CHAPTER 4

Sociotechnical Landscapes

Tribal Broadband Deployment

> The alternative point of view—the social shaping of technology—recognizes that technologies in general (and information technologies in particular, in our case) are the outcomes of social action. They are generated by people operating in social contexts (of all different sorts) and at particular historical moments, all of which shape the imagination of what needs technology might meet and in what settings it might be employed.
>
> —Paul Dourish and Genevieve Bell, *Divining a Digital Future*

THOUGH THE EXPERIENCE OF USING WIRELESS DEVICES MAKES IT seem that the Internet is invisible, intangible, and placeless, the undergirding of the Internet is in fact quite visible, tangible, and place-based. In the winter of 2011, I returned to Seattle holding in my heart and mind, and in the assiduous notes of my research log, the narrative proof of what different Native and tribal leaders, educators, and activists were creating not only through the availability of affordable Internet access and networked technologies but also through networked thinking. Understanding the contemporary political will of various diverse Native peoples means conceptualizing the legacy of Indigenous histories in places, including the drive of many Native peoples as individuals to work together for social and political goals with or without federal or state government support. Likewise, understanding technology means conceptualizing digital objects not as just devices but rather as interfaces within a greater web of interconnected individuals, devices, and systems, in many ways upheld by the overarching work goals of preexisting institutions.

Leaders in Native and tribal communities harness information and communication technologies to accomplish information-sharing goals. The ways leaders collaborate depend on the individuals they know, and how those individuals can work together to accomplish mutually acceptable goals across institutions as diverse as distinct tribal governments, intertribal organizations, universities, nonprofit organizations, and federal funders. While there is great imagination about how ICTs "flatten" the divergences of time and space, thereby increasing the efficiency of information flows and work flows, for Native peoples, the realities of the jurisdictions and borders shaped by legal, political, and cultural sovereignty actually distinguish the spatial topography of ICT networks. These networks shape how Native peoples access and utilize various ICTs. Information is not "free" in Indian Country, and it certainly is not free-flowing; rather, it is shaped by the geopolitical and geophysical terrain, histories of colonization, linguistic choices, ceremonial cycles, protocols of respect, and values around sovereignty, revitalization, and tribal governance needs. All these boundaries and barriers shape Native peoples' choices and decisions around the design and integration of ICTs. Thus it is important to approach Indigenous digital endeavors as creative efforts to apply tools and techniques to addressing local needs and establishing a direction into a locally imagined future. Embracing this conceptual shift can help further unpack the black boxes of culture and technology, as well as center the lived experiences and political realities of Native peoples and the working conditions of tribes.

PLACE, INDIGENEITY, AND THE MATERIALITY OF THE INTERNET

When tribal leaders consider the build-out of any major infrastructure on tribal lands, they must take into consideration a number of factors relating to tribal codes, policies, community needs, financial capacity, and terrain. Land is precious in Indian Country, not merely as an asset or a development resource, but also as an epistemic topography of tribal ways of care and knowing. Native peoples' homelands have historical, spiritual, ecological, and political significance. It is perhaps easy for city-living folks to imagine the Internet as something "out there," as invisible and ephemeral as droplets of water in the air we breathe, and with data centers and network operations as nondescript as the next strip mall. It is more realistic for tribal residents to conceptualize the Internet as something "right here," with decisions about where to build towers shaped by seasonal rhythms of hunting, wildfires, and prayer, not to mention

the matter of land and edifice allocation. Tribal communities take time to discuss appropriate uses of WiFi (wireless fidelity) and mobile phone use, in particular as these relate to the transmission of tribal community news and traditional knowledge. The Internet is made of quite tangible expensive material. The kinds of decisions that tribal ICT champions make to support the build-out of the Internet across tribal lands strike at the core of how tribes view the flow of information and knowledge within and around homelands, as well as how tribal leaders envision technology shaping modern tribal approaches to the exercise of sovereignty and self-determination.

At this point, it is helpful to explain one way of thinking about the components of a broadband Internet infrastructure. Generally, these consist of (1) the network system across which digital content is streamed; (2) the digital content itself; (3) the tangible devices that compose the network hardware, such as computers, cables, towers, and servers; and (4) the policies that regulate the build-out of the network, including uses and content flows. The network system, content, devices, and policies are created and managed by technicians working out of operational centers, such as university labs or network administrative offices. Location means a lot. Contractors must build roads to the towers and lay the foundations. The towers must be positioned over wide swaths of terrain—usually on hills, mountainsides, or other stable, flood-free high points—so that they can transmit signals to each other and down to buildings, be fire-proof and constantly cool, and be where network administrators can oversee massive flows of data. The whole architecture demands an uninterrupted power supply. At this point in the history of digital innovation, the broadband grid depends on the availability of a reliable electric grid.

Generally speaking, the term *broadband* refers to a digital communication channel of at least 256 kilobytes per second and operating in distinct contrast to earlier modes of single-channel dial-up. Technically speaking, *broadband* actually refers to the ability of a device to transmit multiple signals across multiple channels: fiber-optic cable, coaxial cable, and wireless, for example. At present, broadband Internet is usually transmitted by one of three technical setups: fiber-optic cable, wireless, or satellite networks. Robust networks include multiple delivery modes. Installing cable means burying miles of terrestrial cable or stringing aerial fiber-optic cable on poles. Setting up a wide area network for regional wireless delivery requires setting up towers, transmitters, and receivers. Satellite services bounce off orbiting satellite transmitters and introduce latency: the amount of time it takes for a packet to reach the satellite and travel back to the terrestrial receiver. When thinking about

setting up Internet networks, systems designers conceptualize in four dimensions: what is underground, the layout of the visible terrain, how packets might travel through airwaves and, in some cases, across airspace, and all of this over measures of time.

Add to these (1) the encompassing market forces that determine Internet service supply and demand; (2) the physical geography shaping where and how towers, fiber-optic cables, satellites, and receivers are positioned; and (3) the political and institutional jurisdictions that shape the nature of policies and construction. There are also the people who support the build-out of broadband infrastructure networks. These include network administrators, content designers, policy experts, entrepreneurs, vendors and distributors of hardware and software, construction workers and contractors, industry and university researchers, lobbyists, system and interface designers, and Internet consumers of all kinds. Designing and building out a broadband Internet infrastructure requires a massive orchestration of individuals working through institutions. These individuals develop ways of building out the network across the policy and workplace constraints of their institutions, the physical terrain through which the infrastructure will be built, and the technical specifications of software and devices. The deployment of a broadband infrastructure is very much a place-based and institutionally supported enterprise.

Ecologically speaking, a broadband Internet network is a system that supports creative possibility for people who use the resulting services. The infrastructure of that network becomes the backbone for online forms of creative expression. While the people who advance the infrastructure become an integral part of the ecology of the entire system, the network itself becomes an integral part of the capacity of those who rely on Internet access to work and play in an online environment. Broadband network designers and advocates create the means for others to engage creatively in an online environment. This is why ICTs, and especially broadband Internet infrastructures, can be thought of as concerted fabrications. This is also why human-computer interaction researchers—specialists in designing interfaces that translate digital noise into useful human experience—now regard the design of systems as socially shaped, and neither purely technically determined nor entirely socially determined. Indeed, in their 2011 assessment of the future impacts of ubiquitous computing, informatics professor Paul Dourish and Intel researcher Genevieve Bell acknowledged that the diversity of people "operating in social contexts (of all different sorts) and at particular historical moments" promulgates and pursues various technological imaginaries.[1] Thus we can deduce that in different

places within Indian Country, large-scale Internet infrastructure provides the backbone for the various kinds of online creative expressions that users develop and for the network administration work necessary to maintain the base layer of operations.

To the layperson, getting Internet access might be, conceptually, a matter of purchasing a laptop at the mall and calling AT&T or Comcast for a subscription. But the laptop is really only one device for plugging into an existing technical infrastructure, and the Comcast salesperson is only one individual working to support the whole enterprise. To understand the social and political impacts of ICTs means understanding the politics of the grid; focusing only on the device or interface—the mobile phone or website—replicates the fascination with the pyrotechnics. These "may hold our fascinated gaze, but they cannot provide any path to answering our moral questions."[2] What I have observed tribal ICT personnel do in their work is shift the conversation in policy-making arenas from pyrotechnics—talk of tribal websites and streaming radio programs, Facebook pages and digital libraries—to financial investment and political support of the undergirding broadband networks. In many ways, especially for tribes that are underserved or unserved by large telecommunications and Internet service providers, the tribal website and digital community archive are actually the realization of the often invisible efforts of tribal ICT personnel, many of whom worked for years advocating and negotiating for affordable phone and Internet service for their communities.

Unfortunately, at this point in history, it is difficult to depict the broadband landscape in Indian Country from a reductive viewpoint—figures and maps. At present, there are at least twenty tribally owned or Native-owned Internet service providers or in Indian Country, with more in the early establishment and development stages. There are no publicly available reliable data sets assessing Internet coverage in Indian Country, either in terms of technical reach of existing infrastructure or in actual numbers and locations of users, although some tribal service providers have these numbers as part of their private business strategy. As of this writing, affordable, reliable, and robust broadband Internet services continue to be scarce in remote reservation communities. Recent studies reveal that Native families in urban settings who have higher incomes and educational achievement are utilizing the Internet through mobile phones at a greater rate than previously expected. Basic Internet access through mobile phones is still quite different, however, from robust Internet access, the kind in which members of a household enjoy multiple strong Internet connections across multiple productivity devices.

While there are no exhaustive data sets at this point from which we can assess digital access, use, and connectivity across the diverse demographics of Indian Country, we can, as of this writing, still safely presume that robust Internet access and productive use of the Internet (as opposed to basic consumer uses) continue to be limited. We can base this presumption on the following: (1) ICT devices such as smartphones, laptops, tablets, and gaming consoles continue to be expensive for the average Native American household; (2) subscription rates for broadband cable, wireless, and satellite access continue to be more expensive for people residing in rural and remote locations, with many reservation communities located in such regions of the United States; (3) high unemployment rates in Indian Country mean there is less opportunity for individuals to gain Internet access through workplace computers; and (4) there are few regularly published data sets on numbers of users accessing Internet services through reservation schools, libraries, elders centers or computing centers, or nearby public schools and libraries; and (5) there are few studies that measure digital literacy skills and Internet uses, both of which represent different measures from those associated with basic technical connectivity.

