

**Network Sovereignty:
Understanding the Implications of
Tribal Broadband Networks**

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Abstract

For tribal leaders, bringing reliable, affordable broadband Internet service to Indian Country is a matter of self-determination. At this point in history, tribal leaders enforce the sovereign rights of tribes by communicating through information and communication technologies (ICTs) mobilized to work across powerful institutions. Tribal leaders who command the processes of broadband Internet deployment within their communities increase their capacity to support the health of tribal lands, waters, and peoples. Whereas freedom of expression and the exercise of all other human rights through the Internet is a human right, and the infrastructure for connecting to the Internet is essential for citizens to self-govern, so does the U.S. federal government, under obligation of the trust relationship they share with federally-recognized tribes, have a responsibility to support the deployment of broadband Internet infrastructure—including networks, devices, spectrum, technical expertise, and policies—throughout Indian Country. This qualitative inquiry reveals how tribal leaders who deploy broadband Internet to their communities must contend with national telecommunications policy, neighboring deployment strategies, regulatory matters, and the development of steady revenue streams to advance robust broadband network design and services. As each of these intersects with the sovereign rights of tribes, it is possible to conceptualize sociotechnical dimensions to future exercises of tribal sovereignty.

Acknowledgements

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and helps us think and learn.

Preface

Lios enchim aniavu. Inepo Marisa Elena Duarte. In hapchi Marco Antonio Duarte into in ae Angelita Molina Duarte. Vempo Mesillapo hoak. In wai Carlos Antonio Duarte into in wai Micaela Calista Duarte into in wai Alejandro Antonio Duarte. Vempo Austinpo hoak into Mesillapo hoak. I write for my relatives.

The word is bound to the breath, and the breath is bound to the spirit. The spirit suffers daily from living in a strange city far from the homeland, far from the love of the family, of the people, of the ancestors and the children of the beings who have been there since the day of being born into this world.

The word is a loose bead running on a cord connecting the breath and the heart and the mind. The mind is filled with ideas, and these ideas are like stones. The stones are the children of the earth's fine inner workings, upheaved from mountains and polished smooth by rivers, oceans, and winds. Every stone belongs somewhere. Every stone comes from somewhere. Eager to please each other, human beings rush about filling their heads with ideas the way children fill a basket with stones when they go scrambling about the desert or the rocky beach. At times I would take breaks from thinking about this work and walk to a section of Cabrillo Beach, a shoreline within the original homelands of the Tongva people, off the southern coast of Los Angeles, and listen to the ocean tumbling rocks against the shore. Children throw rocks at each other out of curiosity and spite. Adults throw ideas at each other out of curiosity, and sometimes also out of spite. We can forgive a child throwing a stone. It is much more difficult to forgive an adult for hurling a monstrous idea at another human being. When teaching students about racism and colonialism, I remind them, 'you are educated human beings. Remember that your job is

to promote knowledge and wisdom, and not ignorance. Even top professors are capable of fomenting ignorance.’

I took risks in assembling the many ideas comprising this work. I based this work on the following risky ideas:

- 1) Human beings are also herd animals. They are capable of organizing beyond the level of the individual. They orchestrate activity at the level of a community, and articulate their identities based on geopolitical locations and status. En masse, they become swept up into communal systems of belief.
- 2) Human beings are inherently creative. They create systems and structures in this world through the use of tools. The physical manifestation of these systems and structures reflect human beliefs over time.
- 3) The present-day use of the word ‘technology’ is laden with present-day beliefs about progress, scientific and ethical advance through computing, and the superhuman conquest of time, space, history, and environment. There is a belief that being able to speak in code, i.e. programming code, parallels decoding the human genome, and the dark matter of the multiverse, and that somehow, this process of coding and decoding is meaningful for all mankind. These beliefs derive from a Western European Enlightenment history of ideas. Like a magic bullet, the word ‘information’ can at once comprise programming code, genetic code, and the nearly immeasurable mass that one

nanoparticle passes off to another when they collide in the vacuum between all other known and measurable sub-atomic particles.

- 4) The large-scale forces of Western European modernity have resulted in the creation of a global class of humans referred to as ‘natives’ or ‘indigenous’ persons. Across modern nation-states, that particular nomenclature refers to a particular historiographical moment, when particular nation-state authorities were charged with classifying all resident human beings as subjects or non-subjects, citizens or non-citizens, slaves or workers, etc. The words ‘Native’ and ‘Indigenous’ are embedded with a tension of belonging and yet not belonging to the modern nation-state. For an American Indian, it is to be called by all non-Natives an alien within one’s own physical homeland.
- 5) Various fields of science are at present dominated by those who believe that techno-scientific advance must come from a Western European history of ideas, and not from, for example, Tsalagi histories of ideas, Yaqui histories of ideas, Zuni histories of ideas, Anishinaabe histories of ideas, Chamorro histories of ideas, etc. Only recently have a few scientists working within their universities come to agree that Native ways of knowing comprise a source of scientific understanding. Native ways of knowing, indigenous knowledge, Native systems knowledge, all of these phrases are referring to a complexity of understanding of the human universe. As scientists—and especially as

information scientists—we are only at the beginning of our understanding.

I'm Yaqui. I'm a woman writing in the sciences. I write far from home, which is a source of strength, and I am writing through a field that, thus far, is inadequate in terms of language and theory for scoping the lived realities of present-day Native and Indigenous peoples. If the word is a loose bead on a cord connected to the breath, the heart, and the mind, and I am trying, from my lived experience and ways of knowing, to share that word (or words) with another human being who does not share the same ethical orientation (heart) or ways of problem-solving (mind), then what can be the significance of the word I seek to share?

The risks I have taken as a thinker are lesser than the risks I take as a writer, assembling these ideas like rocks into a basket, which I now present to you, in this form as a dissertation. This is the nature of writing. Once a story is loosed into the world, it no longer belongs to the writer. It belongs to those who hear it, and especially to those who retell it. At a certain point I can no longer insist on what is right and wrong about an idea that I have written. I can only say, 'I thought quite a lot about selecting this particular idea, and explaining it in this particular way.' The rocks get taken from the basket, broken into smaller pieces, polished up, or assembled into the baskets of others.

But what about the basket? That is the real contribution here. I am weaving a container for others to re-use. What might the Native and Indigenous peoples of the world have to say about their experiences with information? What might those experiences teach us about the ways we conceptualize this ineffable, somewhat immeasurable phenomenon we pursue, which we are calling information?

I pray for the words to have meaning, for the writing to be clear, and inspiring. As the methods are true, so is the writing here.

Readers should know that I have changed the names of select participants, out of respect for their privacy, and for their willingness to share their personal experiences with me. I have preserved the names of those individuals who are public figures, and whose expressions on their area of expertise are publicly available online, through conference workshops, and through published articles and policy papers.

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Introduction

On December 22, 2012, I was writing from my family home, around thirty minutes from the United States-Mexico borderline. I was assembling the case studies for this present work, reviewing ways tribes built broadband Internet networks into their reservation. The sun was hot and bright. The cotton fields were dry and studded with the knife-sharp stalks of the summer crop.

I took a break. Several stories on my Facebook newsfeed caught my eye: Natives all over the U.S. and Canada were organizing flash mobs to protest Canadian Prime Minister Harper's plans to break treaty obligations in favor of constructing a transborder oil pipeline and tar sands project. Native peoples drumming under the banner of Idle No More were protesting in malls, parks, and college campuses throughout Albuquerque, Tucson, Minneapolis, Los Angeles, Seattle, and Vancouver. Chief Theresa Spence of the Attawapiskat First Nation commenced a hunger strike. In Mexico, the Indigenous peoples' collective Ejército Zapatista de Liberación Nacional was marching en masse through Mexico City, protesting against the unjust and immoral capitalist economic development policies and drug cartel violence promulgated through the administration of Mexican President Peña-Nieto. My own tribe in Sonora, Mexico was blockading the city of Guaymas. Two years before, a young man from the tribe used his smartphone to record state police beating up tribal people for hauling water from a dam diverting water from the river that runs through my people's sacred homelands. The state government agreed that the dam had been built without appropriate tribal consultation, and in return, offered to pay for university scholarships for all tribal youth. Record numbers of young people applied and got into school. The state government reneged, and refused to pay the

tuition. Independent journalists posted photos online of the tribe parking semi-trucks to block all roads in and out of the city of Guaymas. No more than an obscure myth for most Americans, December 22, 2012 marked the end of a 500-year cycle according to the Mayan Daykeepers. But for the Indigenous peoples of the Americas, this date predicated a beginning, an opening up.

Never before had I seen this level of orchestrated Indigenous political organizing via social media. I had read the works of theorists who predicted it would happen. Many times I had imagined how it would happen, how it would look. Mostly arguing from a U.S. context, Native and Indigenous scholars have argued for Native peoples to frame the contemporary relationship between recognized tribes and the nation-state as one based on the need for Native peoples to leverage self-determination toward building a just world for Native peoples with regard to, and in spite of, ongoing colonization. Policies of sovereignty and self-determination are to be understood as stepping stones toward a more flexible, morally Indigenous vision of governance. (Alfred, 2005) At present, and in part due to the way that information and communication technologies (ICTs) have shaped U.S. domestic and global hegemony (Castells, 1997; Howard, 2010; Tehranian, 1999; Tully, 2008), the leaders of Native nations must understand how information flows, the disciplining and transfer of knowledge, and technological innovation function within the multivalent power dynamics of the contemporary colonial arrangement. More fundamentally, this means understanding when, where, and how autonomous Indigenous peoples can leverage information flows across ICTs to meet social and political goals, in spite of the forces of colonization. (Deloria, 1978) While the protests of December 2012 represent a particularly striking mode of political organizing and government

interactions, Native and Indigenous peoples have endured centuries of colonization as a result of daily ordinary habits of sharing information and ways of knowing with each other, workmates, allies, and friends.

In this dissertation, I assert that the tribal command of broadband infrastructures represents one way that Native peoples leverage ICTs toward accomplishing distinctly Native governance goals. While these goals are particular, and depend on the ways that each tribe approaches their mode of self-government, because of the future U.S. reliance on broadband as a means of interacting with citizens and administration, tribal leaders will want to make sure that at minimum, tribal administration buildings, schools and libraries, are able to receive robust and affordable broadband Internet services and devices, including wireless capabilities. As governments, tribes possess the means for acquiring the infrastructure and services that make mobile devices work from deep within Indian Country.

I designed the presentation of this written document with three requirements in mind: 1) to complete a doctoral degree in information science at the University of Washington Information School; 2) to weave Native and Indigenous thought more firmly and productively into the field of information science; and 3) to share what I've learned thus far with my colleagues in the Indigenous Information Research Group. We have work to do, getting our people connected.

Chapter 1. Reframing ICTs in Indian Country

In 2005, Maori scholar Makere Stewart-Harawira published her book on Indigenous responses to globalization, from a Maori perspective. She wrote that no theory that cannot account for the political exigencies of Indigenous peoples may be considered complete.

I read Harawira's book in the late fall of 2009 as I was searching the disparate literatures of information science, sociotechnical studies, and Native and Indigenous studies for any theories that could describe or explain Native peoples' experiences with information and communication technologies, or ICTs. Sitting at a gray desk on a gray carpet, staring at a screen saver during a gray day in Seattle, I set down Harawira's book, and realized I needed to seek answers elsewhere.

That decision was important, because it allowed me to stop struggling with the gaps in the literature. I felt as if I had been piecing together a quilt out of broken thread and not enough fabric. What was most frustrating about that experience, was that in spite of the gaps in the literature, I could speak freely with my colleagues in the Indigenous Information Research Group—Miranda Belarde-Lewis (Zuni/Tlingit), Sheryl A. Day (Chamorro), and Allison B. Krebs (Anishinaabe)—about a range of issues that Native and Indigenous peoples were undergoing with regard to media misrepresentation, lacking information critical to self-governance, and moves for autonomy borne through digital media channels. While the published literature was yielding a few narrative threads, really, it was through our talking together and thinking together that we had begun weaving a new way to think about Native and Indigenous peoples' experiences with information.

Indeed, it was during a visit to my late friend and colleague Ally Krebs's apartment that I realized we were on the right track in our new way of thinking. A few months before I had stumbled across a book by Mexican American philosopher Manuel de Landa, in which he described institutions as crystallizations of human ways of communicating amongst each other and within their environments (1997). I most appreciated this idea for how it echoed Native notions of creation, in which all forms that come into existence are understood as the outcomes of an endless cosmic dynamic, of which humans comprise a very small part. To create is to bring into being. Any object created by human hands is actually a physical manifestation of generations of conscientious human experience within a homeland. (Deloria, 1999)

I was pleased (but not surprised!) to find that Ally had been reading the same book, although what she resonated with was the use of geologic time and metaphors to explain human societies. Many years before, Ally had been searching for a way to fit the study of American Indian philosophies within the narrow catalog at Yale University, and found that a geology degree allowed her to complete her studies in this world. She traveled to the Mayan homelands to study the stone carvings of ancient Mayan scribes. It was there that she experienced the close tie between human philosophies and their visual manifestation through the close relationship between the creator, or scribe, and that most solid element of the earth, granite.

