective use of computer networking. The federal government, too, varies widely in its use of computers and computer networking, and in its plans to interconnect with state, local, and Native governments.[54] Many of the networking applications being explored by federal agencies are relevant to Native governments.

One use of computer networking is for grant application and monitoring, demonstrated by the National Science Foundation. Native governments frequently apply for grants from the Bureau of Indian Affairs, Indian Health Service, Administration for Native Americans, and other agencies. A second application of computer networking is in contract negotiation and administration. As Native governments and community service-providers contract for federal monies for schools, health care, social services, and self-governance, computer networking can help minimize administrative overhead and paperwork.

Ongoing federal policies of self-determination and self-governance will likely necessitate increased cooperation between Native governments and federal agencies to develop information systems that meet each partner's needs. For example, the Cherokee Nation, under a 1994 Memorandum of Understanding with the Department of the Interior's Office of Self-Governance, developed the OSG Database, a financial information and reporting system for the Tribal Self-Governance Demonstration Project.[55] Today, half of the governments participating in self-governance with the OSG have access to the system with a "1-800" telephone number. Only authorized users have access. The cost of development was $135,000, including the initial hardware and software. With

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[50]For a discussion of citizen participation in government, and computer-assisted access to government, see Jim Warren, "How Citizens Can Pursue Practical, Potent, Grassroots Political Action—Net-Based, Computer-Aided," *Boardwatch*, April/May 1994, pp. 74-78.

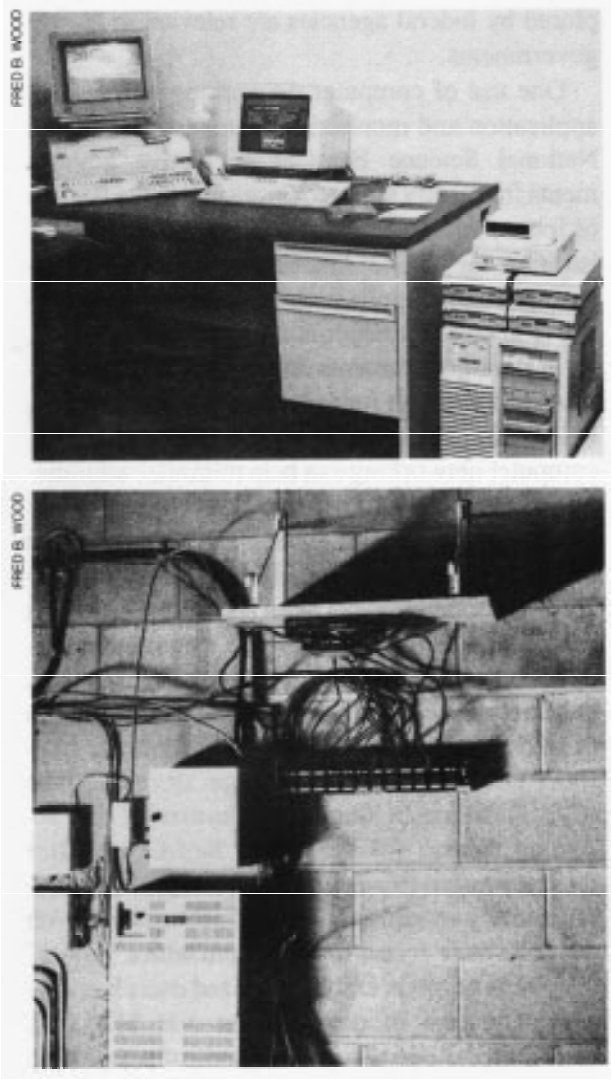
[51]The Library of Congress makes legislative information, such as the full text of all versions of congressional bills and the *Congressional Record* (searchable by keywords or bill number), available on the Internet through Thomas, a World Wide Web site at http://thomas.loc.gov/.

[52]The House of Representatives' Gopher server can be reached at gopher.house.gov; and the World Wide Web server can be reached at http://www.house.gov.

[53]The Project Vote Smart Gopher server can be reached at gopher.neu.edu under the menu title Project Vote Smart. Alternatively, one can reach the Project Vote Smart Bulletin Board Service at 503-737-3777.