Yet ICT devices are available and are being used in Native communities. In 2010, the White House released the National Broadband Plan, which included estimated figures on existing levels of coverage across the fifty states, and a general strategy for supporting infrastructural build-out such that each US home should have Internet coverage of speeds up to 100 megabits per second by the year 2020. However, Shana Barehand Green, former Federal Communications Commission employee and tribal telecommunications taxation expert, argues that while it looks like many parts of Indian Country are represented on the maps, what the maps really show are the specifications for the hardware, as reported by the telecommunications companies, were the hardware to function under optimal operating conditions. This means that the maps do not account for the limitations imposed by physical geography (wireless and satellite services are based for the most part on line-of-sight technologies), inclement weather, or regional monopolies fixing rates and blocking competition.

I had to smile. My family residing in southern New Mexico, for example, has never been able to maintain landline phone service because seasonal rainfall each winter and summer washes out the phone lines. When we first installed a wireless modem, we discovered that the signal would not penetrate the thick adobe walls of the family home, limiting the places where we could set up a desktop computer and laptops. During holiday visits home, when I

need to take phone calls, I carry my smartphone outside and face northwest. Unfortunately, the touchscreen interface shuts down in summer temperatures over ninety degrees. My family does not live in a remote part of Indian Country; they are a fifteen-minute drive from an urban center. While the National Broadband Plan is intended to serve as a big-picture guide, in the end, the complexities of broadband Internet coverage, infrastructure, affordability, access, and use are not well represented in that single document or the accompanying maps and are not adequately represented at all within the diverse landscapes that make up Indian Country.

Meanwhile, to the north in Ontario, ICT champions in the Nishnawbe Aski Nation have been working for years to support broadband Internet access for First Nations peoples throughout Canada. The Kuhkenah network, or K-Net, began as a demonstration project formed out of a partnership between the six tribes of the Northern Chiefs Council and IndustryCanada. Since its inception, community journalists and researchers from McGill University, Montreal, and the University of Guelph have been documenting the build-out of this community-based multipoint network across the remote, densely forested lands of six tribes and the affiliated mountain and lake communities. The effectiveness of their partnerships has allowed K-Net leaders to advocate for the ICT and broadband needs of Native and Indigenous peoples through the Assembly of First Nations, the First Nations Technology Council, and the Indigenous Commission for Communication Technologies in the Americas. All K-Net documentation, including photos, videos, and plans, are posted online so that others may learn from K-Net's experiences as its leaders develop their own community broadband networks. First Nations in western Canada have access to a tribally owned satellite network, which is supplemented by a growing fiber-optic infrastructure. At present, the First Nations Technology Council is working on developing an integrated information management plan, as well as models for broadband networks and associated technology applications for all First Nations communities. Those working in tribal telecommunications policy must keep asking, What conditions shape this divergence between a cohesive First Nations broadband Internet strategy and the lack of a cohesive strategy for US tribes? How is federal funding for state and provincial broadband planning efforts shaping tribal planning efforts? How are private industry and small business shaping Internet accessibility in Indian Country? What are the many strategies tribes employ to acquire affordable Internet services for their communities?

These questions are important because they relate to fundamental questions about tribal sovereignty and self-determination around the build-out of

a major communications infrastructure. Before we can answer these questions, though, it is essential understand how ICT champions build their own broadband Internet infrastructures for tribal communities across tribal lands.

PART I. TDVNET: CONNECTING THE NATIVE PEOPLES OF SOUTHERN CALIFORNIA

In August 2011, I drove to the Pala reservation outside San Diego, where I met with Matt Rantanen (Cree), TDVnet administrator and director of operations for Southern California Tribal Technologies (SCTT). Pala is northeast of downtown San Diego, higher up from the coastline, amid a range of boulder-strewn hills and valleys.

I drove south from Los Angeles, passing Marine Corps Base Camp Pendleton and two US-Mexico border checkpoints on the way. Sensitized to the geopolitical terrain of Indian Country, I noted this border enforcement as a continuation of three interrelated historical colonial legacies: the first being the suppression and forced reorganization of the coastal Native peoples—Kumeyaay, Tongva, Chumash, Cupeño, and others—into the mission system by Spanish, Mexican, and American settlers; the second being the US acquisition and subsequent occupation of northern Mexico under the Treaty of Guadalupe Hidalgo; and the third being the positioning of coastal California as a base of military operations to support twentieth-century US imperial expansion into Asia and Oceania. To my eyes, the development of information systems in Indian Country necessarily coincides with the development of US border enforcement systems.

Having read up on the history of southern California tribes, I learned that one of the first techniques US and Mexican colonial authorities utilized to prevent Native peoples from communicating regionally was damming waterways and preventing mission Indians from traveling via coastal and river routes. It is a history somewhat hidden in the published historical record, though apparent in the peoples' original names. Many of the peoples of what are now the southwestern United States and northwestern Mexico are named for flows of water. Knowledge was shared among diverse peoples along water routes: news, tools, stories, goods, medicines, maps, languages, and histories spread all the way from the southern continent to the far northern reaches of the Americas. The late nineteenth- and early twentieth-century remapping of the American western territories into states and cities coincided with the build-out of the transcontinental railroad, the diversion of major waterways, and

the forced containment of Indians in the reservation system and, in California, the mission system. Many California Natives died during this turbulent time. American settlers kidnapped Native children and forced them into boarding schools. Many of the tribes of southern California now bear the names of missions, yet the memory of the peoples reaches back to an era that precedes the entry of early US and Mexican nationalist settlers.

Matt Rantanen, a Pala tribal administrator, shared with me the story of how the leaders of the Southern California Tribal Chairmen's Association (SCTCA) leveraged key partnerships with Hewlett-Packard engineers and researchers from the University of California, San Diego (UC San Diego), to acquire Internet access for the nineteen tribes bordering San Diego County. The idea of acquiring Internet for the tribes began in the mid-1990s, when tribal leaders realized that even though the reservations were located fairly close to an urban center, the peoples living in canyon, valley, mountain, and rural communities could not afford the expensive satellite access plans offered at the time. Many tribal residents also lacked phone lines. Regional Internet service providers explained that it was too expensive to build the infrastructure to reach these communities and that the demand would not produce sufficient profit. Later, I would discover that tribal broadband project leaders commonly offered this explanation for their inability to find a service provider for their remote, rural reservation communities.

Rantanen recalled that the peoples of the nineteen bands and tribes encompassed by the SCTCA were one people—political neighbors and blood relatives—before the imposition of the mission system and that TDVnet facilitates the communication that brings the people together again. He showed me a map and explained the reach in miles of the TDVnet backbone, with its primary towers located at high points overseeing the valley communities, and how the spectrum is allocated across each operational node. Spreading his fingers above each node, he asked me to imagine the array of pathways through which WiFi Internet service is provided to tribal administration buildings, schools, and libraries.

He said that in the late 1990s, at around the same time that SCTCA leaders were brainstorming how to acquire Internet access for the tribes, UC San Diego physicist Hans Werner-Braun was figuring out how to transmit astronomical data from satellites to the San Diego Supercomputer Center. Werner-Braun already had a group of engineers working on the project through the High Performance Wireless Research and Education Network (HPWREN), a broadband Internet network designated for scientific use. The engineers identified

an optimal location within reservation lands for a tower that would receive and transmit satellite data. Werner-Braun approached the SCTCA, describing his plan to build-out the HPWREN backbone. He explained how the backbone could stream wireless signals to receivers in tribal homes and buildings.

The SCTCA identified a tribal member, IT specialist Michael Peralta, to meet with Werner-Braun and learn about his plan. It was a kitchen table meeting. Werner-Braun drew up a model for Peralta, showing him how to bounce signals from one room of the house to another using transmitters and receivers. Of course, the overarching concept was to provide high-speed wireless Internet service across towers set up on mountaintops and peaks, channeling spectrum down to valley administration buildings and residences.

SCTCA leaders found the concept worth an investment. They partnered with UC San Diego ethnic studies professor Ross Frank and drafted a proposal for a tribal broadband network through the Hewlett-Packard Digital Village program, including HPWREN and Hewlett-Packard engineers as key partners and technical consultants. The goal was to build a network that could sustain broadband operations across four domains—education, culture, economic development, and infrastructure—and to have tribal members administer the build-out, from design to implementation. In 2001, after receiving a three-year, $5 million grant from the Hewlett-Packard Digital Village Program, TDVnet technicians and managers began working with HPWREN engineers and Hewlett-Packard consultants to build out the backbone. As much as possible, TDVnet project leaders tapped into their circles of friends and associates for local Natives and tribal members to assist with aspects of the build-out. Rantanen described finding the necessary talent in interesting places. For example, casual conversations led TDVnet project leaders to a veteran and helicopter pilot. They contracted the pilot to fly heavy equipment from the roadways up to a mountaintop where TDVnet construction crews were building a tower.

Within a few years, the tribal administration buildings, schools, and libraries had free Internet access. By 2005, the network was robust enough to offset some of the load from the HPWREN relays to the TDVnet backbone. Meanwhile, TDVnet engineers began working with tribal community leaders on designing an intranet archive where members of the nineteen tribes could post photos, news, videos, and knowledge of tribal ways.

When the three-year grant ended, the TDVnet project leaders had a plan in place for maintaining network operations and generating revenues for network improvements. They established an Internet service provider, Southern

California Tribal Technologies, as a tribal enterprise and set up a subscription service for tribal residents and neighbors. They also used remaining grant funds to purchase hardware and software for media labs, a digital print shop, and a professional graphic design studio. They established the print shop, Hi-Rez Digital Solutions, as a tribal enterprise where community members could take basic design classes from the Hi-Rez graphic designer.