For Ally and me, the difference between Mayan ancestors inscribing prophetic histories on a rock face and Zapatista Subcomandante Marcos issuing cyber-communicés via airwaves was in the choice of the media and the desired impact. Across centuries, the drive toward Mayan autonomy is the same. The philosophies are resilient,

explanatory, and intact. The peoples are connected, and waiting for the messages. Generations ago, Mayan ancestors learned a language, assembled a set of tools, and carved meaning into a rock face. Generations later, their granddaughters learned to program, assembled a series of laptops and radio equipment, and carved meaning into the airwaves flowing from the mountaintops of Chiapas to homes in Chicago, Mexico City, and Los Angeles. The premise of Laguna writer Leslie Marmon Silko's (1994) prophetic narrative Almanac of the Dead is of a network of tribal coalitions working toward a total spiritual reclamation of the Indigenous Americas. (Romero, 2002) Weaving de Landa's ideas alongside our own, we began thinking, how might these intertribal networks physically manifest?

At present, there are no published theories or conceptualizations within the fields of information science or Native and Indigenous studies that center Native and Indigenous peoples' experiences with ICTs. There are descriptive studies. (Casey, et al, 1999; Morris & Meinrath, 2009; Office of Technology Assessment, U.S. Congress, 1995; Riley, et al, 1999) There are narrative accounts. (Dorr & Ackroyd, 2001; Dyson, et al, 2007; Gordon, 2001; McMahon, 2011; Morris & Meinrath, 2009; Richardson & McLeod, 2011; Stevens, 2007) There are approaches from the fields of communications and anthropology. (Bissell, 2004; Buddle, 2005; Busacca, 2007; Chapin, 2005; Frank, 2001; Hepler, 2009; Landzelius, 2006; Mander, 1991; Srinivasan, 2004; Wilson & Stewart, 2008) Yet none of these attain a level of detail that capture the richness of an Indigenous sociotechnical experience. Part of this has to do with the unfortunate intellectual inheritance of an idea that Native peoples are pre-modern and anti-technological. (Mander, 1991) This colonizing logic most often emerges from works by elite

nationalists of technologically advanced and rapidly industrializing countries, for whom science and computing technologies have become intertwined with notions of progress. (Kroker, 2004) It is this same logic that compels nation-state elites to relocate or eradicate Native peoples because the value of their ‘indigenous knowledge’ or ‘traditional knowledge’ is greater on the world market than is the freedom of the Native peoples to live in right relation within their homelands. It is this same logic that blinds scientists from being able to see Native approaches to design, storytelling, medicine, and food practices as modes of communicating information and knowledge critical for human survival and resiliency across generations.

In the fall of 2009, I was very much aware that I was attempting to write about Indigenous approaches to ICTs in Seattle, one of the top tech cities of the world, ironically named after the leader Chief Sealth, whose peoples’ homelands continue to be unrecognized. I realized I needed to step away from the university, and open my senses to hear the stories of ICTs coming from within Indian Country. I needed to see the landscapes around me as an overlay of digital interactions interlacing homelands cultivated by the hands of Native peoples working together over centuries. I realized I was no longer piecing together broken fragments, but rather, was weaving together many narrative threads, including that of my own as a Yaqui information scientist working through the colonizing logics built into the research university environment.

I adhered to Smith’s (1999) handbook Decolonizing Methodologies, a book written for Indigenous researchers seeking to heal colonial traumas in Indigenous homelands. I selected reframing as the guiding methodology for this work. Reframing is a process through which a social problem often diagnosed as ‘an Indian problem’ is

subverted to show how it is actually an outcome of overlapping patterns of colonization. (Dyck, 1991; Hays, 2007) In this case, prior studies were diagnosing limited Internet access on American Indian reservations as an outcome of the inadequate infrastructure, remote geography, and insufficient market demand endemic to reservation life. In other words, limited Internet access on reservations was an ‘Indian problem.’ I was unsatisfied by these prior descriptions of Native uses of ICTs because they did not account for the exigencies of tribal sovereignty, histories of self-determination, and the reservation system. In the spring of 2011, I commenced an exploratory qualitative study into the Native uses of ICTs, specifically with regard to how these intersect with expressions of tribal sovereignty.

Within a year, the study had blossomed into an iterative qualitative study consisting of four stages, and specifically focusing on the deployment of tribal broadband Internet networks: the large-scale ICT infrastructures that enable the functioning of smaller, localized information systems and devices. Figure 1 depicts how these stages frame each other.

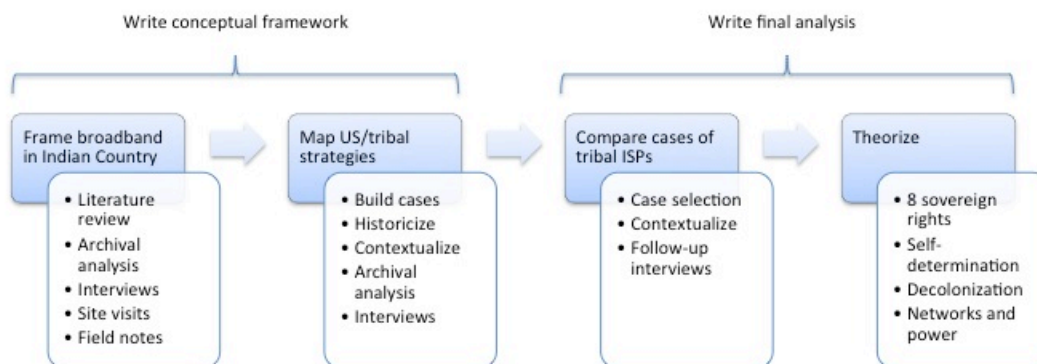


Figure 1. Method of reframing the case of tribal broadband Internet networks

The first stage consisted of reframing understandings of ICTs in Indian Country, and specifically of broadband Internet networks in Indian Country. In the second stage, I mapped tribal strategies for acquiring broadband Internet access against the backdrop of U.S. federal broadband deployment efforts. In the third stage, I compared four cases of self-sustaining tribal Internet service providers (ISPs). In the last stage, I took a step back to gain a sense of the bigger picture. How do tribal broadband networks intersect with theories of the sovereign rights of tribes, and ongoing self-determination and decolonization efforts? What does the case of tribal broadband networks reveal about information scientific accounts of how power operates across ICT infrastructures?

To acquire data, over three years, I reviewed the literature on ICTs in Indian Country. I attended workshops and conducted interviews and site visits with people acquiring broadband for reservation communities. I conducted archival analysis: reviewed policy papers, broadband grant and loan applications, and infrastructural deployment plans. I built case studies out of narrative accounts of tribal Internet service provision efforts. I was compelled by visualizations of network maps, anecdotes of intertribal political organizing, southwestern Native peoples' stories of Spider Woman, and the understanding of broadband network towers emerging out of peoples' generations-long relationship within living landscapes. I developed an eye for seeing pieces of ICT infrastructure in every reservation I visited and at every Native convening I attended. I followed the ways people used devices like smart phones and tablets, and I collected ephemera on Native websites, ICT businesses, and artworks. I treated the methodology of reframing as the construction of a loom holding the narrative threads in place. My writing became a design process. The ability to step back and theorize became

a matter of gazing upon a fabric woven out of people's experiences written within the histories of particularly Indigenous sociotechnical landscapes.

By the second stage of the research, I had gathered sufficient evidence to recognize that the narrative threads were revealing strategies tribal leaders had developed to acquire broadband Internet access for their reservation communities. I began identifying the problems that these strategies generated and resolved, as well as the social and political impacts of these strategies. I could see that, in sum, these strategies help us to foresee, as information scientists and as scholars of tribal sovereignty, the implications of deploying a major U.S. ICT infrastructure across sovereign tribal lands.

Ultimately, I found reframing to be a powerful methodology because it has allowed me to surface accounts of Native peoples pushing beyond the colonial boundaries that have curbed their ability to share information and knowledge through the media of ICTs. It has allowed me to reveal how the ongoing build-out of the national broadband Internet infrastructure depends on the participation of sovereign Native nations. It has also allowed me to understand broadband Internet infrastructures as a technology integral to the flourishing of Native peoples.

Chapter 2. The Overlap Between Technology and Sovereignty

In the summer of 2011, I commenced an exploratory qualitative study into tribally-centered ICT projects. I sought interviews with people working with or developing digital information systems designed to support the exercise or enforcement of tribal sovereign rights. My goal was to articulate instances where ICTs and sovereignty interrelate within the boundaries demarcating Indian Country.

I defined ICTs as digital devices that function as part of a larger system of people and devices to circulate information essential to the integrity of the hosting institution or organization. I conceptualized landscapes—and especially urban landscapes—as laden with invisible interconnected and at times disjointed systems of digital devices transmitting continuous streams of data and information from one server to another.

At the time, I was leveraging a loose definition of tribal sovereignty. Around nine months prior, I had been working with my colleagues in the Indigenous Information Research Group to articulate the significance of information for tribal governments. From an operations standpoint, tribal governments are departmentalized into units, including health services, land management, education, member enrollment, law enforcement, etc. Each of these units have systems for sharing information between each other, with institutional partners, and with the federal agencies that support operations through grants and loans. For example, a tribal clinic may build information systems to report local statistics to Indian Health Services, the Centers for Disease Control, and also to the tribal council for the purposes of informed decision-making. Our research group had been conceptualizing phenomena associated with the obstruction of information flows

essential for the governance of a tribe, including when federal authorities or other partners misinterpret, misuse, or harness information to exploit tribal governments.

A well-known example of this is when the Havasupai Tribe partnered with researchers at Arizona State University in Phoenix to track incidence of diabetes among the Havasupai people. Study participants donated blood samples, understanding that the researchers were looking for genetic markers for diabetes. But the researchers had a different program in mind, and began testing the samples for incidence of mental illness and inbreeding. Operating within a frame of biological determinism, they asserted that the blood showed that the Havasupai people were not entirely Havasupai. Treating the blood as pure information—removed from context, devoid of significance beyond that of the ASU lab—the researchers objectified the samples and attributed them with values far removed from the desert canyon philosophy of the Havasupai people. Worse, the ways of thinking that shaped the interpretation of the test results bore a colonial mindset, with the Indians depicted as socially inferior and unwell, while the purportedly technologically superior university researchers gained credit for their advancement of genetic science.

As Indigenous students of information, we recognized what had happened, how a peoples' blood had been reclassified as information, and how that reclassification allowed the state university researchers to treat the Havasupai people with inhumanity. We also recognized how the cultural sovereignty of the Havasupai people—that is, the reality of their existence as a self-governing Native peoples free to live by their ways of knowing developed over millennia within the ecologies of their homeland—would ultimately overpower whatever ill-educated results the researchers had prepared. Indeed, people within the Havasupai community partnered with documentary filmmakers to tell their

side of the story. A lawsuit was filed. Tribal people spoke to journalists about the mistreatment they had experienced. The researchers were defamed for their breach of research ethics.

Working from a conference room at the University of Washington, those of us in the Indigenous Information Research Group began considering how to convey to tribal leaders the importance of protecting tribal peoples' data and information as a matter of the integrity of tribal ways of knowing and modes of self-governance. Interpreting tribal sovereignty from a protectionist stance, we began considering how the political and legal sovereign rights of tribes, centered around cultural sovereignty, might be leveraged to protect against the misuse of tribal data and information. We were working with fairly malleable definitions of information and sovereignty.

At its most minimal, tribal sovereignty may be understood as the dynamic relationship between the will of a people to live by the ways of knowing they have cultivated over millennia within a homeland, and the legal and political rights they have negotiated with the occupying federal government. Others have distinguished these as cultural sovereignty and legal/political sovereignty. At present, federally recognized tribes within the boundaries of the United States exercise the following eight rights as sovereign governments: the rights to self-govern, determine citizenship, and administer justice; the rights to regulate domestic relations, property inheritance, taxation, and conduct of federal employees; and the right to sovereign immunity.

For tribes, sovereignty refers to the integrity of a people, as well as to the integrity of their government. It is important to distinguish between the two because at present many Native and Indigenous peoples live under an imposed and therefore negotiated

form of government, in which there is a clear memory of how Indigenous modes of self-governance differed from the colonial form of government. To retain this memory, a free and autonomous Native people share information among themselves and with neighbors to strengthen their knowledge of their homeland, shared history, Native language, ceremonial cycle, and lineage. The leaders of a sovereign tribal government also share information among themselves and with the leaders of neighboring governments to strengthen the tribal capacity to self-govern, determine citizenship, administer justice, and so forth.