[54]See OTA, *Making Government Work: Electronic Delivery of Federal Services*, op. cit., footnote 5.

[55]See footnote 46. In 1994, the Department of the Interior's Office of Self-Governance (OSG) serviced 26 tribes in the lower 48 states, and 70 tribal and village governments in Alaska. In 1996, the OSG plans to deliver $200 million in funds to 45 tribes in the lower 48 states, and 130 tribal and village governments in Alaska.




*Top: Network control computers at the Oneida Nation's tribal headquatrters building in Oneida, New York. The Oneida Nation makes extensive use of computers to support tribal administration.* ***Bottom:*** *A portion of the fiberoptic telecommunications network that links tribal buildings and homes of the Oneida Nation.*

this system, OSG employees can concentrate more on timely delivery of funds and financial data integrity, rather than on time-consuming paper methods of fund reporting and financial administration.[56]

The desire of many Native communities to take more responsibility for their own self-governance, and the shift of functions from the federal (and sometimes state) government to tribal/village governments, is increasing the impetus to use computers as an administrative and management tool. Moreover, Native governments, including many tribes and especially the Alaska Native regional and village corporations, carry out business and government functions that require specialized information systems. The use of computer networking and videoconferencing for expressing views and reaching consensus may be problematic for some Native groups with a tradition of face-to-face, consensual, deliberative decisionmaking.

### ■ Kiosks and Electronic Benefits Transfer

Kiosks and electronic benefits transfer could be used, separately or in combination, to deliver information and benefits to Native American communities.[57] This could substantially increase delivery efficiencies in rural areas. In the more remote areas, kiosks could be collocated with a community communication center at a local school, health care facility, multiservice center, or tribal/village government office. These kiosks could be designed to provide access to a wide range of information. They also could disburse specified monetary benefits for health and social services, either by placing credit on a smart card or by dispensing cash if the kiosk includes an automated teller machine.

## TELECOMMUNICATIONS ACCESS FOR COMMUNITY-BUILDING

Education, health care, economic development, environmental protection, and governance will each have a range of needs for telecommunications infrastructure. Many of these community applications can benefit from videoconferencing, computer networking, multimedia, and wireless

[56] Arlene Brown, Financial Officer, Office of Self-Governance, Department of the Interior, personal communication, May 1995.

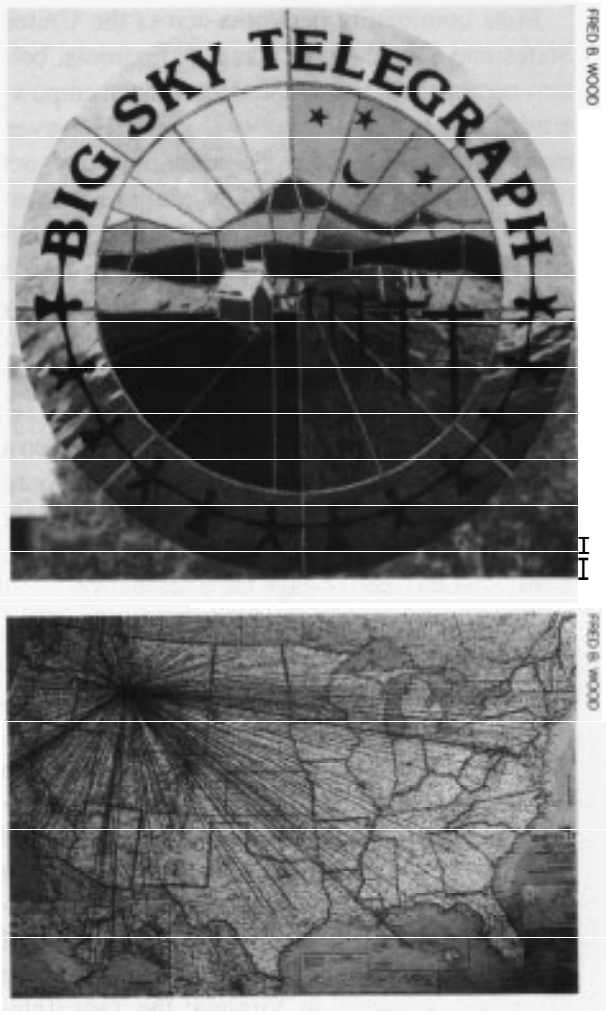
[57] See OTA, *Making Government Work: Electronic Delivery of Federal Services,* op. cit., footnote 5.