TDVnet project leaders also set up a digital recording studio, where community members, and especially youth, could make their own videos, record music, and webcast special events. They set up computing labs, hosting classes ranging from basic computing skills to Cisco network certification courses. Shy youngsters sitting in computing classes learned to use the digital recording studio and were soon editing their own videos and showing friends how to use the studio in the process.

The tribal enterprises began generating profits sufficient to create local jobs and support network enhancements. Community members taking computing classes and using media labs showed increased interest in supporting tribal broadband Internet services. Some tribal members also advanced in job skills training; Southern California Tribal Technologies offered Cisco network certification courses, and leaders began identifying business, technology, and policy solutions for sustaining and expanding operations. They filed for 8(a) certification, setting up SCTT for small-business mentorship, loan, and government contract opportunities. Rantanen partnered with researchers at the University of Illinois at Urbana-Champaign to explore the development of wireless mesh for supplying Internet to tribal residents living in canyons where they could not receive a clear signal from the towers. SCTT engineers wired solar panels and wind turbines into the generators powering the towers, saving on energy costs.

Meanwhile, though the tribal schools and libraries were receiving high-speed Internet through the TDVnet channel, Rantanen discovered that tribal libraries were not qualified to receive e-rate funds—FCC Internet access subsidies for public libraries and schools—because the funding was distributed solely through state governments, not through sovereign Native nations. He began speaking to people in Congress and other political representatives about this and related issues. He gained a seat on the FCC Native Task Force, advising the FCC on adjusting programs so that tribes would get help with acquiring broadband Internet, including the possibility of drafting a tribal priority for broadband spectrum. Indeed, TDVnet was tested and continues to run almost entirely off unlicensed spectrum. This is an extremely important issue that

pertains to matters of tribal jurisdiction, the trust relationship between tribes and the federal government, and the often uneasy political relationship between tribes and states, in which states charged with distributing federal funds often overlook, disregard, or are unsure of how to approach tribal neighbors when it comes to resource sharing and funding.

In 2009, when the FCC released a notice of inquiry on how to adjust its broadband grant and loan programs to meet tribal and rural residential needs, TDVnet managers were among the first to point out that the US Department of Agriculture (USDA) Rural Development Broadband Initiatives Program (USDA Broadband Initiatives Program) and National Telecommunications and Information Administration (NTIA) Broadband Technology Opportunities Program criteria were slanted to preclude tribal applicants. While Rantanen was able to demonstrate the feasibility of a proposed TDVnet infrastructural upgrade, SCTT was unfortunately not eligible for an NTIA Broadband Technology Opportunities Program award due to the restrictive program criteria. It did, however, receive funding to support a broadband impact study and digital literacy program through the Zero Divide Foundation, a Bay Area digital inclusion advocacy group. At present, SCTT is increasing demand through sponsoring literacy and learning programs yet still needs major funding to acquire access to spectrum, upgrade hardware at the towers and in labs, and build out the backbone to support greater bandwidth and reach the more remote communities.

Near the end of my visit, on the walk to my car, Rantanen motioned with his hand to show the path of the WiFi signal from the dishes atop the nearest mountain tower to the dishes attached to the tribal administrative buildings. A Hi-Rez Digital Solutions employee had planted sunflowers beneath water trickling from a rooftop swamp cooler. He described how free and affordable access to broadband Internet was allowing cousins who lived on different reservations to connect with one another via Xbox Live, grandmothers to view long-lost photos online, and council members to review a digital archive of past council meetings. ICTs—and especially broadband ICTs—are about helping people connect with one another. For tribal peoples who have been forcibly disconnected from one another for generations by settler-state leaders interested in seizing Native lands and waters, tribally owned broadband infrastructure takes on a value beyond that of simply enabling education, economic development, or cultural revitalization. The combination of business acumen, technical expertise, political savvy, and a few key partnerships helped SCTCA broadband champions grow TDVnet from a demonstration project into a tribal enterprise and create space for ICT innovation and agenda setting in Indian

Country. TDVnet helps many people working at many different locations and through many different positions in the SCTCA tribal community share information and work together toward strengthening the cultural and political sovereignty of the nineteen tribes.

The development of TDVnet is characterized by both the sociotechnical vision of the project leaders and the nature of the partnerships supporting its build-out: it is an example of the social shaping of technical infrastructure. The intertribal and cross-institutional approach introduces a level of complexity that reveals the many jurisdictional matters that tribes must think about when implementing an ICT project of this magnitude.

First, the nineteen tribes that compose the SCTCA represent a diverse range of geopolitical terrain. Some of the tribes are federally recognized. Some are state recognized. Some remain unrecognized by either the US federal government or the state of California, yet as inherently sovereign Native peoples, they bear the rights of cultural sovereignty.

Second, there are differences in the economic capacity of each tribe. Some of the tribes host gaming operations on their reservations. Some tribal governments pay out dividends from gaming operations and other enterprises in the form of per capita payments to individual tribal members. For some tribes, per capita payments can signify tribal households with higher-than-average disposable incomes. Payments can also signify more striking economic differences within a single reservation or neighboring reservations: households with significantly higher incomes can neighbor households below the poverty line. Because of such striking economic variance, I would later find that many tribal ICT champions view their work deploying broadband as a social enterprise—a matter of governance, sovereignty, and self-determination—rather than primarily as a profit-making enterprise.

Third, there are differences of place and nearness to urban centers. In southern California, some of the tribes are located much closer to urban and semi-urban locations that may already receive competitive broadband Internet service rates from regional providers, while others are in more rural or remote locations that lack basic infrastructure. Population counts for each tribe differ, as do community information needs and existing telecommunications infrastructural capacity.

Finally, the nineteen tribes are spread in a checkerboard pattern across the southern California region, meaning that the entirety of the southern California Native homeland is intersected by Bureau of Land Management land, county land, private property, and land that belongs to the state of California.

In terms of deployment, this signifies the drafting of many memorandums of agreement and many right-of-way permits and the consistent promulgation of the vision of affordable and reliable Internet for tribal residents and neighbors.

The leaders of the Southern California Tribal Chairmen's Association agreed to work across these differences when they identified a broadband network backbone as a meaningful long-term intertribal investment. While each tribe may utilize the services of Southern California Tribal Technologies in different ways, the TDVnet project leaders nevertheless set up the backbone to serve all communities regardless of the abovementioned differences. The design and build-out of TDVnet capture some of the best qualities of a community-based network. The design is based on a common vision—connecting tribal peoples for cultural sovereignty and economic development—with the build-out occurring through an iterative series of partnerships, needs assessments, network improvements, and outreach efforts. Figure 4.1 illustrates the SCTCA strategy for acquiring broadband Internet for its constituent tribes. It is based on an intertribal, inter-institutional, collaborative community development approach in which cultural sovereignty and economic development are the impetus, with partnerships, profits from tribal enterprise, and network innovations providing the means of connecting the tribes.

Rantanen's description of the build-out of TDVnet helps us better understand how broadband infrastructures and services designed specifically for tribal communities are conducive to tribal peoples' abilities to connect and create online. Moreover, it shows how the partnerships orchestrated to build these critical infrastructures ground productive relationships between tribal leaders, industry partners, and university researchers.

After speaking with Rantanen and learning about what it took to build out TDVnet, I began to think more critically about the steps tribes have to take if they are to acquire their own broadband Internet infrastructure. I began searching for any kind of documentation revealing the factors shaping the ability of tribal ICT champions to build broadband networks across reservation lands. I found evidence of these factors on the websites of tribal telecommunications and Internet service providers. I found evidence in tribal telecommunications policy papers, those published both on tribal sites and through organizations such as Native Public Media, the FCC Office of Native Affairs and Policy, and the National Congress of American Indians (NCAI). I found evidence in proposed tribal broadband infrastructural deployment plans prepared for the USDA Broadband Initiatives Program and NTIA Broadband Technology Opportunities Program application cycles.

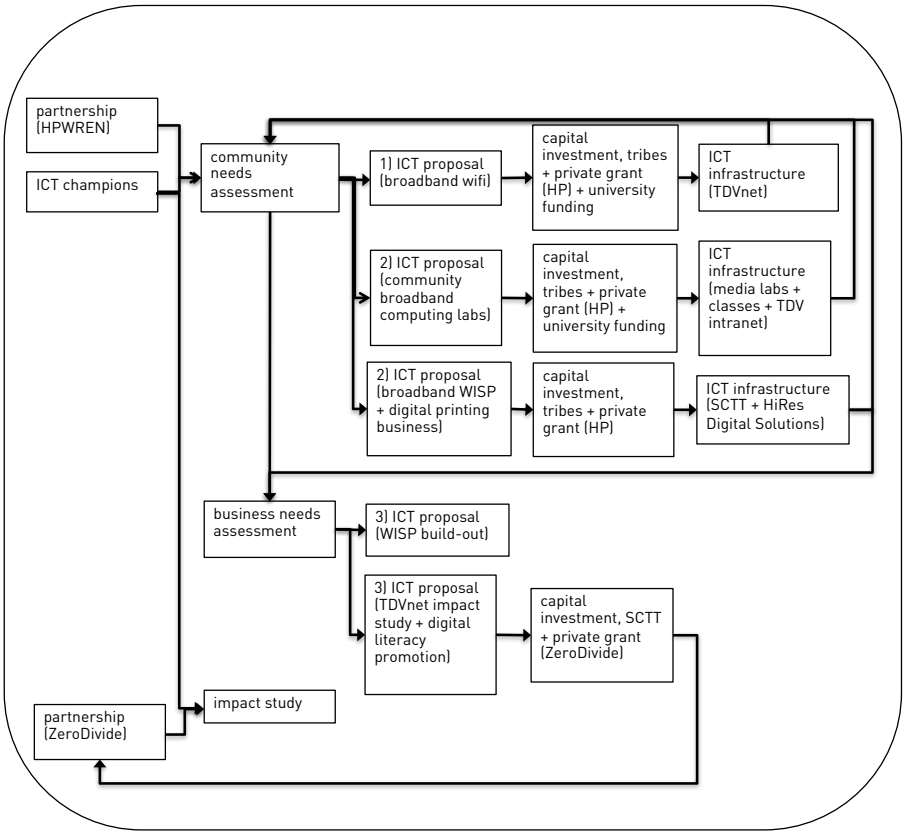

FIGURE 4.1. The Southern California Tribal Chairmen's Association strategy for building a network backbone sufficiently robust to serve the nineteen affiliated tribes consisted of several recursive phases. Local ICT champions partnered with researchers at the High Performance Wireless Research and Education Network at the University of California, San Diego, to build (1) a WiFi network with university funding, grant funding, and a tribal capital investment; (2) a computing lab; (3) a wireless Internet service provider and digital printing business; and (4) a digital literacy project, which led to a new partnership with ZeroDivide.