When I entered the field in the summer of 2011, I understood how integral information-sharing is for Native peoples and for tribal government leaders, but I didn't understand precisely how information and sovereignty interrelate. Specifically, I did not realize how completely tribal sovereignty shapes daily work in Indian Country, and also how integral ICTs are for circulating information critical to the daily exercise of sovereignty.

That summer, I drove from Tucson, to Phoenix, to San Diego, and interviewed by phone and in-person nine individuals working on a range of projects, from tribal radio stations to oral history websites, law enforcement information-sharing centers, databases for tribal governance practices, tribal broadband policy-making, and network certification programs. My goal was to sensitize myself to dimensions shaping the interaction between exercises of sovereignty and uses of ICTs.

KPYT-LPFM: The Operations Behind ‘The Voice of the Pascua Yaqui Tribe’

I began by speaking with Victor Wright, the manager at my own tribe’s new radio station, KPYT-LPFM, which, at the time, had just set up a streaming radio program. The station is housed in the old smoke shop, an adobe-style building beside the tribal casino about twelve miles south of the desert city of Tucson, Arizona. The station placard bears the turquoise and red colors of the Pascua Yaqui tribal flag, with the black and white outline of a radio tower pointing to the sky. Victor and I enjoyed a conversation about the beginnings of KPYT-LPFM from his office between the media and live recording studios. While we spoke, a deejay was helping the tribal higher education director’s son listen to his voice recorded live on the air for the first time. The station technician, a retired engineer, sat at a table in the bright sunlight, modifying an antenna for greater reception. Gesturing at a server rack, I asked Victor what it took to get the streaming radio program up and going.

Victor described his experience working for a commercial radio station in Tucson, and how, after a while, he became more interested in working for community radio, where he could tailor the music and programming to community interests. He mentioned this to one of his friends, who was a councilman for the tribe. For a few years, the councilmembers had been discussing how to get a tribal radio station going, especially to promote Yaqui language programming and music, and local news and events. Victor’s friend asked him if he would be open to helping the tribe set up their station. When Victor described this, I thought, here is an example of tribal leaders recognizing the need for community-level information to strengthen the people’s ways of knowing.

As it turned out, Victor was the right man for the job. His experience working with commercial radio regulations and with community radio needs helped him take charge of the balancing act between Federal Communications Commission (FCC) operations standards and the requirements of the Pascua Yaqui tribal government. He set up the station by regularly updating the councilmembers and also by developing relationships with the different tribal departments helping with the set-up, from construction to Information Technology (IT) services to the tribal library. He hired and trained tribal members to work as station employees, and tapped into his circle of radio colleagues and community radio advocates for advice and assistance on training and technical fixes.

Working in this way, he connected with Traci Morris and Loris Taylor of Native Public Media, an Arizona-based media advocacy non-profit organization, and was able to advocate for the FCC to establish a tribal priority for licensing radio spectrum in the shape of reservation lands. Before, tribes had difficulty acquiring licenses because the FCC was allocating licenses to utilize geometric cubes of airwaves over squares of land. When tribes would apply for access to airwaves above tribal lands, which are not in the shape of squares, they would find that competing radio stations already had licenses on or near tribal lands, effectively blocking tribes from using radio as a means for communicating local information to the tribal community. In the end, the Pascua Yaqui Tribe ended up acquiring a low power frequency modulation, or LPFM, license.

The official reservation lands for the Pascua Yaqui Tribe consist of 202 acres southwest of Tucson, but the more than 8,000 members of the Pascua Yaqui Tribe actually inhabit several barrios, camps, and villages in and around Tucson and Phoenix,

and also live in family units throughout California, New Mexico, Texas, and throughout the United States. As a people, Yaquis have resided for millennia throughout what is now northwest Mexico and the southwest United States. The original sacred homelands of the Yaqui people are located outside of Guaymas, in the Mexican state of Sonora. In one of many violent confrontations with the Mexican state, the late 20th century Mexican President Porfirio Diaz issued a policy of capture and enslavement for Yaqui peoples defending their homelands or providing care to those Yaquis suspected of rebellion against Mexican federal or state authorities. Yaqui people were packed into trains and sent to work in the hemp and sisal plantations in the Yucatán and Quintana Roo, far southeast of their homelands. To this day, surviving Yaqui families reside throughout both the U.S. and Mexico, and the leaders of the tribe in the U.S. and the pueblos in Mexico work together to share information about how changes in the communities, and in federal, state and tribal policies affect the health and wellbeing of the people as a whole.

While a low power FM station serves the needs of those people living on the reservation near south Tucson, the bandwidth is insufficient for meeting the needs of tribal people living throughout the U.S. and Mexico. The streaming radio station allows anyone living beyond the reach of KYPT-LPFM 100.3 to visit the tribal website and listen to the language lessons, music, news, and other special programs. Victor worked with the tribal council and with specialists in the tribal IT department to set up and test the streaming radio system. Shortly after setting it up, Victor began receiving emails and phone calls from listeners in unexpected places, thanking the tribal radio station for the interesting programming and local music. Musicians submitted their CDs for radio play.

Victor made sure that the deejays promoted community programs on air within half a day of receiving requests. The station technician began testing ways to bend the antennas so that in spite of the low power designation, the signal could be boosted through a technical modification. Victor organized a volunteer program to teach youth to work in a radio station, create programs, and record and play their own media on the air. Little did I know, but this theme of teaching and training tribal youth would pop up in every tribal ICT venture I learned about.

Indeed, the individuals I interviewed during that summer would echo many of Victor's experiences utilizing ICTs to convey information for tribal community needs. Ideas for projects began with tribal leaders discussing the need for quality local information. Leaders would tap into their network of friends, family, and associates to find talented and experienced individuals to carry out the implementation. These individuals would work as champions, advocates, and managers of the project. In Victor's case, he champions the potential for community radio within the tribe, connecting local needs with the capacity of the technology. He advocates for tribal radio in local and national forums. He also manages the daily functioning of the radio station. This blend of activity—a form of ICT leadership—requires knowledge of the tribal community's history and geopolitical status, contemporary community needs and interests, an understanding of the policy and technical requirements needed to run the ICT project, entrepreneurial acumen, managerial skill, and a long-term vision for what the ICT in question can do to improve community well-being. Over and over, I saw how strong relationships were key in acquiring capital to fund projects, developing technical training programs, acquiring hardware and software, hiring the right people for the right

jobs, and advocating for needed policy changes with governmental agencies, such as the FCC.

Smart Walls and Two-Way Radios: ICTs Across the Tohono O’odham Nation

After visiting with Victor, I spent time speaking with Police Chief Gabriel Martinez at the Tohono O’odham Police Department. Like the Yaqui people, the Tohono O’odham people are binational, having lived for millennia within desert and coastal homelands stretching from what is now northwest Mexico through the southwest U.S. As a federally-recognized U.S. tribe, the Tohono O’odham Nation comprises over 4,500 square miles of land located south of Tucson along the U.S.- Mexico border. Indeed, the nation’s southern boundary is also the U.S.-Mexico border, a borderline negotiated through the 1854 Gadsden Purchase, when U.S. Ambassador James Gadsden sought completion of a southernmost U.S. transcontinental railroad line, as well as reconciliation of outstanding property and citizenship claims made to American and Mexican settlers during the 1848 Treaty of Guadalupe Hidalgo. Over 150 years later, the U.S. Mexico borderline continues to be a contested space regarding land access, ownership, and citizenship rights. This is especially true for the Tohono O’odham people and their government, the Tohono O’odham Nation.

A few days earlier, I had traveled with Tohono O’odham human rights activist Mike Wilson into the desert to fill water tanks and leave gallons of water for people without passports and green cards who cross illegally into the U.S. through the O’odham deserts rather than through border checkpoints. The Sonoran desert is harsh terrain, arid

and rocky, reaching temperatures of over 100 degrees Fahrenheit during spring, summer and fall, and dropping to less than 60 degrees at night. Many people perish in these harsh conditions. A number of years ago, U.S. Customs and Border Protection—formerly Immigration and Naturalization Services, and now positioned under the Department of Homeland Security—designed a deterrence technique in which they positioned checkpoints at geographically temperate locations, thereby funneling people seeking to cross without papers through the more harsh desert terrain. The goal of the program was to utilize the harsh desert landscape to deter people from crossing. Yet people still cross. Sadly, the number of people who cross and perish through the Tohono O’odham Nation is highest out of all other points along the U.S. Mexico border.

Mike Wilson is critical of the Tohono O’odham Nation executive leadership for what he explains is their misreading and misuse of tribal sovereignty. (De León & Wilson, 2010) He cautioned me about believing too much in the notion of tribal sovereignty. Mike Wilson is a U.S. Marine veteran, and a former pastor of a local Baptist church. Born and raised on the U.S. Mexico border—internalizing it as a conflict zone for all who cross there—I empathized with his critique. Sitting and working alongside Mike reminded me quite a lot of visiting with my own relatives, cool-headed critical thinkers as familiar with the desert terrain as with the human dynamics that unfold in borderland emergency rooms and at the edges of tribal ceremonial grounds.

I watched the changes in the beautiful desert landscape from the cab of Mike’s pick-up as he drove us from one watering station to the next. From an information perspective, I sought evidence of telephone lines, radio towers, satellite dishes, wireless receivers, and the like. As we approached the border, we drove by a building that served

as a base station for U.S. Customs and Border Protection officers working on O’odham land. A large steel tower lay exposed to the sun, unused, in pieces alongside the building. I asked Mike what that piece of equipment was. It was a smart wall tower, an expensive information system designed about a decade before by Boeing. The goal of that smart wall project had been to utilize 360 degree environmental sensors and wireless broadband technology to transmit data about movements in the landscape out to roving unmanned aerial devices and back to border officers working at base stations and at strategic points in the field. Later, as we drove to another watering station, I noted heaped beside a dumpster old television sets, broken telephones, mattresses and kid’s toys. I considered how tribal leaders must perceive the life cycle of devices—from design to deployment to recycling and elimination—within the taut geopolitical ecology of their homelands.

Questions of how the sovereign rights of tribes are tested at the boundaries of tribal lands were on my mind as I sat with Chief Gabriel Martinez in his office across from the San Xavier Mission south of Tucson. Chief Martinez described how his officers undergo a critical decision making process when they are alone out in the field and run across groups of individuals involved in illegal activity. There are parts of the Tohono O’odham Nation desert landscape where cell phones don’t receive signals. Officers carry short-range radios as a communications back-up. I asked about the systems that they use to share information with authorities from other law enforcement agencies, such as the U.S. Customs and Border Protection officers, the neighboring Pima County Sheriff’s Department, and the Tucson Police Department. Chief Martinez described the fusion centers project sponsored by the U.S. Department of Justice.

Fusion centers are strategically located organizations that intake and collocate information from state, municipal, tribal, federal and other law enforcement agencies for the purposes of intelligence analysis. Chief Martinez referenced the infamous case *Oliphant v. Suquamish*, in which U.S. Supreme Court Justice William Rehnquist decided that tribal courts could not try non-Indians residing on Indian reservations. (1978) The number of non-Indian criminal suspects living on reservations is high. I considered what I know about the way crime and violence regenerates in the U.S.-Mexico border zone, and triangulated to consider the U.S.-Mexico-Tohono O’odham Nation border zone. Truly, American Indians are border crossers. It is central to the Native experience, to exist as kin to an Indigenous people, and yet to also exist as a marginalized subject of a dominant colonial government, a member of a tribe, and a voting citizen of a state and federal government. From an information perspective, I thought about the asymmetries in information-sharing that must occur as tribes seek to make their information systems operable with neighboring municipal, county, state, and federal authorities, the trust that must be involved in making information-sharing decisions, and law enforcement consideration for public safety needs and rights of tribal members and non-Indians living on reservation lands.

Tohono O’odham Nation hosts three casinos within the boundaries of their reservation. Chief Martinez described the work his team does there, watching for criminal activity associated with gaming operations and maintaining public order. With such a large and institutionally diverse landscape to monitor, I imagined Chief Martinez’s officers working to uphold public safety at some places laden with robust ICT infrastructure and information flows—such as near the casinos and townships—and at

other places thick with linguistic differences, no cellular and radio service, and regulations obstructing or curbing critical information-sharing—such as at the borderlines and deep in the desert. Each year, during certain seasons, many people in the region, including O’odham people, Yaqui people, Mexican Americans and others, enter into arduous pilgrimages from one mission to another, to family homes, and to other sites of prayer located alongside centuries-old routes from southern Arizona into the Mexican state of Sonora. These pilgrimages are an important aspect of Tohono O’odham spiritual practice and history. Chief Martinez described a communications technique that the public safety officers employ to warn folks on pilgrimage about points of safe passage, sudden thunderstorms, and fire warnings. Listening to Chief Martinez, I came to understand how dispatch centers, fax machines, cellular phones, shortwave radios, Facebook pages, and tribal radio stations playing through the speakers of four-wheel drive trucks ranging through the desert are all part of a flexible system of devices for sharing information critical to maintaining public safety in the remote parts of Indian Country.