technologies. However, for community-building, the telecommunications infrastructure must be both cost-effective and accessible. In many Native communities, this will require cost-sharing partnerships combined with strategies to broaden access. Two promising possibilities for community-building are: 1) creating publicly accessible telecommunications technology centers affiliated with schools, health care centers, government offices, and the like; and 2) creating community computer networks. Community telecommunications centers and community computer networks offer new solutions to contemporary social needs. Results of pilot tests and projects to date are generally favorable, but further research and evaluation are necessary.

## ■ Community Telecommunications Centers

Some highly leveraged opportunities for community telecommunications centers include the AIHEC network centers at the tribal colleges and Internet accessible computer terminals at K-12 schools. Native educational institutions would need to look beyond their traditional role of serving only enrolled students and assume anew role of serving the broader Native American community. Other possibilities include providing health care facilities, libraries, or cultural centers with public information terminals ardor Internet connectivity. Radio or TV stations with digital satellite uplinks and downlinks also could serve as telecommunications centers or gateways for data and video transmissions with other networks. For example, the American Indian Radio On Satellite program might work with Native American governments to help them utilize satellite links.

Schools, hospitals, government agencies, radio stations, and other institutions in Native American communities might also consider partnering with each other or becoming champions of a community network. For example, the Sisseton-Wahpeton Sioux Tribe Telecommunications Committee is helping four entities—a tribal community college, K-12 tribal school, tribal government, and IHS local service unit-establish local area networks. Each local area network will be interconnected to form a wide area network and connect with the Internet.[58]




***Top:*** *Big Sky Telegraph is a community-based computer network headquartered at Western Montana College in Dillon, Montana. Big Sky is dedicated to empowerment of grassroots Americans-including Native Americans-through the use of computers and telecommunications.* ***Bottom:*** *Map showing teleconnections between Big Sky Telegraph and the contiguous states, Alaska, and Hawaii.*

[58] Sisseton-Wahpeton Sioux Tribe Telecommunications Committee, "Telecommunications Project," unpublished paper, Agency Village, SD, n.d.

Most community networks across the United States and Canada have taken a grassroots, bottom-up approach that emphasizes citizen empowerment rather than institutional goals. However, many Native American communities may not have a critical mass to support a grassroots movement. As a consequence, a Native American government or other institution may have to take a lead role. A community network owned or run by one or a few organizations, rather than a community-appointed board of directors or the equivalent, would need to ensure that the network remains true to community values and needs. Even a community-based board could lose touch if board members do not have diverse backgrounds and are unwilling to continually challenge the network to grow, develop, and engage the community.

## Community Computer Networks

Community computer networks, largely grassroots efforts initiated by concerned community members, caught the attention of the mainstream in 1992. At about the same time, the Internet became popular with the media and the public, and the federal government put forth the concept of an information superhighway (also known as the National Information Infrastructure).[59] Examples of community networks include the Blacksburg Electronic Village[60] in Virginia; the Taos Telecommunity in New Mexico; Big Sky Telegraph in Montana;[61] Prairienet in Illinois; and the Boulder Community Network in Colorado.[62] Networks such as Prairienet that subscribe to the National Public Telecomputing Network are trademarked Free-Nets™ and follow the model of the Cleveland Free-Net. Other community networks are variously called public access networks, community computing, electronic bulletin board services, telecommunities, or televillages. Most are accessible through both public centers and home computers, and through the Internet.