After a while, I began to get a sense for the conditions shaping tribal broadband infrastructural deployment and selected three more projects to analyze and compare: Red Spectrum Communications (Coeur d'Alene), the Lakota Network (Cheyenne River Sioux Tribe), and the Navajo Nation Tribal Utility Authority and Regulatory Commission. These cases were appropriate candidates because of the length of time they had been operating, the relative durability of their operations, the comparability of their complexity, and their differing approaches to employing broadband Internet to upholding tribal sovereignty.

Moreover, the descriptions of these projects contained clear messages about building ICTs that would support tribal sovereignty as it is imagined in the specific tribal communities. I had read enough studies about technological projects in Indian Country in which researchers obscured tribal sovereignty as a matter of "culture" either by failing to address legal sovereignty at all or by diminishing sovereignty as one of a series of values incompatible with the ideology of techno-scientific progress. Another trend in the literature was the application of methodologies to Indigenous experiences of infrastructure that decentered the history of colonialism from an Indigenous experience. For example, an earlier Marxist analysis of TDVnet produced a compelling analysis but fell short of recognizing tribal goals that move beyond the constraints of nationalist economic orders. This is not to say that the findings of a Marxist analysis do not apply—indeed problems of surplus labor in sociotechnical networks are of central concern in a global networked order. Rather, when it comes to theorizing the impacts of ICTs in Native and Indigenous communities, we also have to acknowledge the significance of digital connectivity for people who were oppressed for generations through an intentional colonial imposition of containment and forced disconnection. In this sense, tribal youth connecting with one another through Xbox Live is quite meaningful. It feels hopeful. It feels possible to imagine that one day those Kumeyaay kids playing Xbox Live might design and develop their own immersive Indigenous game, with all the savvy of tribal youth accustomed to both the strength of their tribal philosophies and the resilience forged in the harsh realities of an economic order built on the nightmare of Manifest Destiny. Foregrounding the early build-out of TDVnet against the history of southern California colonialism allows us to see a moment in which digital connectivity is a privilege that people in tribal communities had not yet taken for granted but which they have begun to breathe into with great intention for a hopeful future.

PART 2. RED SPECTRUM COMMUNICATIONS: ACCESS FOR POLITICAL AND CULTURAL SOVEREIGNTY

In 2011, at the Telecommunications Forum at the Sixty-Eighth National Congress of American Indians in Portland, Oregon, Valerie Fast Horse, information technology director for the Coeur d'Alene Tribe, spoke about some of the issues tribes face when establishing Internet service providers. In an earlier interview published in an Idaho newspaper, she described how her service setting up communication networks for the Army and Army Reserves prepared her to

think about potential uses of ICTs in her own reservation community. In the late 1990s, Fast Horse was posted at Dhahran, Saudi Arabia, working as a communications specialist with the US Army. While on active duty, she asked herself, What would happen in the tribe if I were to bring these technologies to the reservation? Hearing Fast Horse speak reminded me of how Rantanen had contracted a military veteran with piloting skills to load and lift heavy equipment from a valley floor to a mountaintop network-backbone base station via helicopter.

Worlds away from Saudi Arabia, Coeur d'Alene is a 525-square-mile expanse sloping between northern Idaho farmland and the eastern Rockies. At the center of the homeland is Lake Coeur d'Alene, a key body of water within a greater watershed, which includes the Coeur d'Alene River and Lake Coeur d'Alene. In 1991, the Coeur d'Alene Tribe filed a lawsuit against mining companies and the Union Pacific Railroad for dumping a century's worth of smelting and mining waste into the Coeur d'Alene watershed. The tribe sponsored a detailed scientific investigation. The results qualified the watershed as the second-largest Superfund site within US borders, with an expected cleanup cost of more than $200 million. While Fast Horse was setting up communication networks in Saudi Arabia, back home in Coeur d'Alene, the Union Pacific Railroad and the Hecla Mining Company settled the resulting environmental lawsuit with the US government. The tribe began leading the cleanup effort in partnership with the US Forest Service, the US Fish and Wildlife Service, the Bureau of Land Management, and the US Geological Survey. By the time Fast Horse returned to the reservation to work as the director of the tribe's department of information technology, the US Supreme Court had recognized that the lower Coeur d'Alene watershed belonged, and had always belonged, to the Coeur d'Alene people. It was a hard-won battle for the Coeur d'Alene people, and it is ongoing, as the tribe leads the cleanup effort.

Fast Horse entered the job bearing a strong message of cultural sovereignty. She understood the power of ICTs for Native peoples, not just as a means of facilitating tribal administrative work practices, but also as a way of sharing the ideas, art, and political commentary that are integral to expressions of cultural sovereignty. With the support of the tribe, Fast Horse created Rezkast, a site where Native people can share videos about matters of interest in Indian Country.

I had heard about Rezkast from tribal librarians, people whose entire professional practice is built around the goals of encouraging alphabetic and digital literacy, not to mention reading for pleasure, in Indian Country. In the first

decade of the 2000s, while YouTube was taking off in mainstream society, Rezkast was filling a gap in Indian Country, providing a technical platform for sharing news, language lessons, sports updates, history lessons, and music of interest. Moreover, the prime method of sharing updates through Rezkast is by uploading video and audio files. Native deejays began sharing interviews with Native educators and activists on issues in Indian Country, as well as song files, at the site. Videos of amazing rez ball moments made the archive. So did powwow videos and interviews with elders on different social topics. In one video, Coeur d'Alene elder Noel Campbell speaks about technology and the fear of cameras that many Native people have and explains that he no longer fears cameras, as younger generations are beginning to use computing technology to fight for their rights as Indian people.

The launch and ongoing success of Rezkast helped Fast Horse and tribal IT specialist Tom Jones demonstrate both the capacity of the Coeur d'Alene IT department and the potential for ICT innovation in Indian Country. Recognizing the need for affordable Internet to support tribal household use of technologies like Rezkast, Fast Horse and Jones combined their technical, business, and political acumen to propose a wireless Internet service provider as a tribal enterprise. After conducting a community assessment and demonstrating feasibility, Fast Horse and Jones obtained funding from the tribe and from the 2002 USDA Rural Utility Services Community Connect grant and loan program. They incorporated Red Spectrum Communications as the Coeur d'Alene wireless Internet service provider, offering free or low-cost wireless broadband Internet to community anchor institutions and homes on the reservation and in neighboring rural Idaho and Washington.

Fast Horse and Jones began advising the FCC and other tribal groups on how to think about implementing Internet services for tribal homes and anchor institutions. In light of the ongoing work with the US Geological Survey and other partners, Fast Horse and Jones also expanded Coeur d'Alene IT services to include a geographic information system for surveying and managing tribal lands and waters. In 2011, Boise State University honored Fast Horse as a part of its Women Making History program. It is important to note that in conference presentations, interviews with reporters, and other public-speaking moments, Fast Horse framed the idea of tribal command of broadband Internet infrastructure in terms of addressing specific political, social, and environmental exigencies around Coeur d'Alene, an orientation distinct from mainstream depictions of broadband Internet as a requisite precursor to an American consumer's technological utopia.

During the first five years, after seeing increasing demand for faster broadband, Fast Horse and Jones were already planning an infrastructural upgrade to Red Spectrum operations. After a second community assessment, they developed a plan to deploy fiber-optic cable using the fiber-to-the-home method. This move would not only boost upload and download speeds but also expand the range of service plans offered through Red Spectrum. Much like before, they were able to demonstrate demand, capacity, feasibility, and success with previous Internet service provision to both the tribal council and the 2009 USDA American Recovery and Reinvestment Act grant and loan program for strengthening rural infrastructure toward economic development. At present, Red Spectrum is in the process of laying 275 miles of terrestrial fiber-optic cable that will supply affordable broadband Internet to 3,500 households within the Coeur d'Alene reservation and neighboring communities.

Learning about how Red Spectrum Communications came to be showed me that there are at least a few strategies that tribal ICT champions must employ before establishing broadband Internet infrastructure and services. They must assess community demand. They must stage a pilot project that can demonstrate ICT skill, community impact, innovative capacity, and project completion. For Red Spectrum, Rezkast was the pilot. The outcomes of the pilot project can lead to the development of a proposal for more robust broadband infrastructure. That proposal must take into account available sources of funding, including tribal investments or federal grant and loan awards. Each time a phase of infrastructural build-out is finished, the project leads assess the outcomes, synthesizing that knowledge until it is time to plan and propose the next network enhancement. Figure 4.2 depicts the Coeur d'Alene strategy for acquiring broadband Internet access.