In a month’s time, I spoke with six more individuals about their projects: Samuel James of KUYI, Hopi radio; Joan Timeche of the Native Nations Institute; Sandra Littletree of the Knowledge River Tribal Librarians Oral History Project; Traci Morris of Native Public Media; and Matt Rantanen of the Southern California Tribal Digital Village Network. With each person I interviewed, I learned more about how uses of ICTs relate to exercises of tribal sovereignty.

KUYI Hopi Radio: Programming to Match the Rhythm of Homeland

Samuel James, the station manager at KUYI Hopi radio, described how the Hopi Tribe set up their own community radio station. The Hopi people are a pueblo people who have resided for millennia in the canyon and desert mesas in what is now the four corners area of New Mexico, Arizona, Colorado and Utah. The Hopi Tribe reservation land is presently located in northeast Arizona—surrounded by the Navajo Nation reservation land—and the tribal government serves Hopi people and Tewa people residing within its borders. Bearing a complex philosophy and spiritual practice, the Hopi people have for generations exercised a communal mode of self-governance deeply rooted in the seasonal rhythms of their homeland. As a federally-recognized tribe, they have also developed a government that interfaces with the Bureau of Indian Affairs and other federal agencies.

When Samuel and I first arranged for a phone conversation, I laughed because we both had to plan to park ourselves in unusual locations where we could receive cellular phone signals. He was heading to a parking lot near a gas station in Hopi where he could receive a signal, and I was sitting in the back of my father's truck in Mesilla, New Mexico, facing northwest. I'd been to Hopi before to visit friends, and was soothed by the blue sky filled with traveling rainclouds, the subtle shapes of the windswept desert floor, and the striking rock mesas. I had seen a hawk dive full speed down the side of a mesa, hunting from cool clear sky to heated rock wall.

It is difficult to express the appreciation for the ecology of a landscape to others. It takes a great deal of deep listening and working within a tribal community to begin to experience the seasonal rhythms in the bones, and to understand the reason for adapting to those rhythms. Samuel described how deejays at KUYI play certain kinds of music at

certain times of the year, in motion with the meanings of the seasons. Edgy or violent music is avoided during the gentle winter months. At other times, deejays select music from other Native peoples, encouraging the local community to open their ears to new sounds from peoples who likewise understand what it is to live in right relation with a homeland. Language learning opportunities are included as much as possible. KUYI personnel seriously discussed the pros and cons of airing tribal council debates during election season. On the one hand, the radio could provide critical elections information to community members—especially homebound elders—who couldn't attend the debates in person. On the other hand, that kind of self-governance information is a private matter for tribes. Messages heard over the radio—separated from body language, context, and visual cues—could be misinterpreted or misunderstood. The radio station did not want to be perceived as 'airing the dirty laundry' of internal council matters.

Samuel's explanations reminded me of Victor Wright's decisions to train his deejays not to play certain kinds of Yaqui music at certain times during the year long ceremonial cycle. Adapting ICTs to the ecology and internal rhythms of tribal homelands requires respect for language, ways of knowing, tribal privacy and security, and modes of self-governance. The Indigenous Information Research Group had been considering this dimension as one of those that most distinguishes Native uses of ICTs: in many Native communities, certain kinds of content—especially content that is sacred in nature, and content that threatens the security of private tribal self-governance operations—may not be recorded and broadcast across any form of media. In many Native communities, cellular phones and recording devices of any kind, including sketchpads, cameras, audio and video recorders, are prohibited on ceremonial grounds, especially during moments of

prayer. Our group's discussions of this issue contributed to my colleague Miranda Belarde-Lewis's investigation of YouTube as a space for sharing videos of sacred and social Native dances. (Belarde-Lewis, 2011) I began to think about how the notion of access must differ for Native peoples, who not only must contend with the poor quality content that exists about Native peoples, but who must also contend with the policies and geography of their reservation, as well as those of the surrounding tribal, municipal, county, state and federal governments. The FCC decision to adjust spectrum licensing to fit the shape of reservations, and not just in the shape of a block of cubic miles, does a lot for giving a tribe access to the AM/FM radio spectrum coursing through their homelands. It is up to the project personnel to decide how to make appropriate use of that spectrum within the geopolitical constraints of the reservation.

The Native Nations Institute and Knowledge River: ICTs for Sharing Knowledge

Acquiring the devices and setting up a system for sharing quality information is only the beginning, though. The need for quality information within a Native or tribal community drives the decision to utilize ICTs. This became clear to me as I spoke with Joan Timeche, director of the Native Nations Institute located at the University of Arizona in Tucson. Since 2001, the Native Nations Institute has served as a research and policy institute focusing on issues of self-determination, self-governance and economic development for tribes. One of their main goals is to disseminate research results, policy implications, and lessons from leaders in Indian Country back to tribal leaders for the purposes of informed decision-making. The Native Nations Institute leaders participate

each year in the Honoring Nations award program through the Harvard Institute on American Indian Economic Development. When we met, Joan handed me a copy of the past year's Honoring Nations program. I scanned the booklet and quickly noted how a majority of the award-winning programs were projects focused on building information systems to circulate quality information specifically for the purposes of upholding the operations of sovereign tribal governments.

The Mille Lacs Band of Ojibwe utilized data about the local ecology to write the Minnesota 1837 Ceded Territory Conservation Code, regulating subsistence hunting and fishing. The code has been incorporated into regional district and appeals courts, resulting in increased understanding between tribal members and non-tribal neighbors who hunt and fish in the same terrain. The Coquille Indian Tribe worked with the Smithsonian Institution and the University of Oregon to design the Southwest Oregon Research Project, an archive of cultural, historical, and linguistic documents pertaining to the tribal peoples of the area. Copies of documents were given to regional tribes during potlatches, contributing to a regional restoration of knowledge of Native peoples. Leaders within the Gila River Tribe needed a way to provide affordable and reliable phone service for their people residing on the reservation in southern Arizona. They started Gila River Telecommunications, Inc., a regional phone and Internet service provider for tribal residents and neighbors. Different tribes use geographic information systems (GIS) to track wildlife, water quality, and land uses for tribal land management. Tribes create systems for protecting pottery, weavings, petroglyphs, sacred dances, and artworks and aligning tribal, state, and federal policies in this regard. Tribes utilize ICTs toward language revitalization, including the abovementioned radio stations, online learning

modules, and digital storytelling tools. Almost all of the honorees in the Honoring Nations program included a dimension of preserving lands for youth and educating future generations.

After meeting with Joan, I met with Sandra Littletree of the University of Arizona Knowledge River Program, which supports Latino and Native American students seeking a degree in librarianship. Faced with a scarcity of literature and needing a way to teach students about their chosen profession, Sandra partnered with friends and colleagues in the American Indian Librarians Association and the New Mexico Tribal Libraries Foundation to film long-time tribal librarians speaking about their experiences, and posted these in an online oral history archive. At the time of my visit, Native Nations Institute personnel were also preparing to launch a subscription database comprised of video lectures by leaders in Indian Country speaking on a range of matters pertinent to dimensions of tribal self-governance. More than about collecting data, these and aforementioned information systems were designed to pass on Native leaders' ways of knowing.

Speaking with Joan helped me to understand how tribes develop information systems for collecting local data that can be used for local-decision making, and for building intergenerational knowledge. Inevitably, the decisions that tribal leaders make interface with the decisions and practices of neighboring governments. Of particular interest to me were those information systems that were designed specifically for intertribal and intergovernmental information-sharing. But of greater interest were those systems that focused on providing Internet access, in particular, as every individual I spoke to referenced not only the lack of quality information for tribal communities, but

also mentioned in passing the lack of basic phone, cellular and Internet service in many tribal homes.

Indeed, meeting with Traci Morris of Native Public Media, and then later, with Matt Rantanen of the Southern California Tribal Digital Village Network, helped me realize the critical importance of reliable and affordable Internet service within reservation communities.

I had entered the field that summer understanding that information was important for the decision-making process of tribal leaders. I came to understand that the cultural sovereignty of a people relates to the ability of elders and experienced members to share ways of knowing with younger members. I saw how tribal geopolitics—political boundaries, physical geography, seasonal cycles, self-governance procedures—shapes uses of ICTs. I recognized the importance of relationship-building and partnerships, as all of the projects I learned about began with a few leaders sharing ideas, and then tapping into their network of friends and colleagues to find individuals to implement ICT projects. Project leaders possessed a unique skill set, capable of managing daily operations, advocating in local, state, and national arenas, as well as listening to and working with tribal leaders to articulate the long-term vision for the ICT project within the community. I also began to see how the content streaming across ICTs contributes to the local mode of self-governance, as political issues are debated across these channels. Project leaders continuously assess community needs, and think about ways to apply technical know-how to meet those needs.

Native Public Media: Broadband Internet Shaping Creativity in Indian Country

I met with Traci Morris, at the time, director of operations at Native Public Media, in a busy coffee shop near downtown Phoenix, Arizona. As far as I could tell, each visitor to the coffee shop had a smart phone. This was a far cry from sitting in the back of my father's truck trying to receive a cellular signal near the Rio Grande, and far removed from the U.S.-Mexico-Tohono O'odham Nation borderline, where the smart wall sits in pieces and a braying generator lights all who cross through the border fence at night. A long-time advocate for Native community radio, Traci was adamant about the impacts that radio can bring to Native communities. But she was more adamant about the impacts that broadband Internet can bring to Native communities. A regular media advocate in Washington, D.C., Traci assured me that people in Congress don't understand what it's like to be in a place with no cellular or landline phone service, such as in Indian Country. She described for me what it's like to invite a senator to visit a reservation, and to watch his body language as he realizes he receives no reception on his cellular phone, and that if he isn't receiving reception, no one else is either. She also said many people don't quite understand the implications of broadband Internet for reshaping work and creativity in Indian Country. She described the digital dome at the Institute for American Indian Arts, a 360-degree digital recording space where students record Native dances and make films. What were the implications of this kind of technology with regard to the Native art of storytelling and other creative expressions? What kind of knowledge could be archived for future generations?

As an information scientist, I followed Traci's line of thought completely. The smart wall is a broadband technology. The Tribal Librarian's Digital Oral History

website runs at broadband speeds. The video lectures housed in the Native Nations Institute leadership database soak up a great deal of bandwidth. I wondered how many people in Hopi or in my own tribe have sufficiently fast Internet speeds in their homes or workplaces to be able to access this kind of content. During my fieldwork, my ability to convene with the Indigenous Information Research Group depended on my ability to drive to a café or a hotel with a connection fast enough to support videoconferencing. I wondered what it would take to give every tribal leader in Indian Country an affordable smart phone and plan.

Already attuned to the presence of digital devices, I began to conceptualize Indian Country as a vast expanse of geopolitically interrelated landscapes peopled by leaders sharing information about their tribes across a range of digital devices: smart phones, laptops, workstations connected to server rooms connected to broadband towers connected by fiber optic cables to nodes buried alongside nearby interstate highways. There are dark spots in Indian Country, where no one receives any service due to the technical limitations of the devices. There are grey spots in Indian Country, where the elders have determined that no recording devices of any kind may be used out of respect for ceremonial rhythms and the sacred landscape. There are places in Indian Country that are extremely wired, where youngsters connect with each other on X-Box Live, grandmothers play the slots at the casinos, and young activists update anti-colonial memes on their Facebook timelines. Prior studies had been positioning Native Americans as digital have-nots. (Casey, et al, 1999; Dorr & Ackroyd, 2001; Dyson, et al, 2007; Gordon, 2001; Mander, 1991; Office of Technology Assessment, U.S. Congress, 1995; Riley, et al, 1999) Through listening to the experiences of those working with ICTs in

Indian Country, I saw that this was not the case, but rather, that like everything else that occurs within the boundaries of reservations, decisions about ICT infrastructure and uses must be negotiated within the local geopolitical terrain.