Activists and observers of community networking stress that the basic concept of community networking is an ongoing cyclical *process* whereby community needs are discovered, solutions negotiated, changes made, and results evaluated for the next round. The basic goals are grassroots empowerment; community-driven vision; developing local expertise; and providing content and services to meet local needs and constraints. The Morino Institute suggests several criteria critical to the growth of current community networks and the establishment of future community networks:[63]

- make positive social change the goal,
- understand the needs and engage the efforts of the community,
- build a strong and open technological base,
- make information available that is relevant to and in the context of the community,

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[59]See Jay Weston, "Old Freedoms and New Technologies: The Evolution of Community Networking," *Free Speech and Privacy in the Information Age Symposium*, University of Waterloo, Canada (invited paper), Nov. 26, 1994, available by e-mail from jweston@ccs.carleton.ca or through the Electronic Frontier Foundation World Wide Web site http://www.eff.org/pub/Publications/; and Doug Schuler, "Community Networks: Building a New Participatory Medium," *Communications of the ACM*, vol. 37, No. 1, January 1994.

[60]For a description, see Rajiv Chandrasekaran, "In Virginia, a Virtual Community Tries Plugging Into Itself," *The Washington Post*, Apr. 11, 1995, pp. A1, A12.

[61]See Frank Odasz, "Community Economic Development Networks: A Grassroots Leadership Challenge," *Internet Research*, vol. 4, No. 1, spring 1994.

[62]For more information via e-mail write to webmaker@bev.net for the Blacksburg Electronic Village, feedback@laplaza.taos.nm.us for the Taos Telecommunity, info@prairienet.org for Prairienet, and coordinator@bcn.boulder.co.us for the Boulder Community Network. The World Wide Web home pages for these community networks are http://www.bev.net, http://laplaza.taos.nm.us, http://www.prairienet.org, and http://bcn.boulder.co.us.

[63]The Morino Institute, "Assessment and Evolution of Community Networking," paper presented by Mario Morino at the *Apple Conference on Building Community Computing Networks*, Cupertino, CA, May 5, 1994.

## BOX 3-6: Forward-Thinking Community-Building

My friend, a Seneca scholar, once remembered that many people have a mental snapshot of native people taken 300 years ago, and they want to retain that image . . Perhaps we are approaching a time when everyday Americans want to become better Indians than the Indians themselves . . . Certainly I believe that ancient tribal cultures have important lessons to teach the rest of the world about the interconnectedness of all living things and the fact that our very existence is dependent upon the natural world we are rapidly destroying Our languages are still strong, ceremonies that we have been conducting since the beginning of time are still being held, our governments are surviving, and most importantly, we continue to exist as a distinct cultural group in the midst of the most powerful country in the world, Yet, we also must recognize that we face a daunting set of problems and issues—continual threats to tribal sovereignty, low educational attainment levels, double-digit unemployment, many homes without basic amenities, and racism. To grapple with these problems in a forward-thinking, positive way, we are beginning to look more and more to our own people, communities, and history for solutions, We have begun to trust our own thinking again.

Wilma P. Mankiller, Principal Chief, Cherokee Nation

SOURCE Reprinted from native American Programs, Department of Housing and Urban Development, *Our Home: Giving Form to Traditional Values, Design Principles for Indian Housing* (Washington, DC 1994)

- ensure broad-based access,
- plan for growth, establish a sustaining economic model, prepare for competition, and
- collaborate to form a powerful community computer network movement nationally.

The lessons learned from current efforts could be valuable for Native American communities, each with its own cultural, social, economic, and political needs that could be met, in part, by creating its own community network.[64] Possible champions of Native American community networking might include Native technology activists, community leaders, Native American governments, community service providers, tribal colleges and libraries, and local businesses. Native American community networking needs to be forward-thinking and contribute to community-building, and it also must be firmly rooted in Native cultures and values (see box 3-6).[65]

[64]For a discussion of the opportunities and challenges of telecommunications for rural communities, including some Native American communities, see OTA, *Making Government Work: Electronic Delivery of Federal Services,* op. cit., footnote *5;* and U.S. Congress, Office of Technology Assessment, *Rural America at the Crossroads: Networking for the Future,* OTA-TCT-471 (Washington, DC: U.S. Government Printing Office, April 1991).

[65]For discussion of grassroots Native computer applications, see chapter 2; Patric Hedland, "Ancient Tales Online," *Online Access, Summer* 1992, pp. 8- 11; and Cynthia Denton, "The American Indian Share-Art Gallery," *Whole Earth Review,* summer 1991, pp. 36-37.