The exercise of cultural sovereignty is of prime importance to the Coeur d'Alene Tribe and guides administrative operations and investments in enterprise. Coeur d'Alene recognizes the sovereignty of tribes as inherent. Unlike tribes whom the US government forcibly removed from their homelands, the people of the Coeur d'Alene Tribe lived within the lands now known as Idaho and the United States long before the establishment of either. At present the Coeur d'Alene Tribe's commitment to protecting the homeland is enforced through the exercise of legal and political sovereignty, but especially by investing in projects that, like Rezkast, strengthen Coeur d'Alene cultural sovereignty. While Red Spectrum Communications has been funded by the USDA as a matter of rural economic development through infrastructural improvement, Rezkast, the tribal global information system, and Red Spectrum were sponsored and

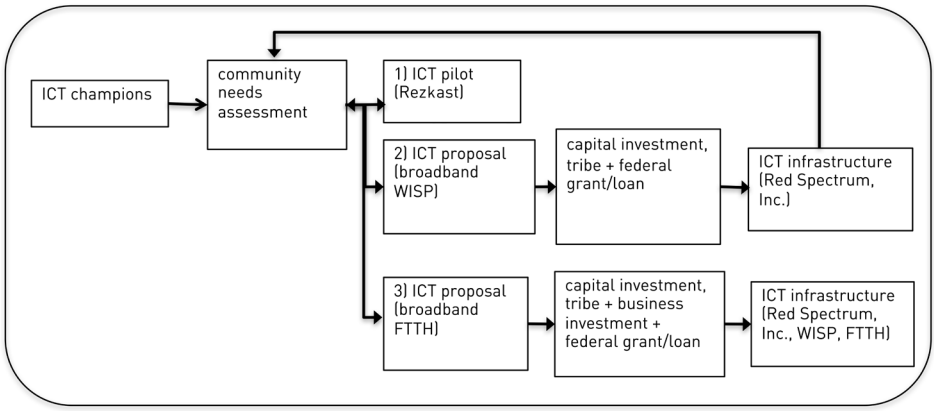

FIGURE 4.2. The ICT champions at Red Spectrum Communications worked through their capacity within the Coeur d'Alene tribal government to conduct a community needs assessment and pilot Rezkast. The success of the pilot gave them leverage to propose a tribal wireless Internet service provider and acquire a federal loan as well as a tribal capital investment. The success of Red Spectrum Communications led to their fiber-to-the-home project.

funded by the tribe as an investment in the Coeur d'Alene people, who need to communicate with one another about matters affecting their ability to defend their cultural integrity and the health of their homelands and waters. The Coeur d'Alene Tribe's approach to broadband Internet deployment is based in tribal governance goals and funded in part by tribal business revenues, including those of Red Spectrum and other enterprises. The technical approach is based on leapfrogging and infrastructural build-out over time in step with community demand and tribal governance goals. Red Spectrum's focus is on improving access to broadband so that Native peoples within and beyond the Coeur d'Alene homelands can support tribal sovereignty and cultural revitalization.

Comparatively, tracing the build-out of Southern California Tribal Technologies' TDVnet and the Red Spectrum Communications network backbone teaches us about the iterative process of building out networks of this scale. Cycles of visioning, needs assessment, deployment, and modification, proposals for enhancement and support, and processes of investment lead to many opportunities for both strengthening the vision for use of these technical infrastructures and stabilizing their value within the values frameworks already in place within the communities of use.

Tribal broadband networks are distinguished from other community-based broadband networks by values around duty to tribal homelands and place-based ways of knowing. Native peoples continue to serve in higher than average

numbers in various branches of the US military. Learning about ICTs in Indian Country revealed an aspect of the contributions of veterans in tribal communities. Many veterans return from active duty with a range of digital communications and leadership skills, the desire to contribute to their tribal communities, and eligibility for veterans loans through the US Small Business Administration. While I observed multiple cases of veterans supporting ICT projects in Indian Country, in the case of Red Spectrum Communications, Valerie Fast Horse dedicated her particular skill set, respect for homelands, and lived experience to building out an entire network for her tribe.

Understanding the Red Spectrum Communications build-out teaches us about what happens in stages through the build-out process. Once the broadband network is woven into the tribal homeland, the reservation gains a digital overlay and becomes a topography for knowledge sharing and memory work through both digital and face-to-face modes of communication. With each change made to the network itself, as well as with the introduction of newer systems and devices—faster phones, flashier social media interfaces, global information system tools, online grants and procurement systems—there is an attendant calibration within the communities of use: a time of practice, modification, assessment, and acceptance (or not) of specific devices and interfaces. The question is thus not whether tribes will accept this new technology but rather whether tribal communities will incorporate these systems into existing work and life practices, in accordance with existing ways of knowing.

PART 3. MANY VOICES, MANY SOLUTIONS AT THE 2012 TRIBAL TELECOM AND TECHNOLOGY SUMMIT

Two years into this research, I quickly gathered that there was a loose affiliation of like-minded individuals working on tribal Internet and tribal telecommunications issues in Indian Country. The same names, federal offices, and associations kept popping up not only in descriptions of their work but also in policy papers. As an information scientist, I had the sense that this was perhaps evidence of networks of individuals practicing an effective form of agenda setting, tapping into their own social networks within their communities in order to connect with individuals in federal offices. However, the 2012 Tribal Telecom and Technology Summit showed me another layer of complexity in the political landscape around telecommunications and technology in Indian Country.

I would come to understand that this layer of complexity had to do with (1) the diversity of tribes and the accompanying varying modes of decision mak-

ing, (2) choices about how to conscript various kinds of networked computing systems into specific tribal governmental processes, and (3) the nature of investing in perpetually advancing digital technological systems. I found that those working at the intersection of tribal policy and telecommunications deployment are able to gain perspective on decisions affecting their local communities by sharing experiences and ideas in goal-specific intertribal forums. The first realization: when tribal leaders begin thinking of incorporating streaming radio, high-speed computing labs, online voting, social media, or other such networked computing technologies into their tribal community or government services, they start to think about the availability of the Internet for tribal members. Thinking about that brings up questions on the cost of devices, areas of Internet availability, digital literacy, privacy and security, technical skills development, and more. It becomes apparent that the introduction of networked computing systems into jurisdictionally bounded spaces like reservations opens up a host of questions about Internet practices, policies at many governmental levels, economic development, education, and more. Moreover, conversations about these topics need to occur at the same time across various levels of leadership within and around tribal communities. A kind of complex communication occurs, and the team who posed the original idea functions as the spider testing various threads in a web of related conversations.

I first experienced this somewhat overwhelming stream of conversations in 2012, at the first Tribal Telecom and Technology Summit in Phoenix. I went seeking documentation of any US tribal broadband operation reaching the K-Net level of specificity. The conference was organized by just a few groups: a tribal telecom taxation law firm, Native Public Media, and Gila River Telecommunications, which was at the time one of the handful of tribal Internet service providers in the United States. The conference was hosted at the Wild Horse Pass Resort and Casino on the Gila River reservation southwest of Phoenix. While there, I met many attendees who were hoping to find out more about either acquiring basic telecommunications services for their reservation communities or overcoming obstacles to setting up tribal Internet service providers.

A representative from Havasupai was there to learn about how her tribe could acquire access for communities located at the base of the Grand Canyon and high up through rocky terrain. I also met two men who described how a private telecommunications company established a monopoly across their desert reservation in California years ago and committed the tribe to a noncompetition agreement in exchange for much-needed telephone service. Later, when the tribe built a casino and resort, leaders realized soon enough that

members were being significantly overcharged for Internet and phone service. By that time, the tribe had the capital, technical personnel, and know-how to set up its own Internet service provider, and at much more affordable rates than those of the predatory company. Unfortunately, the noncompetition agreement was still standing and, with it, the threat of costly legal battles.

Summit attendees included managers of Internet service providers who had successfully navigated the FCC spectrum licensing process, lawyers and accountants whose entire work focused on detangling tribal telecommunications taxation issues, community leaders whose elders expressed concern about the distractions ICTs might introduce among tribal youth, lawyers thinking about how—because of the nature of online information sharing—tribal telecommunications and Internet service providers interrelate with tribal intellectual property issues, and entrepreneurs building data centers as part of tribal economic development portfolios. There were even designers of wireless towers who specialized in constructing towers that merge aesthetically into the local built environment: towers shaped like trees, designed as public art, or in the color palette of neighboring buildings.

Many of these individuals noted the lack of reliable public data about telecommunications and Internet services in Indian Country. Many also remarked on a critical discrepancy in federal subsidy programs. On the one hand, the federal government provides subsidies for building out basic landline telephone and 911 services to low-income and rural residents. Many residents of Indian Country are low-income and live in rural and remote locations, so this would seem to be a helpful option that tribes would want to pursue. On the other hand, the federal government also provides grants and loans for broadband Internet infrastructural build-out in rural and remote locations. The National Broadband Plan spells out a strategy for providing a majority of critical services—Internet, energy and electricity, economic development, citizen participation, law enforcement, education—across broadband Internet modalities such as WiFi, satellite, and fiber-optic cable, and less so through basic landline telephone infrastructure.

This positions cash-strapped tribes between a rock and a hard place. Acquiring basic phone service subsidies requires showing need and lack of telecommunications infrastructure, yet acquiring broadband Internet infrastructure subsidies requires showing demand and feasibility. This uncomfortable space—somewhere between total poverty and total possibility—is unfortunately a familiar space for tribal leaders seeking grants and loans. It is not unrelated to the colonial formation of an "Indian problem": colonial authorities will grant

rations if the people can prove death and devastating illness, but as soon as they demonstrate a bit of health, they are constrained by the bureaucratic red tape that maintains the disconnections imposed by the reservation system.

Summit organizer and tribal taxation lawyer Randy Evans later said that the 2012 conference was originally planned to be a small workshop for fewer than forty individuals. But word spread, and registration quickly mushroomed to more than a hundred participants, transforming the Tribal Telecom and Technology Summit from a workshop to a conference. FCC chairman Michael Copps spoke at the first conference, underlining a commitment that former president Bill Clinton had made during a 2000 visit to the Navajo reservation: the federal government has a responsibility to help tribes connect and overcome the digital divide. In 2013, due to a federal sequester, the FCC was unable to send representatives from its recently formed Office of Native Affairs and Policy. Nevertheless, conference registration and attendance at the 2013 summit were nearly triple the 2012 summit registration and attendance. Evans described how telecommunications and Internet service provider taxation topics alone are complex and important, a point underscored by Shana Barehand Green. I recalled that Traci Morris, director of operations for Native Public Media at the time, referred to unexamined vast and thorny tribal broadband policy issues, especially with regard to the sovereign rights of tribes, and how each tribe chooses to enforce and enact those rights given its political geography.