Within my own ways of knowing, cultivated from having grown up going to ceremony with my family in Old Pascua and running around the deserts surrounding Tucson and the river valley of Mesilla, New Mexico, I had come to see each moment as a blossoming, an unfolding within a greater dynamic of endless creation. I had read the writings of Vine Deloria, Jr. and Martin Heidegger alike on technology as a point of becoming, when human hands bring into being a system designed for the purposes of human expression. (Deloria, 1999; Heidegger, 1977) But where Heidegger wrote about the technological domination of the natural landscape by a superior race of men, Deloria wrote about all human creativity as acts within this endless cosmic creation, an insight into which Native peoples bear a particular understanding by virtue of their spiritual relationships with the landscape and relation to all of the beings therein. I began to distinguish ICTs in Indian Country as serving purposes focused on Native peoples' expressions of their cultural sovereignty. Likewise, there are many examples of information systems in Indian Country designed for the purposes of supporting the operations of tribes. However, none of these can function without the availability of affordable and robust broadband Internet.

Chapter 3. Four Cases of Broadband Network Deployment in Indian Country

Visiting Matt Rantanen at the center of operations for the Tribal Digital Village Network (TDVnet) showed me that I hadn't been seeing the forest for the trees. While investigating Native uses of ICTs, I had implicitly been looking for a singularly Indigenous approach to uses of ICTs, when in reality, there are as many ways for Native peoples to develop ICT projects as there are Native communities. In a way, that

demonstrated colonial thinking on my part. Before, I'd been immersed in a published body of literature—coming from information science and science, technology and society studies—that presumed a binary opposite between Native and Indigenous peoples and so-called modern technologically advanced people, a literature written by individuals who hadn't accounted for the information demands of tribal sovereignty. My instinct was to push back at that false logic. In doing so, I was able to articulate a bigger picture.

Indeed, speaking with different individuals who utilize ICTs for their daily work showed me that for the time being and for years to come, underlying all uses of ICTs and web-based information systems there is the need for affordable, reliable, and robust broadband Internet access. More than that, there is the need for tribal leaders to command uses of broadband Internet infrastructure as it is built out across sovereign tribal lands. This level of command empowers tribal leaders to guide flows of information to work for the goals of Native peoples and tribal governments.

TDVnet: Understanding Broadband Networks Within a Borderland Geography

In August of 2011, I drove to the Pala reservation outside of San Diego, where I met with Matt Rantanen (Cree), TDVnet administrator and director of operations for Southern California Tribal Technologies (SCTT).

The Pala reservation is located 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 U.S.-Mexico border

checkpoints on the way in. 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, Cupeno and others—into the mission system by both Mexican and American settlers; the second being the U.S. 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 20th century U.S. imperial expansionist goals into Asia and the Pacific islands. To my eyes, the development of information systems in Indian Country necessarily coincides with the development of U.S. border enforcement systems.

Having read up on the history of southern California tribes, I learned that one of the first techniques U.S. and Mexican colonial authorities utilized to prevent Native peoples from communicating regionally was by damming waterways and preventing mission Indians from traveling from one location to another via coastal and river routes. (Akins, 2011; Bauer, 2011; Findlay, 1983) 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 U.S. 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 all the way from the southern continents to the far northern reaches of the Americas. The 20th 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 into the reservation system, and in, California, the mission

system. Many California Natives died during this turbulent time. American settlers kidnapped Native children from their families 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 prior to the entry of early U.S. and Mexican nationalist settlers.

The American Indian spirit prevails. Entering into Pala, I drove past a sun-warm buffalo lounging in a green pasture. I had to laugh. Just like that, I was back in Indian Country.

I met Matt Rantanen at the Pala tribal administration buildings. He 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 University of California San Diego (UCSD) researchers to acquire Internet access for the nineteen tribes bordering San Diego County. The idea of acquiring Internet for the tribes began when, in the mid-90s, tribal leaders realized that even though the different reservations were located fairly close to an urban center, the peoples living in the canyon, valley, mountain, and rural communities were unable to afford the expensive satellite access plans offered at the time. Many tribal residents also lacked phone lines. Regional Internet service providers (ISPs) explained that it was too expensive to build the infrastructure to reach these communities, and that the demand would not produce a sufficient profit. Later, I would discover that this was a common explanation that tribal broadband project leaders would provide regarding the inability to find an ISP for their rural and remote reservation communities.

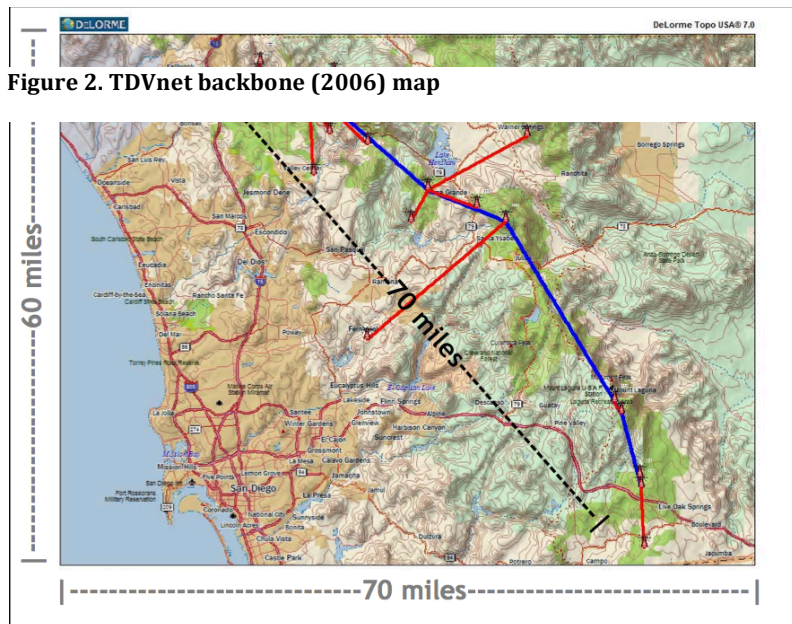
Matt remarked on how the peoples of the nineteen bands and tribes comprising the SCTCA were one people—political neighbors and relatives—before the imposition of the mission system, and how building out TDVnet facilitates the communication that brings the people together again. He showed me a map, and explained the reach in miles of the TDVnet backbone, where the primary towers are located at high points overseeing the valley communities, and how the spectrum is allocated across each operational node. (Figure 2) He spread his fingers above each node, and asked me to imagine the array of pathways through which

wireless fidelity (WiFi) Internet service is provided to tribal administration buildings, schools and libraries.

Conceptualizing

Components of a

Broadband Internet Infrastructure



At this point, it's helpful to explain one way to think about the components of a broadband Internet infrastructure of this scale. Broadly, these consist of 1) the network system across which digital content is streamed; 2) the digital content itself; 3) the tangible devices that comprise 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 centers of innovation. In the case of TDVnet, in the beginning, there were at least three centers of innovation shaping network build-out: the associated UCSD labs, the TDVnet lab, and Hewlett Packard offices.

Broadband Internet is usually transmitted by one of three technical set-ups: 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 and poles. Setting up a wide area network (WAN) for regional wireless delivery requires setting up towers, transmitters and receivers. Satellite services bounce off of satellite transmitters orbiting in airspace, and introduce latency: the amount of time it takes for a packet to reach the satellite and travel back to the terrestrial receiver. TDVnet is a wireless WAN.

Add to these a) the encompassing market forces that determine Internet service supply and demand; b) the physical geography shaping where and how towers, fiber-optic cables, satellites and receivers are positioned; and c) the political and institutional jurisdictions that shape the nature of policies and construction. In the case of TDVnet, these include a) the telecommunications and Internet service business and use environment around San Diego County, and b) the urban landscape, highways, hills and valleys, canyons and mountains around San Diego County. The political and institutional jurisdictions that shape TDVnet are complex, including the jurisdictional limitations of nineteen separate tribes—some of which are federally-recognized, some state-recognized, and some unrecognized; the institutional limitations of the associated UCSD labs, and the institutional limitations of the Hewlett Packard Digital Village program.

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.

A broadband Internet network is a system that supports creative possibility for people who use the resulting broadband Internet 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 for those relying on Internet access to work and play via an online environment. Broadband network designers and advocates create the means for others to engage creatively in an online environment.

Listening to Matt Rantanen describe the build-out of TDVnet helped me understand how broadband infrastructures and services designed for tribal communities are conducive to tribal peoples' abilities to connect and create online. But more than that, I began to see how the partnerships orchestrated to build out these critical infrastructures ground productive relationships between tribal leaders, industry partners, and university researchers.

TDVnet: Partnering to Connect the Native Peoples of Southern California

Matt explained how, in the late '90s, at around the same time that SCTCA leaders were brainstorming how to acquire Internet access for the tribes, UCSD physicist Hans Werner-Braun was figuring out how to transmit astronomical data from satellites down 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 HPWREN engineers identified an optimal point within the reservation lands for placing a tower to 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 tribal member and 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 him, showing him how to bounce signals using transmitters and receivers from one room of the house to another. Of course, the overarching concept was to provide high-speed wireless Internet service across towers set up on the tops of mountains and peaks, channeling spectrum down to valley administration buildings and residences.

SCTCA leaders found the concept worth investing in. They partnered with UCSD ethnic studies professor Ross Frank to draft 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 five million dollar grant, 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 to identify local Natives and tribal members to assist with aspects of the build-out. Matt described finding necessary talent in interesting places. For example, casual conversations led TDVnet project leaders to contract the services of a veteran and helicopter pilot. The pilot worked with TDVnet construction crews to fly heavy equipment from the roadways up to a mountaintop where a tower was being built.

Within a few years, the tribal administration buildings, schools, and libraries were receiving free Internet access. By 2005, the network was robust enough to offset some of the load from the HPWREN relays to the TDVnet backbone. (HPWREN, 2005) Meanwhile, TDVnet engineers began working with tribal community leaders to design an intranet archive where members of the nineteen tribes could post photos, news, videos, and knowledge of tribal ways. (Srinivasan, 2004)

By the end of the three-year grant, the project leaders of TDVnet had a plan in place for maintaining network operations and for generating revenues for network improvements. They established an ISP as a tribal enterprise, and named it Southern California Tribal Technologies. TDVnet operations would continue under this enterprise, allowing the project leaders to 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 a print shop, Hi-Rez Digital Solutions, as a tribal enterprise. Community members took 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 pretty soon were editing their own videos, 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. The computing classes and media labs increased community interest and use of broadband Internet services. The courses in network certification also contributed to job skills training. Thinking about sustaining and expanding operations led SCTT leaders to identify business, technology, and policy solutions. 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 at the bottom of canyons where towers cannot transmit a clear signal. (Southern California Tribal Digital Village, 2006) SCTT engineers wired solar panels and wind turbines into the generators powering the towers, saving on costs.

Meanwhile, though TDVnet was already supplying high speed Internet to tribal anchor institutions such as schools and libraries, Rantanen discovered that tribal libraries were not qualified to receive e-rate funds—FCC Internet access subsidies to public libraries and schools—because the funding was distributed solely through state governments, and not through sovereign Native nations. Rantanen began speaking to Congress people and other political representatives about this and related issues. He gained a seat on the FCC Native Task Force, advising on how the FCC could adjust programs to help tribes acquire broadband Internet, including the possibility of drafting a tribal priority for broadband spectrum. Indeed, TDVnet was tested and continues to run almost entirely off of unlicensed spectrum. (Rantanen, 2011)

When in 2009 the FCC released a notice of inquiry on how to adjust their broadband grant and loan programs to meet tribal and rural residential needs, TDVnet managers were among the first to point out how the United States Department of Agricultural Rural Development Broadband Initiatives Program (USDA BIP) and National Telecommunications and Information Administration Broadband Technology Opportunities Program (NTIA BTOP) criteria were slanted to preclude tribal applicants. (Rantanen, 2011) While Rantanen was able to demonstrate the feasibility of a proposed TDVnet infrastructural upgrade, SCTT was unfortunately not eligible for a BTOP award due to the restrictive program criteria. They 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 are still in need of major funding to acquire access to spectrum, upgrade the hardware at the towers and in labs, and build

out the backbone to support greater bandwidth needs and reach the more remote communities.

TDVnet got its start through the goals of the SCTCA to explore broadband Internet technology as the means for supporting cultural, educational, and economic revitalization across the 19 tribes. But 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 space for ICT innovation and agenda-setting in Indian Country. Indeed, 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.

Near the end of my visit to the SCTT offices at Pala, on the walk to my car, Rantanen motioned the pathway by which the dishes atop the nearest mountain tower broadcast a WiFi signal to the dishes attached to the tribal administrative buildings. One of the employees of Hi-Rez Digital Solutions had planted sunflowers beneath water trickling from a rooftop swamp cooler. Rantanen described how free and affordable access to broadband Internet was allowing cousins who lived on different reservations to connect with each other 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 each other. For tribal peoples who have, for generations, been forcibly disconnected from each other by the efforts of Settler state leaders interested in seizing Native lands and waters, tribally owned broadband infrastructure takes on a value beyond that of simply education, economic development, or cultural revitalization. TDVnet helps many people working at

many different locations and through many different positions within the SCTCA tribal community to work toward strengthening the cultural and political sovereignty of nineteen tribes.

An Aerial View: Broadband Infrastructure in Indian Country

At present, there are at least sixteen tribally owned ISPs in Indian Country. There are no reliable data sets assessing Internet coverage in Indian Country, either in terms of technical reach of existing infrastructure, or actual numbers and locations of users. Those of us in the Indigenous Information Research Group have been, for years, working under the supposition that reliable and robust broadband Internet services continue to be scarce in reservation communities and among Native and Indigenous families living within the political borders of the United States.

Our supposition is based on the combination of our perspectives, as each of us has worked and lived for years alongside friends, colleagues, and relatives in the information, technology, and education fields in Indian Country. Our suppositions consist of the following: 1) ICT devices such as smart phones, laptops, tablets, and gaming consoles continue to be expensive for the average Native family; 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 rural and remote regions of the U.S., 3) as unemployment rates are high in Indian Country, there is less opportunity for individuals in Indian Country to gain Internet access through workplace computers, 4) there are no reliable published data on numbers of users

able to access Internet services through reservation schools, libraries, elders centers or computing centers, or through nearby public schools and libraries.

Yet we know that ICT devices are available and are being used in Native communities. (Morris & Meinrath, 2009; Stevens, 2007; Wilson & Stewart, 2008) In 2010 the White House released the National Broadband Plan, including estimated figures of existing levels of coverage across the fifty states, and a general strategy for supporting infrastructural build-out such that each U.S. home should have Internet coverage of speeds up to 200 mbps by the year 2020. (Federal Communications Commission, 2010) Intrigued by the coverage figures reported in the National Broadband Map, I spoke with former FCC employee and tribal telecommunications taxation expert Shana Barehand Green. Barehand Green explained the coverage maps. While it looks like many parts of Indian Country are represented in 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. 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 has never been able to maintain landline phone service because each winter and summer the seasonal rainfall washes out the phone lines. When we first installed a wireless modem, we discovered that the signal wouldn't penetrate through the thick adobe walls of the family home, limiting where we could place a desktop PC and laptops. During holidays, when I'm home visiting and need to take phone calls, I carry my 4G smart phone outside and face

northwest. Unfortunately, the touchscreen interface shuts down in summer temperatures over 90 degrees. My family doesn't reside 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 well at all within the diverse landscapes comprising Indian Country.

Meanwhile, to the north in Ontario, ICT champions within 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 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. (Beaton, 2009) 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, have recently been posted online for others to learn from as they develop their own community broadband networks. First Nations in west Canada have access to a tribally-owned satellite network. This 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. (DeBruyn, 2012) What conditions shape this divergence between a cohesive First Nations broadband Internet strategy and the lack of a cohesive strategy for U.S. tribes? (McMahon, 2011)

In 2012, I attended the first U.S. Tribal Telecom conference. I went seeking any documentation of U.S. tribal broadband operations 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, one of the handful of tribal ISPs in the U.S. The conference was hosted at the Wild Horse Pass Resort and Casino on the Gila River reservation southwest of Phoenix, Arizona. While there, I met many people attending to find out more about either acquiring basic telecommunications services for their reservation communities, or about overcoming obstacles to set up tribal ISPs.

I met a representative from Havasupai who was there to learn about how her tribe could acquire access for their communities located at the base of Grand Canyon and high up through the rocky terrain. I met two gentlemen who described how, years ago, a private telecommunications company established a monopoly across their desert reservation in California, committing the tribe to sign a non-competition agreement in exchange for providing much-needed telephone service. Years later, the tribe built their casino and resort, and soon enough realized that they were being overcharged for Internet and phone service. By that time, the tribe possessed the capital, technical personnel, and know-how to be able to set up their own ISP, and at much more affordable rates than that

of the predatory company. Unfortunately, the non-competition agreement stands, and with it, the threat of costly legal battles.

I met with managers of ISPs who had successfully navigated the FCC spectrum licensing process. I met lawyers and accountants whose entire work focused on detangling tribal telecommunications taxation issues. I met community leaders whose elders expressed concern for the distraction that ICTs might impose among tribal youth. I met lawyers thinking about how—because of the nature of data and information-sharing online—tribal telecommunications and ISPs interrelate with tribal intellectual property issues.

Many of the individuals who I spoke with noted the lack of reliable 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 9-1-1 services to low-income and rural residents. Many residents within Indian Country are low-income and reside in rural and remote locations. One might think this would be a helpful option for tribes 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. (FCC, 2010)

This positions cash-strapped tribes between a rock and a hard place. To acquire basic phone service subsidies requires showing need and lack of telecommunications infrastructure. Yet to acquire 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's 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.

A year later, I met with Tribal Telecom conference organizers and tribal taxation lawyers Randy Evans and Sharon Catron. I found that the conference was originally planned to be a small workshop for less than forty individuals. But word spread, and registration quickly mushroomed to over a hundred participants, transforming Tribal Telecom from a workshop to a conference. FCC Chairman Michael Copps spoke, underlining a commitment that former President Bill Clinton had asserted during a 2000 visit to the Navajo reservation: the U.S. federal government has a responsibility to help tribes connect and overcome the digital divide. (Clinton, 2000; Copps, 2012) In 2013, due to a federal sequester, the FCC was unable to send representatives from the recently formed Office of Native Affairs and Policy. Nevertheless, Tribal Telecom 2013 nearly tripled in size. Catron and Evans described how telecommunications and ISP taxation topics alone are complex and important, a point underscored by Shana Barehand Green. (Barehand Green, 2012; Evans and Dunstan, 2013) I recalled how Traci Morris, former

director of operations for Native Public Media, referenced 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 their political geography.

There is a major need for baseline data describing levels of coverage, infrastructural capacity, affordability, potential for access, and actual uses of broadband Internet in Indian Country. A study of this magnitude would require collaboration among university researchers familiar with tribal sovereignty, telecommunications and ISP industry partners, network professionals, information professionals, policy people, tribal community members, and federal government partners. But before any team could design such a study—which would presumably consist of a mixed methods approach consisting of some survey components—that team would need to understand the conditions shaping tribal broadband Internet access, uses, and infrastructural ownership.

After I spoke with Matt Rantanen and learned about what it took to build out TDVnet, I began to think more critically about the steps tribes have to take to acquire their own broadband Internet infrastructure. Attending the Tribal Telecom conference helped me get a sense of some of the factors shaping broadband deployment in Indian Country. I began searching for any kind of documentation revealing the factors shaping tribal ICT champions' abilities to build broadband networks across reservation lands. I found evidence of these factors on the websites of tribal telecommunications and ISPs. I found evidence in tribal telecommunications policy papers, both those published on tribal sites and through organizations like Native Public Media, the FCC Office of Native Affairs and Policy, and the National Congress of American Indians. I found evidence in proposed tribal broadband infrastructural deployment plans prepared for the USDA BIP

and NTIA BTOP application cycles. After a while, I began to get a sense for the conditions shaping tribal broadband infrastructural deployment. I selected four cases to more deeply analyze and compare: Red Spectrum Communications (Couer d'Alene), TDVnet (19 tribes of the Southern California Tribal Chairmen's Association), the Lakota Network (Cheyenne River Sioux Tribe), and the Navajo Nation Tribal Utility Authority and Regulatory Commission. I selected these cases for their length of time in operation, the relative durability of their operations, the comparability of their complexity, and for the differing approaches to applying broadband Internet to uphold tribal sovereignty.

Red Spectrum Communications: Improving Access to Support the Exercise of Political and Cultural Sovereignty

In 2011 I attended the telecommunications forum at the 68th National Congress of American Indians in Portland, Oregon. While there, I heard Valerie Fast Horse, Information Technology Director for the Couer d'Alene Tribe, speak about some of the issues tribes face establishing ISPs. When I had been searching for any and all documentation about tribal broadband deployments, I had run across an interview with Fast Horse, published in an Idaho newspaper, where she described a bit about how her prior service setting up communication networks for the Army and the Army Reserves prepared her to think about potential uses of ICTs in her own reservation community. (Kramer, 2011)

Hearing Fast Horse speak reminded me of how Rantanen contracted a military veteran with the piloting skill to load and lift heavy equipment from a valley floor to a

mountaintop base station via helicopter. I would later attend two conferences—the 2012 Native American Veteran and Small Business Conference and Tradeshow in Tulalip, Washington, and the 2012 TribalNet conference in San Diego, California—where I would see how many ICT-based tribal enterprises and Native owned businesses were leveraging the knowledge and technical skillsets of veterans in Indian Country.

In the late '90's, Fast Horse was posted at Dahrhan, Saudia Arabia, working as a communications specialist with the U.S. Army. While on active duty, she asked herself, what would happen in the tribe if I were to bring these technologies to the reservation?

Worlds away from Saudi Arabia, Couer 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 Couer d'Alene, a key body of water within a greater watershed, including the Couer d'Alene River. In 1991, the Couer d'Alene Tribe filed a lawsuit against mining companies and the Union Pacific Railroad for a century of dumping tons of smelting and mining waste into the Couer d'Alene watershed, including Lake Couer d'Alene. The tribe sponsored a detailed scientific investigation. The results qualified the watershed as the second largest Superfund site within U.S. borders, with an expected clean-up cost of over 200 million dollars. While Fast Horse was setting up communication networks in Saudi Arabia, back home in Couer d'Alene, the Union Pacific Railroad and the HECLA mining company settled the resulting environmental lawsuit with the U.S. government. The tribe began leading the clean-up effort in partnership with the U.S. Forest Service, the U.S. Fish and Wildlife Department, the Bureau of Land Management, and the U.S. 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 U.S. Supreme Court recognized that the lower Couer d'Alene watershed belonged, and had always belonged, to the Couer d'Alene people. It was a hard won battle for the Couer d'Alene people, and it is ongoing, as the tribe leads the clean-up effort. (Cernera et al, 2012; Committee on Superfund



Site Assessment and Remediation in the Coeur d' Alene River Basin, National Research Council, 2005)

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 to facilitate tribal administrative work practices, but also as a way to share 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 for people to share videos about matters of interest in Indian Country. (Geranios, 2009)

The launch and ongoing success of RezKast helped Fast Horse and tribal IT specialist Tom Jones demonstrate both the capacity of the Couer d'Alene IT department and the potential for ICT innovation in Indian Country.

Figure 2. Valerie Fast Horse, IT director for the Couer d'Alene Tribe, in the computer server room

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 (WISP) as a tribal enterprise. After conducting a community assessment and demonstrating feasibility, Fast Horse and Jones acquired funding from the tribe as well as from the 2002 USDA Rural Utility Services (RUS) Community Connect grant and loan program. They incorporated Red Spectrum Communications as the Couer d'Alene WISP, providing free or low cost wireless broadband Internet to community anchor institutions and homes on the reservation and in neighboring rural Idaho and Washington.

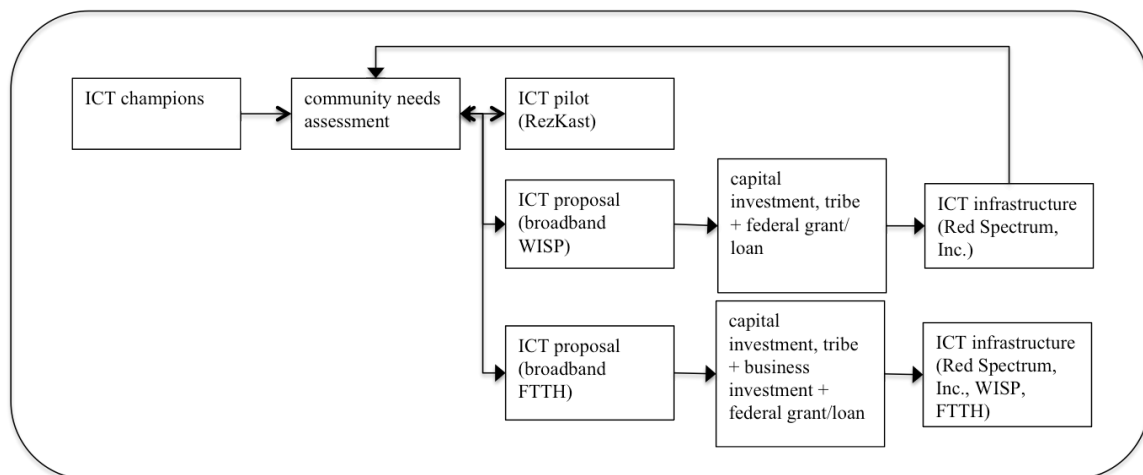
Fast Horse and Jones began advising the FCC and other tribal groups on how to think about implementing Internet services to tribal homes and anchor institutions. In light of the ongoing work with the U.S. Geological Survey and other partners, Fast Horse and Jones also expanded Couer d'Alene IT services to include a geographic information services (GIS) program for surveying and managing tribal lands and waters. In 2011, Boise State University honored Fast Horse as a part of their 'Women Making History' program. (Kuhrt, 2011)

During that time, 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 to the home. This move would not only bolster 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 prior Internet service provision to both the tribal council and to the 2009 USDA American Recovery and Reinvestment Act (ARRA) grant and loan program for strengthening rural infrastructure

toward economic development. At present, Red Spectrum Communications is in the process of laying 275 miles of terrestrial fiber-optic cable to supply affordable broadband Internet to 3,500 households within the Couer 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 undergo prior to 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 depicts the Couer D'Alene strategy for acquiring broadband Internet access.