The Tribal Telecom and Technology Summit underscored not only the differing values and experiences shaping tribal decisions to pursue broadband build-out but also the common goal of building these infrastructures as tools in support of sovereignty and self-determination. As the 2012 conference progressed, speakers and participants noted that the call for "best practices" in infrastructural development seemed unrealistic; that every tribe seemed to identify its solutions for acquiring broadband and telecommunications services based on its own unique tribal histories, geographies, terrain, and existing levels of infrastructural access.

Thus in the case of tribal broadband deployment, the idea of place-based ways of knowing refers to not only ecological knowledge and tribal philosophies but also knowledge of the local political, social, economic, and technical terrain. At present there are more than 568 federally recognized tribes within US borders. This does not account for tribes that are state-recognized and those that are unrecognized by federal and state governments yet bear the rights of inherently sovereign Native peoples. In the years to come, each of these communities—tribes and peoples—will apply broadband access solutions

according to its technical capacity, unique landscapes, and needs. There should be more than 568 different solutions to acquiring broadband access in Indian Country.

Over the next few years, Tribal Telecom and Technology Summit organizers would embrace this finding, acknowledging that many voices contribute many inspiring and instructive experiences of tribal telecommunications and broadband deployment, from infrastructural concerns to application-layer creativity like Rezkast and streaming radio. They would also cleave firmly to a resolution foregrounding the experiences of presenters working for tribal sovereignty and self-determination and avoiding sales presentations by wireless vendors or how-to presentations by federal authorities far removed from tribal life on reservations. Likewise, as a researcher, attuning oneself to the nature of leadership in Indian Country—a leadership fully aware of US colonial mentalities and what it takes to work through and think beyond colonial expectations—opens up the potential for understanding how to design methodologies and garner insights that reflect Native experiences and perspectives.

Understanding the formation of the Tribal Telecom and Technology Summit as a forum designed by individuals invested in applying ICTs toward tribal sovereignty reveals another layer of social power enacted through sociotechnical infrastructural development. Network backbones, Internet service providers, and the accordant policies and practices represent such complex systems that it does indeed take many people to make them work. In the case of reservation-based systems, all those individuals become conscripted in one way or another into the pursuit of tribal sovereignty and self-determination. Those who obstruct tribal build-out of Internet and telecommunications infrastructure stimulate the organization of tribal advocacy groups and their allies, leading to the eventual formation of expert telecommunications policy advocates working across multiple reservation communities, multiple levels of government, and educational institutions and in Washington, D.C.

Through these conferences, one can see the opening of an industry in Indian Country, including a fair share of economic uncertainty, entrepreneurial acumen, big dreams, and technical know-how. On occasion, conference organizers and presenters would ask participants questions like, "Is this really happening? Do Indians really have a seat at the table for making these decisions?" Inevitably, the director of a successful tribal telecom or Internet service provider—perhaps Ruben Hernandez from Fort Mojave Telecommunications, Godfrey Enjady from Mescalero Apache Telecom, John Badal from Sacred Wind Communications, or Danae Wilson from the Nez Perce Information Technology

Department—would stand and affirm the reality of the digital overlay, its profitability, its potential for stable economic development, and the need for continual training and technical skill development.

PART 4. LAKOTA NETWORK: TELECOMMUNICATIONS FOR ECONOMIC SELF-DETERMINATION

While TDVnet and Red Spectrum Communications were designed around strong values of cultural sovereignty, and TDVnet incorporated elements of economic development, Lakota Network out in Cheyenne River Sioux country is equally compelling because of its stronger emphasis on telecommunications as a matter of economic self-determination. Several speakers and participants at the Tribal Telecom and Technology Summits mentioned that tribal investment in ICTs creates job skills, but the idea that ICTs might provide a means toward tribal economic self-determination is much greater than that. This idea of ICTs implies the capacity for a tribal community to embrace a life world wherein there is sufficient technical skill, demand, and supply of digital goods such that a tribe can gain a corner in a global telecommunications market. The Cheyenne River Sioux Tribe has managed to do just that. In 1958, the tribe established the Cheyenne River Sioux Tribe Telephone Authority (CRSTTA). One of the first 100 percent Native-owned telecoms, it was sponsored by the tribe but operated by a board of directors separate from tribal administration.

The Cheyenne River Sioux Tribe has enforced tribal sovereignty through negotiations with the United States for more than a century, and perhaps most famously through the 1868 Treaty of Fort Laramie. Awareness of representation and the power of infrastructure pervades the language of the treaty. Article XI requires that tribal signatories

> relinquish all right to occupy permanently the territory outside their reservations as herein defined, but yet reserve the right to hunt on any lands north of North Platte, and on the Republican Fork of the Smoky Hill River, so long as the buffalo may range thereon in such numbers as to justify the chase.

Article XI outlines seven requirements to which the "said Indians further expressly agree." The sixth requires that

> they withdraw all pretence of opposition to the construction of the railroad now being built along the Platte River and westward to the Pacific ocean,

> and they will not in future object to the construction of railroads, wagon roads, mail stations, or other works of utility or necessity, which may be ordered or permitted by the laws of the United States. But should such roads or other works be constructed on the lands of their reservation, the government will pay the tribe whatever amount of damage may be assessed by three disinterested commissioners to be appointed by the President for that purpose, one of the said commissioners to be a chief or headman of the tribe.

Since that time, the four bands of the Peoples of the Plains—the Mnikoju, Owohe Nupa, Itazipa Cola, and Siha Sapa—have negotiated with US and Canadian federal authorities and civil authorities through the states of South Dakota, North Dakota, Montana, Wyoming, Nebraska, Iowa, and Minnesota on matters affecting the right to access sacred sites, protect the homelands, repatriate artifacts, exercise religious freedom, and provide for the just and lawful treatment not only of the people of the Cheyenne River Sioux Tribe but also of the Native peoples of Turtle Island.

During the late 1960s and early 1970s, much organizing around the American Indian Movement (AIM) happened through the Nakota-Dakota-Lakota homeland. Keenly aware of the impacts of media and telecommunications, AIM organizers mobilized Native peoples and allies across Turtle Island through strategic radio and television broadcasts. The generation of Native leaders who are now running major political organizations, such as the National Congress of American Indians, and directing the operations of tribal colleges and other national-level forums were in their teens when the AIM occupation of Alcatraz and the federal government blockade at Pine Ridge were shown on television. Both of these broadcasts irrevocably shaped the nature and ethos of intertribal organizing and activism in Indian Country. The scholarly study of media representation continues to be a significant area of research in American Indian Studies.

The historical understanding of tribal media and ICT infrastructure as a mechanism for the enactment of tribal sovereignty also pervades the establishment of the Cheyenne River Sioux Tribe Telephone Authority. It was the first Native-owned company to utilize loans from the Rural Electrification Administration—one of President Roosevelt's many New Deal programs—to improve services for tribal residents. The establishment of the tribal telephone authority parallels the establishment of the tribal radio station. By the late 1970s, the telephone authority had a strong record of engagement with

the Rural Utility Services loan programs. For decades, CRSTTA leadership expanded the telephone authority, investing in the business as a tribal enterprise and training Native employees. A commitment to self-determination through tribal economic development fueled continual investment.

By the late 1990s, as the CRSTTA was establishing itself as an eligible telecommunications carrier with the FCC in accord with the 1996 Communications Act, telecommunications entrepreneur and CRSTTA manager J. D. Williams (Cheyenne River Sioux) was also challenging the South Dakota Public Utilities Commission's attempts to regulate the sale of telephone exchanges on reservation land as an infringement of tribal sovereignty. Around this same time, tribal IT specialist Gregg Bourland (Cheyenne River Sioux) began persuading tribal administrators to set up websites for their departments. While this proposal was met with doubts at first, over time, tribal administrators saw the benefits of Internet access and self-representation in the online environment. Within a few years, Bourland had advanced politically to become a member of the tribal council. He supported the development of a tribal department for the management of information systems. He also began working with Williams to think of ways to start up an Internet service provider for the tribe. After conducting a community assessment and writing a business plan, he and Williams convinced the board of directors to commit funds and allow employee training. Thus the Lakota Network was established as a regional Internet service provider. By the mid-2000s, the CRSTTA began laying miles of fiber-optic cable through the reservation.

Tracing the development of the Lakota Network over time reveals how the current infrastructure is an outcome of tribal leaders' many negotiations with state and federal authorities. Through infrastructure construction, tribal leaders enforced Cheyenne River Sioux rights to self-governance and self-determination as these relate to telecommunications. In that way, tribal leaders positioned federal support of telecommunications infrastructural loans to tribally owned business as part of the federal government's trust responsibility to US tribes.

Within a few years of establishing the Lakota Network as an Internet service provider, Bourland and Williams begin thinking about how to increase revenues to support additional infrastructural build-out and training so that the tribe could create businesses based in a knowledge economy. They drew up a business plan for hosting a credit card company's data management and backup services through the Lakota Network. Unfortunately, negotiations fell through when Bourland and Williams realized there was insufficient technical skill

among the reservation workforce. I appreciated learning about this dimension of long-term broadband infrastructural build-out; failures and false starts are also learning opportunities and encourage new perspectives on growth. Without a firm faith in a self-correcting future, it is possible to be overwhelmed by a false start. In this case, Bourland and Williams were seeking to create a future in which tribal citizens could flourish through knowledge work, becoming digitally engaged employees and businesspeople from their reservation community.