Figure 4. Couer D'Alene strategy for acquiring broadband Internet access



The exercise of cultural sovereignty is of prime importance to the Couer d'Alene Tribe, guiding administrative operations and investments in enterprise. Couer d'Alene recognizes the sovereignty of tribes as inherent. Unlike tribes whom the U.S. government forcibly removed from their homelands, the people of the Couer d'Alene tribe have lived within the lands now known as Idaho and the United States long before the establishment of either of these governments. At present the Couer 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 Couer d'Alene cultural sovereignty. (Couer D'Alene Tribe, 2013) While Red Spectrum Communications has been funded by the USDA as a matter of rural economic development through infrastructural improvement, RezKast, the tribal GIS program, and Red Spectrum were sponsored and funded by the tribe as an investment in the needs of the Couer d'Alene people to communicate with each other about matters affecting their ability to defend their cultural integrity and the health of their homelands and waters. **The Couer 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. The focus of Red Spectrum Communications is on improving access to broadband so that Native peoples within and beyond the Couer d'Alene homelands can support tribal sovereignty and cultural revitalization.**

TDVnet: A Partnership Approach for Acquiring Regional Intertribal Broadband

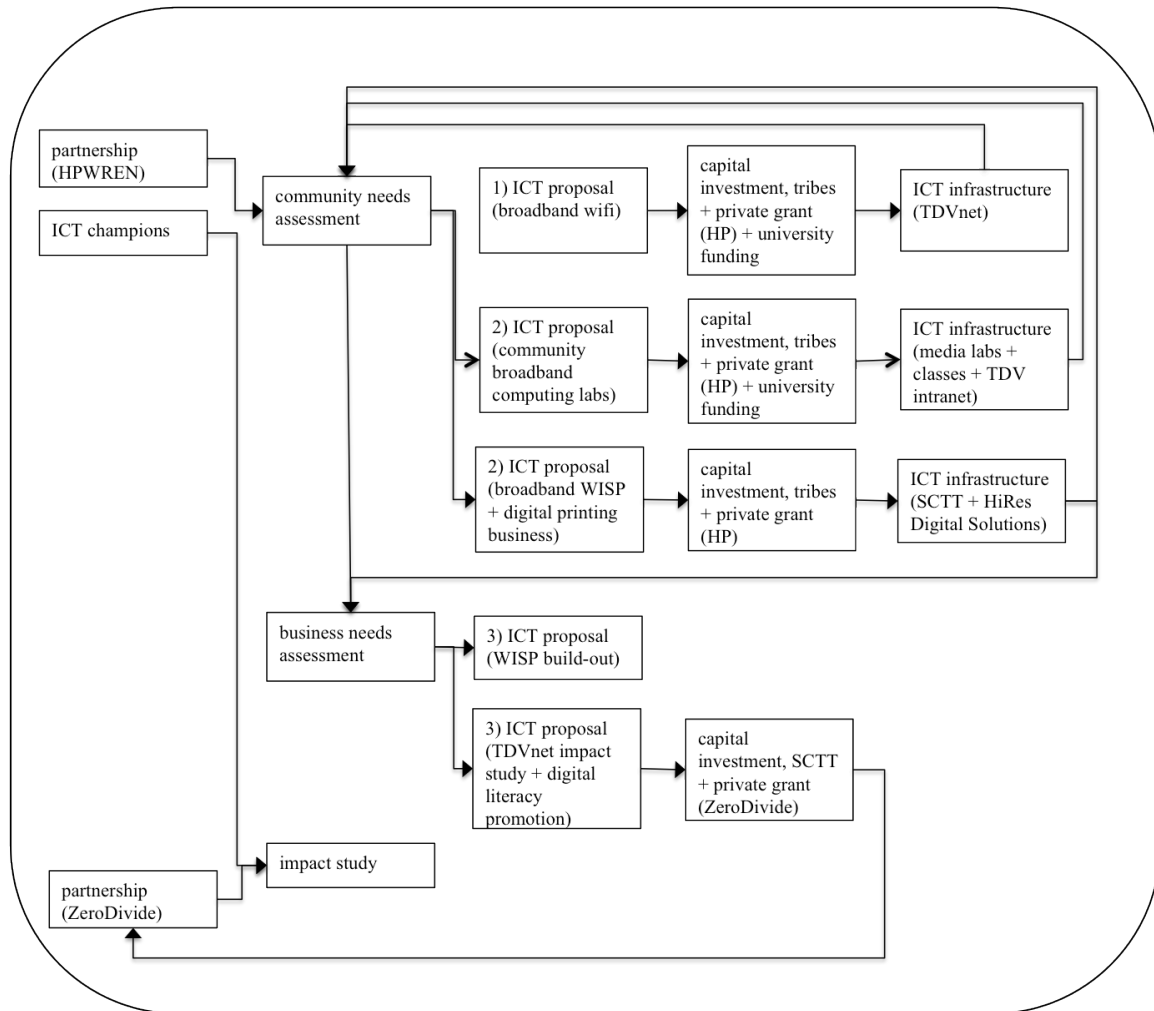
After reviewing the broadband network build-out process of other tribal ISPs, I reconsidered the process of building out TDVnet. While Red Spectrum Communications was designed around a strong message of cultural sovereignty, the values informing the design of TDVnet blended economic development with cultural sovereignty. Also, Red Spectrum Communications emerged out of a single tribe, while TDVnet grew from an intertribal and cross-institutional arrangement.

This intertribal and cross-institutional approach introduces a level of complexity into the broadband infrastructural build-out process. The nineteen tribes comprising the Southern California Tribal Chairmen's Association represent a diverse range of geopolitical terrain. Some of the tribes are federally-recognized. Some are state-recognized. Some remain unrecognized by either the U.S. federal government or the state of California, yet as inherently sovereign Native peoples, they bear the rights of cultural sovereignty. 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. Some of the tribes are physically located much closer to urban and semi-urban locations—locations that may already receive competitive broadband Internet service rates from regional providers—while others are in more rural or remote locations—locations lacking basic infrastructure. Population counts for each tribe differ, as do the community information needs and existing telecommunications infrastructural capacity. Furthermore, 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 belonging to the State of California.

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-time intertribal investment. While each tribe may utilize SCTT services in different ways, the TDVnet project leaders nevertheless set up the backbone to serve all of the communities regardless of the abovementioned differences. The design and build-out of TDVnet captures 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 5 demonstrates the SCTCA strategy for acquiring broadband Internet for their constituent tribes.

Figure 5. Southern California Tribal Chairmen's Association strategy for acquiring broadband Internet for affiliated tribes



The SCTCA strategy for acquiring broadband Internet access 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 to connect the tribes.

Lakota Network: Exercising the Right to Tribal Telecommunications and Economic Self-determination

At present there are over 568 federally recognized tribes within U.S. borders. This doesn't account for the tribes that are state-recognized, and those that are unrecognized by federal and state governments, yet who bear the rights of inherently sovereign Native peoples. Each of these communities—tribes and peoples—will, in the years to come, apply broadband access solutions according to their technical capacity and needs. There should be over 568 different solutions to acquiring broadband access in Indian Country.

While TDVnet and Red Spectrum Communications were designed around strong values of cultural sovereignty, and TDVnet incorporated elements of economic development, I found Lakota Network out in Cheyenne River Sioux country to be compelling because of the stronger emphasis on telecommunications as a matter of economic self-determination.

In 1958, the Cheyenne River Sioux Tribe established the Cheyenne River Sioux Tribe Telephone Authority (CRSTTA). It was one of the first 100% Native owned telecoms, sponsored by the Cheyenne River Sioux Tribe, but operated by a board of directors separate from tribal administration.

The Cheyenne River Sioux Tribe have enforced tribal sovereignty through negotiations with the U.S. for over a century, and perhaps most famously through the 1868 Treaty of Fort Laramie. Since that time, the four bands of the Peoples of the Plains—the Mnikoju, Owohe Nupa, Itazipa Cola, and Siha Sapa—have negotiated with U.S. 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 of not only the people of the Cheyenne River Sioux Tribe but also of the Native peoples of Turtle Island.

Indeed, during the late sixties and early seventies, 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. (Busacca, 2007; Heppler, 2009) The generation of Native leaders who are now running major political organizations such as NCAI, directing the operations of tribal colleges, and other national-level forums were, during their teen years, watching on television the AIM occupation of Alcatraz and the federal government blockade at Pine Ridge. 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 pervades the establishment of the CRSTTA. The establishment of the tribal telephone authority parallels the establishment of the tribal radio station. During a particularly brutal land claims negotiation with the federal government, tribal leaders exercised their treaty rights to force the federal government to lay miles of terrestrial cable across the reservation to ensure tribal telecommunications access. This is why the Lakota Network represents such a compelling case. The current broadband infrastructure is a direct outcome of an argument for the federal provision of telecommunications infrastructure as part of the trust responsibility that the federal government has with regard to U.S. tribes.

For three decades, the tribe expanded the telephone authority, investing in the business as a tribal enterprise, training Native employees, and obtaining rural utility investment funds from government grant programs. A commitment to self-determination through tribal economic development fueled continual investment in the telephone authority. (Figure 6)

In the nineties, around the same time that the SCTCA leaders were thinking of how to acquire community Internet access, tribal IT specialist Gregg Bourland (Cheyenne River Sioux) began persuading tribal administrators to set up websites for their departments. While at first this proposal was met with doubts, 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. Bourland supported the development of a tribal department for the management of information systems. He also began working with J.D. Williams (Cheyenne River Sioux), an experienced IT and telecommunications entrepreneur, to think of ways to start up an ISP for the tribe.

Figure 6. Cheyenne River Sioux Tribe Telephone Authority customer website

The screenshot shows the website for the Cheyenne River Sioux Tribe Telephone Authority. The header includes the tribe's name and logo, with navigation links for Home, About Us, Help/FAQ, Links & Resources, and a Contact Us button. The main banner features a smiling woman and a welcome message: "Welcome to the Cheyenne River Sioux Tribe Telephone Authority". Below the banner is a navigation menu with links for Packages, Telephone, Internet & Network, IPTV, Gas Company Services, Sales & Services Division, and My Bill. The content area is divided into sections for Internet And IPTV (IDSL Solutions, WildBlue Satellite) and Phone Services (Local Phone Services And Solutions, Long Distance Phone Services And Solutions). A sidebar on the left highlights the tribe's dedicated employees and their experience.