Thus Bourland and Williams learned from the failure, conducted another community assessment, and convinced the tribal government to invest in a community computing and training center that would focus on increasing the technical skill set of tribal members. While tribal members underwent certified training programs, Bourland and Williams drafted another business plan to spin off a data entry, document digitization, and digital records management company, Lakota Technologies, Inc. Their plan passed muster with the tribal council, the telephone authority board of directors, and the USDA American Recovery and Reinvestment Act grant and loan program committee. With funding from the tribe and the USDA, Bourland and Williams established Lakota Technologies, Inc. They also acquired prime data digitization contracts from the National Library of Medicine, the US Department of Defense, and other key partners. Williams has since retired, and Mona Thompson (Cheyenne River Sioux) now manages the Cheyenne River Sioux Tribe Telephone Authority. At this point in history, technical improvements to the Lakota Network occur through investments in Lakota Technologies Incorporated.[3] Figure 4.3 depicts the Cheyenne River Sioux Tribe strategy for acquiring broadband Internet access.

Like the Coeur d'Alene Tribe and the Southern California Tribal Chairmen's Association, the Cheyenne River Sioux Tribe established an affordable Internet service provider as a tribal enterprise. However, unlike Red Spectrum Communications and Southern California Tribal Technologies, the Cheyenne River Sioux Tribe Telephone Authority is primarily a for-profit business-driven model focused on investing in tribal ventures in knowledge work. The strategy for building out the Lakota Network and developing a robust broadband infrastructure on the reservation follows cycles of business planning, community readiness assessment, and opportunities for increasing the tribe's return on investment. The long-term plan is to diversify the tribal business portfolio.

By developing lucrative business partnerships, acquiring government contracts, and capitalizing on profits in order to attract government grants,

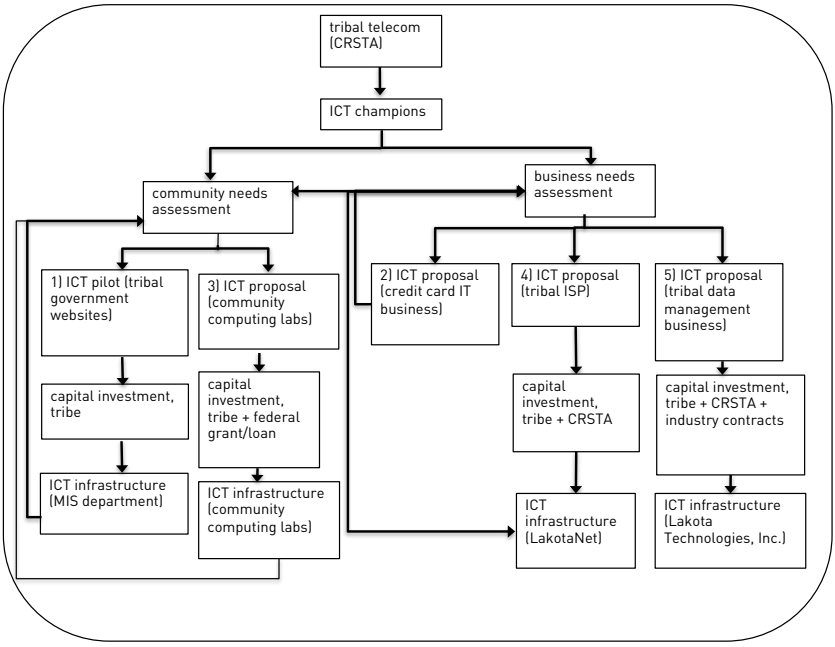

FIGURE 4.3. The Cheyenne River Sioux Telephone Authority engaged in business planning in addition to community needs assessment as leaders developed a strategy for acquiring broadband Internet. While their focus on community needs led to the development of their tribal government websites, management of information systems department, and community computing labs, their business planning led to a credit card billing business, which gave them the opportunity to grow the skill set for a tribal Internet service provider and, eventually, Lakota Technologies, Inc.

the CRSTTA is creating knowledge work opportunities for tribal members. The Cheyenne River Sioux Tribe's approach to leveraging telecommunications so as to bring in profits and create jobs on the reservation is a distinctive expression of economic self-determination. While self-determination refers to the right of tribes to design and implement their own social services programs for their people, economic self-determination refers to the right of tribes to support tribal enterprises that best meet community needs. The Cheyenne River Sioux Tribe's investment in broadband Internet services, geared toward economic self-determination, relates to the inherent sovereign right of the four bands of the Peoples of the Plains to live and work within their homelands.

This case is also helpful for revealing another quality about the stability of large-scale community-based ICT infrastructures. In many ways, the effectiveness of Lakota Technologies, Inc., is built on the effectiveness of the Lakota

Network, which was in turn built on lessons learned through both stable and riskier innovations and investments through the telephone authority. Similarly, the effectiveness of Red Spectrum Communications at Coeur d'Alene was built on lessons learned through the deployment of Rezkast. The effectiveness of the TDVnet built out of Pala was based on lessons learned through the deployment of HPWREN. This demonstrates that if a tribe already has some effective digital system or infrastructure in place, the path its ICT project team chooses for broadband deployment will be shaped in part by its experiences with the existing digital system and technical infrastructure.

In ICT circles, this reflects the sensation of "always being in beta," the concept that every project is a pilot until it becomes reliable and useful enough to serve as a staging ground—on the basis of either technical infrastructure or the accumulation of sociotechnical expertise—for another project. John Law and Bruno Latour refer to the exercises of power inherent in the accretional and cumulative design of sociotechnical systems, when the system begins to generate its own normative practices and rules of logic and customary order.[4] This is the calibration to which Richard Coyne refers, pilot technology projects—in these cases, accessible interfaces like tribal websites, landline phone services, and Rezkast—become communicative instruments allowing community members to become attuned to one another in new ways and also to improve the interfaces to meet community needs through regular work processes of modification and innovation.[5] Tribes who support the incubation of home-grown ICTs are thus also creating environments that allow for this community-level calibration. Here we see the appropriateness of a community informatics approach to system design, in which tribal communities that command the means for designing, deploying, and using sociotechnical systems also appear to have command over the ordinary, daily practices of calibration that integrate these systems into the local ecology of work practices.

Here we also see the need for Indigenous scholars to understand the ways global economic patterns shape decisions about tribal ICT investments and the access that Indigenous activist-advocates and students have to digital communications infrastructure. In one way, creating jobs on reservations that develop digital literacy is a necessary idea. Tribal residents can enjoy good jobs without having to leave the reservation, and if they do choose to go elsewhere for work, they will have a skill set that qualifies them for fair-paying jobs in the knowledge economy. This represents a goal for tribal leaders who are concerned with overwhelmingly high unemployment rates on reservation lands. From another perspective, however, Indigenous scholars worry about the reach

and influence of neoliberal markets in Native communities, particularly through prosumption, the willingness of social media users to contribute free labor through their social media use while media companies profit. ICTs certainly represent a world of possibility for the unjust neoliberal circulation of labor, bodies, information, and goods in world trade circuits. Many decolonization goals are fixed on the eradication of unjust neocolonial trade and labor practices and their replacement with alternative pathways to economic development, including local, environmentally sustainable, communal approaches. These kinds of questions make the study of ICTs critical in Indian Country. The leadership at the Cheyenne River Sioux Tribe Telephone Authority has undoubtedly supported moves for self-determination around telecommunications in Indian Country. J. D. Williams has testified many times before Congress and has made sure that the state of South Dakota does not profit unduly through exploitation of the rules of sovereignty. We have to ask ourselves how tribal command of ICT infrastructure and enterprises shapes tribal social, political, and economic power sharing under conditions of neoliberal colonialism. Having a greater vision of tribal ICTs as part of global economic circuits of trade helps us understand the span of these impacts as we weave broadband infrastructures into tribal landscapes. We should not shrink from these questions but, rather, embrace them as we allow the diffusion of digital devices through our homelands.

PART 5. NAVAJO NATION: REGULATING TO PROMOTE COMPETITION

Without a doubt, when tribes invest in large-scale infrastructures for public goods—waterways, electric power, transportation infrastructure, and communications infrastructure—they are also investing in creating a space for themselves in global markets. The build-out of the Lakota Network showed me the importance of tribal command of these kinds of infrastructures, from ownership, to citizen training and employability, to decisions on how to spin off associated tribal enterprises. Indeed, command of the infrastructure and ownership of the associated businesses are what allowed the Cheyenne River Sioux Tribe Telephone Authority to acquire contracts from the National Library of Medicine and other government clients. This highlights an important aspect of tribal broadband networks: though the design and development of tribal broadband infrastructures are community-based, the resulting Internet service provider is very much a business venture. Intertwined in political, cultural, and

legal terms, tribal sovereignty and self-determination are fundamentally about a people's right to provide for themselves in ways that best meet their needs. Indeed, designing a project based on the sovereign rights of tribes and values of self-determination represents one antidote to the so-called Indian problem.

But the "Indian problem" is multidimensional. It is the metaphor that elite classes in a white supremacist state utilize to describe the black box of Indian Country. It is a rhetorical trope that, in one phrase, capitalizes on societal ignorance about the specificity and diversity of many tribal nations, histories, philosophies, and landscapes. When tribal leaders work together to challenge this trope, pointing to dominant society for the cause of their exigency and then identifying home-grown solutions that work better than the self-serving solutions offered by members of the global elite, radical transformations are possible. New solutions emerge that center the needs and potential of tribal ways of life.

With regard to ICTs in Indian Country, one of the most well-publicized cases of tribal lack of Internet access began with a story about Myra Jodie, a teenager from the Navajo Nation who won a computer she could not use. That a teenager could not use a new computer in her home stunned an American public fascinated with its own burgeoning global digital reach. Media attention resulted in the Gates Foundation Native American Access to Technology Program, which benefited my own relatives on the Pascua Yaqui reservation and which I, as a librarian, had been following for years.

In the winter of 2012, I attended a session of the Tribal Telecom and Technology conference hosted by Navajo Nation Telecommunications Regulatory Commissioner Brian Tagaban. Tagaban had been a Cisco network administrator before he returned to Navajo Nation to encourage the tribal broadband buildout strategy. The Navajo Nation Tribal Utility Authority and the Navajo Nation Telecommunications Regulatory Commission are important cases for consideration because of the unique approach to tribal regulatory command of broadband infrastructure and the potential for broadband innovation and enterprise within Navajo Nation. Fitting the story of the Navajo Nation Telecommunications Regulatory Commission alongside the story of Myra Jodie's big win teaches us something about Native uses of ICTs in the popular imagination.

The story begins in 2000, when fourteen-year-old Myra Jodie used a computer at her school on the Navajo reservation in Arizona to enter a contest for an iMac. Actor Jeff Goldblum was advertising the iMac's ease of use: plug and play, hard drive and monitor in one, a good fit for every home with a phone line. But Myra's family did not have a phone line. The San Jose–based contest

sponsors traced her home address and from there contacted her school. However, once the iMac was delivered, there was still the problem of the phone line. What use was this computer in a place where electricity was at a premium, and where Internet access was limited to a few machines at the school?

Myra Jodie's contest win became iconic for digital divide advocates. Former president Bill Clinton recognized the incredible divergence in access highlighted by this case. In April 2000, he became the first US president to visit a reservation, the Navajo Nation, where he specifically addressed issues of the digital divide in Indian Country. While Apple was airing ads showing how easy it was to plug and play on a bright-hued Mac, here was a story of a young person who owned a Mac but could not easily get access to a basic phone line. In response, community development program officers at the Bill and Melinda Gates Foundation, the corporate giving branch of Microsoft, implemented the Native American Access to Technology Program (NAATP), through which the foundation would provide Microsoft hardware, software, training, and funding for setting up local area networks for US tribes.

However, the rural tribes of the Four Corners region—where the corners of New Mexico, Arizona, Utah, and Colorado meet—posed unimagined problems to NAATP managers. Local area networks were either impossible to set up or unaffordable in locations without cables for landline phone service or, in some cases, electricity. While NAATP technicians synced expensive satellite hookups and hosted community training sessions, tribal personnel wondered to what end they would make use of these costly machines when their analog work practices were already well suited to tribal daily life. NAATP officers noted in a mid-point project evaluation that every tribe they encountered spoke of the incipient "smoldering conflict" in border towns and schools that was in part a factor in community concerns about adopting potentially exploitative ICTs. By the time funding for satellite Internet access ended, many of the tribal communities had resorted to managing the computers in a somewhat limited fashion. In a final report, somewhat overwhelmed by the complexity of their effort, NAATP officers concluded, "We know that we still have more to learn, so we are concentrating on the work ahead of us before we decide whether to expand our scope. We do know that the Gates Foundation and those of us who work for it have benefitted greatly from this program. Our perspective and understanding has broadened and deepened. We believe the best way we can honor the inspiring efforts of the tribal libraries and librarians we have met is to share our story and to support their work." Unfortunately, in Indian Country, this kind of refrain is common. It as if "our problems" are too complex for a

quick fix, such that obstacles are more like endemic conditions than solvable problems. I detected elements of an "Indian problem," in which justice-oriented members of the privileged class either ignore or cannot perceive or make sense of the impacts of colonialism in their diagnosis of why and how charitable projects fail. These kinds of diagnoses often pin the problem on the tribal peoples themselves, hence the regenerative violence of the "Indian problem" and projects designed to cure it.

However, while the Native American Access to Technology Program was attracting mainstream media publicity, in other parts of the Navajo Nation, tribal ICT champions were drafting a proposal to acquire technology contracts from the US Department of Defense and partnerships with HPWREN, the TerraGrid project, and the US Department of Energy. These contracts would lead to investment, including training, equipment, and lab space, in Navajo Technical College, a two-year institution focused on increasing the technical capacity and employability of Navajo Nation residents. Learning in part from challenges encountered through the NAATP, and also in line with Navajo Nation goals to support educational and economic opportunities for tribal members, they wrote the Internet to Hogan plan, a ten-year initiative to install the largest wireless mesh network on a reservation through chapter houses and other key anchor institutions. Since well before the famed achievements of the Code Talkers, the people of the Navajo Nation had been working on what would now be considered cyber-security and protection of the land through intelligence gathering and policy making. Sticking close to the long-term plan to embed Navajo Nation with a durable ICT infrastructure and support the technical advancement of the Diné people, the Navajo Nation Tribal Utility Authority has moved on to another phase of broadband deployment, a fiber-to-the-home project funded in part by a USDA Broadband Initiatives Program grant and loan award. The nation also split up ownership and regulatory oversight of acquiring broadband Internet access for tribal peoples by establishing a separate Navajo Nation Telecommunications Regulatory Commission.

Soft-spoken and knowledgeable, Tagaban developed his business and technical acumen working at Cisco as a network administrator. He returned to Navajo Nation to serve on the regulatory commission, guiding the nation on matters related to the close connection between technical and policy decisions around broadband network design, deployment, and use. Unlike the broadband deployment strategies of Coeur d'Alene, the Southern California Tribal Chairmen's Association, and the Cheyenne River Sioux, Navajo Nation has not started its own profit-making Internet service provider as a tribal enterprise but rather

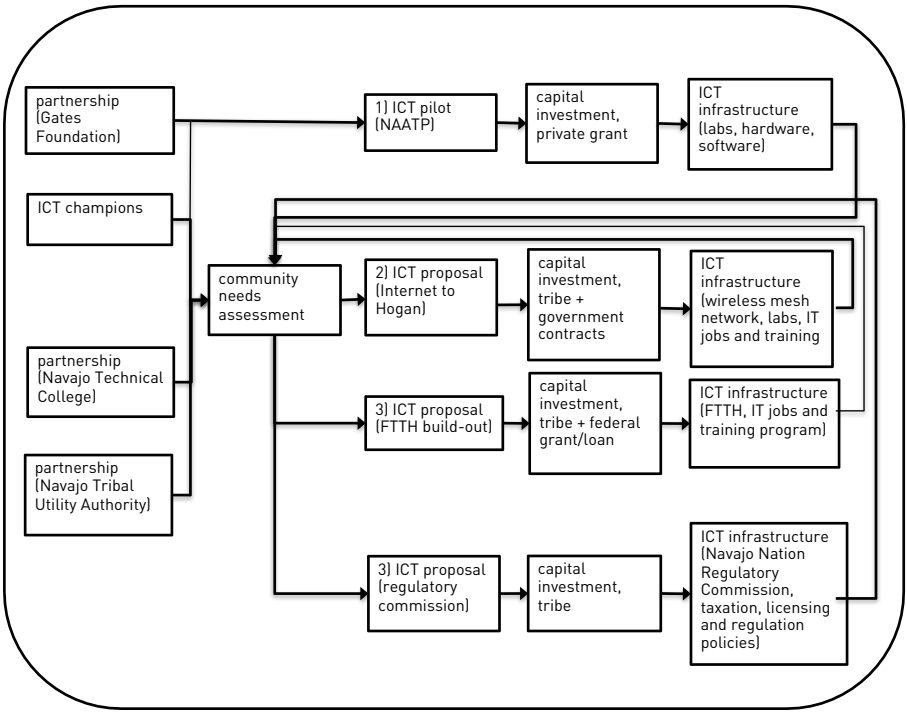

FIGURE 4.4. The Navajo Nation implemented its strategy for acquiring broadband Internet infrastructure through multiple partnerships. ICT champions considered the outcomes of the Gates Foundation Native American Access to Technology Program in addition to community needs assessments, which in turn led to the Internet to the Hogan plan, fiber-to-the-home build-out, and tribal telecommunications regulatory commission.

has chosen to take ownership of the infrastructure and regulation of its use while taxing external Internet service providers that use the reservation's broadband infrastructure.

The goal of this approach is to promote local competition among service providers, many of whom, given access to durable reservation infrastructure, receive federal and state subsidies for improving access across the neighboring states and rural counties of Arizona and New Mexico. The increased competition can lead to lower pricing for residents of the nation and also relieve the tribal utility authority and regulatory commission so they can continue focusing on infrastructural build-out, enhancements to Navajo Technical College, policy work, and job creation and training. At the 2012 Tribal Telecom and Technology Summit, Tagaban indicated the complexities of having to both train and certify IT specialists as network database administrators, which is

technically a whole new ball game, while keeping track of broadband policy changes at the national level as they interface with changes at the tribal level. He split his time between training, updating chapter house leaders and key tribal broadband partners, and drafting and tracking policies to keep the broadband deployment efforts in motion. Figure 4.4 depicts the Navajo Nation's strategy for acquiring broadband access.

Like the Coeur d'Alene, Navajo Nation is one tribe and one people. Unlike the Coeur d'Alene, however, Navajo Nation decided not to set up an Internet service provider as a tribal enterprise but rather to invest in durable infrastructure and regulation in order to incentivize competition among regional service providers. Like the Southern California Tribal Chairmen's Association, Navajo Nation acquires access to infrastructure, hardware, and software by leveraging partnerships through educational institutions. However, although the SCTCA and Navajo Nation both must deal with agreements across jurisdictional lines, the boundaries are distinct: intertribal and inter-institutional in the case of SCTCA and intratribal and interstate in the case of Navajo Nation. Like the Cheyenne River Sioux Tribe, Navajo Nation emphasizes ownership of infrastructure and acquires large government contracts and federal subsidies that support infrastructural build-out and technical training.

The difference between the two is that Navajo Nation emphasizes greater tribal government telecommunications regulation than does the Cheyenne River Sioux Tribe. The Navajo Nation strategy can be characterized by intratribal institutional alignments focused on technical advancement for the nation through ownership and regulation of broadband infrastructure, but not necessarily through ownership of a tribal Internet service provider. Navajo Nation's strategy promotes affordability of Internet services by means of competition and regulation. When I think about the expanse of the Navajo Nation, which is spread across states, I can most appreciate this solution. Like the SCTCA, it must retain flexibility so that it can run fiber and stream signals across such a diverse geopolitical terrain. Moreover, as a tribal nation with a landmass larger than many eastern states, a high number of college and graduate school graduates, and a technical university, with the right leadership in the years to come its members may increasingly be able to position themselves as leaders in digital and design innovation within Indian Country.