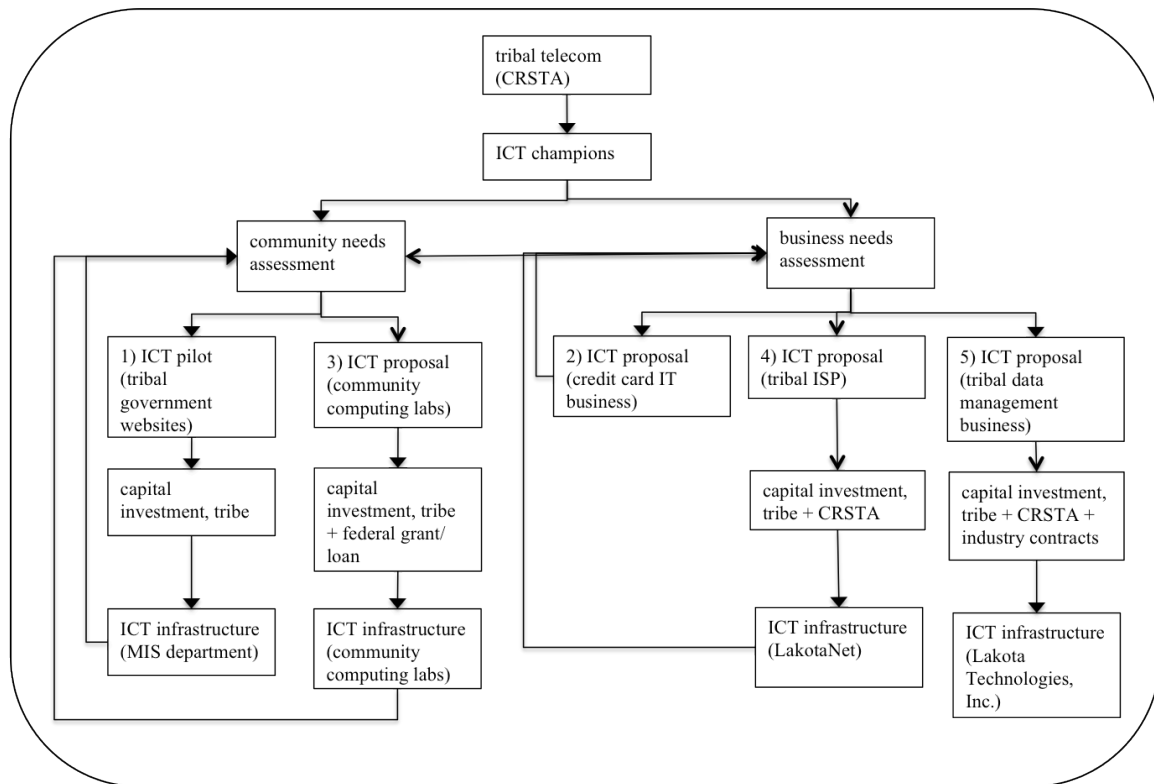
After conducting a community assessment and writing business plan, they convinced the board of directors to commit funds and allow employee training. Thus the Lakota Network was established as a regional ISP. (Field, 2001)

Within a few years, 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 with a credit card company to host the company data management and back-up 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.

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. Their plan passed the muster of tribal council, the telephone authority board of directors, and the USDA ARRA grant and loan program committee. With funding from the tribe and the USDA, Bourland and Williams established Lakota Technologies Incorporated. They also acquired prime data digitization contracts from the National Library of Medicine, the Department of Defense, and other key partners. At this point in history, technical advances to the Lakota Network will occur through investments in Lakota Technologies Incorporated. (Cheyenne River Sioux Tribe Telephone Authority, 2013) Figure 7 depicts the Cheyenne River Sioux Tribe strategy for acquiring broadband Internet access.

Figure 7. Cheyenne River Sioux Tribe strategy for acquiring broadband infrastructure



Like the Couer d’Alene Tribe and the SCTCA, the Cheyenne River Sioux Tribe established an affordable ISP as a tribal enterprise. However, unlike Red Spectrum Communications and SCTT, **the CRST 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.**

Through developing lucrative business partnerships, acquiring government contracts, and capitalizing on profits to attract government grants, the CRSTTA is creating knowledge work opportunities for tribal members. The way that the Cheyenne River Sioux Tribe leverages telecommunications to bring in profits and create jobs on the

reservation distinguishes their approach as an 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 peoples, economic self-determination refers to the right of tribes to support tribal enterprises that best meet community needs. The Cheyenne River Sioux Tribe investment in broadband Internet services 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.

Navajo Nation Tribal Utility Authority and Regulatory Commission: Regulating Use to Promote Competition and Technical Skill

The story about the build-out of the Lakota Network showed me the importance of tribal command of ICT infrastructures, from ownership to decisions about how to spin-off associated tribal enterprises. Indeed, the command of the infrastructure and ownership of the associated businesses is what allowed CRSSTA 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 is community-based, the resulting ISP is very much a business venture. Intertwined in political, cultural, and legal terms, tribal sovereignty and self-determination are fundamentally about a peoples' right to provide for themselves in ways that best meets their needs. Indeed, designing a project based on the sovereign rights of tribes and values of self-determination represent an antidote to the so-called 'Indian problem.'

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 a teenager from Navajo Nation who had won a computer she couldn't use. Media attention resulted in the Gates Foundation Native American Access to Technology Program, a program which my own relatives on the Pascua Yaqui reservation benefitted from, and which I, as a librarian, had been following for years. What was the impact of the NAATP in Indian Country? What were the specific outcomes?

In the winter of 2012, I attended a session at the Tribal Telecom conference hosted by Navajo Nation Telecommunications Regulatory Commissioner Brian Tagaban. Tagaban had been a Cisco network administrator before he returned to the Navajo Nation to encourage the tribal broadband build-out strategy. The Navajo Nation Tribal Utility Authority and Regulatory Commission represent an important case 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 infamous story of Myra Jodie's big win also teaches us something about Native uses of ICTs in the popular imagination.

The story begins in 2000, when 14-year-old Myra Jodie used a computer at her school on the Navajo reservation in Arizona to enter a contest for an iMac. At the time, 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 didn't 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 again was 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 of 2000, he set the record as the first U.S. President to visit the Navajo Nation, where he specifically addressed issues of the digital divide in Indian Country. (Clinton, 2000; Linthicum, 2000) (Figure 8) While Apple was airing ads showing how easy it was to plug-and-play on a brightly hued Mac, here was a story of a young person who owned a Mac, but could not easily access 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),

in which the Foundation would provide Microsoft hardware, software, training, and funding to set up local area networks (LANs) for U.S. tribes. (Gordon, 2001)

However, the rural tribes of the four corners region—New Mexico, Arizona, Utah, and Colorado—posed unimagined problems to the NAATP managers. LANs were either impossible to set up or unaffordable in locations without cables for landline phone service, or in some cases,

Figure 8. Former President Bill Clinton speaking before 25,000 in Shiprock, New Mexico (AP)



electricity. While NAATP technicians synced expensive satellite hook-ups and hosted community trainings, 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 program 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 behind community concerns about adoption of potentially exploitative ICTs within the tribes. (Sirois, 2001) By the time funding for satellite Internet access ended, many of the tribal communities had resorted to managing the granted computers in a somewhat limited fashion. In a final report, somewhat overwhelmed by the complexity of their effort, NAATP officers concluded that,

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. (Dorr & Akeroyd, 2001)

Unfortunately, in Indian Country, this kind of refrain is common and recognizable as an iteration of the so-called ‘Indian problem,’ in which do-gooder members of the privileged class ignore the impacts of long-term colonization in their diagnosis of why and how charitable projects fail. Often these kind of diagnoses pin the problem right back on the tribal peoples themselves, hence the regenerative violence of the ‘Indian problem,’ as well as projects designed to cure them. (Dyck, 1991; Hays, 2007; Smith, 1999)

However, while the NAATP was gaining mainstream media publicity, in other parts of the Navajo Nation, tribal ICT champions were drafting a proposal to acquire

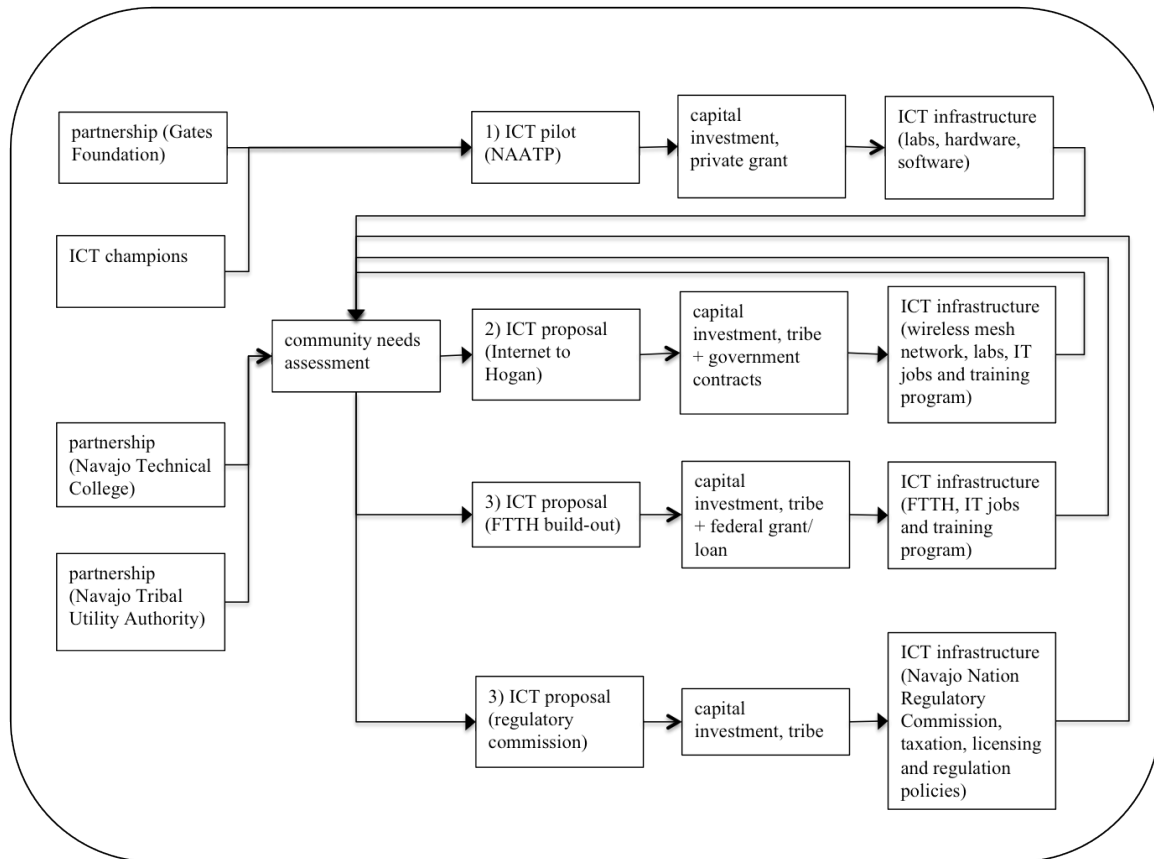
technology contracts from the Department of Defense and partnerships with HPWREN, the TerraGrid project, and the US Department of Energy that would lead to investment, including training, equipment, and lab space, at Navajo Technical College, a two-year institution focused on increasing the technical capacity and employability of Navajo Nation residents. (Computerworld Honors Program, 2007; Grey, 2007; Navajo Technical College, 2013) In part learning from the challenges encountered through the NAATP and also in line with Navajo Nation goals to support educational and economic opportunities for tribal members, they had drafted the Internet to the Hogan plan, a ten-year initiative to install the largest wireless mesh network on a reservation through the chapter houses and other key anchor institutions. (Pyrillis, 2009) Since well before the famed achievements of the Codetalkers, 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 to support the technical advancement of the Diné people, the Navajo Nation Tribal Utility Authority has now moved on to another phase of broadband deployment, a fiber-to-the-home project funded in part by a USDA BIP grant and loan award. The Nation also split up the 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, Brian 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 relating to the close connection between technical and policy decisions around broadband network

design, deployment, and use. Unlike the broadband deployment strategies of Couer d'Alene, the SCTCA, and the Cheyenne River Sioux, Navajo Nation has not started up its own profit-making ISP as a tribal enterprise, but rather has chosen to take ownership over the infrastructure and regulation of its use, while taxing external ISPs—some of whom may be Native-owned—to offer services through the reservation's broadband infrastructure. (Navajo Nation Telecommunications Regulatory Commission, 2013)

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 can also relieve the tribal utility authority and regulatory commission to continue focusing on infrastructural build-out, enhancements to Navajo Tech, policy work, and job creation and training. At the 2012 Tribal Telecom conference at Gila River, Tagaban indicated the complexities of having to both train and certify IT specialists to work as network database administrators, which is technically a whole new ballgame, while also keeping track of broadband policy changes at the national level as they interface with changes at the tribal level. (Tagaban, 2012) Tagaban splits 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 9 depicts the strategy Navajo Nation has implemented to acquire broadband access.

Figure 9. Navajo Nation strategy for acquiring broadband Internet infrastructure



Like the Couer d’Alene, Navajo Nation is one tribe and one people. However, unlike the Couer d’Alene, Navajo Nation decided not to set up an ISP as a tribal enterprise, but rather to invest in durable infrastructure and regulation in order to incentivize competition among regional ISPs. Like the SCTCA, Navajo Nation leverages partnership through educational institutions to acquire access to infrastructure, hardware, and software. 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 to support

infrastructural build-out and technical training. However, Navajo Nation emphasizes greater tribal government control than does the Cheyenne River Sioux Tribe. **The Navajo Nation strategy can be characterized by intratribal institutional alignments focused on technical advancement of the Nation through ownership and regulation of broadband infrastructure. Navajo Nation's strategy promotes affordability of Internet services through competition and regulation.**

Due to the unique political status of sovereign tribes and their economic history of disenfranchisement, tribal ICT champions have had to work through a variety of social, economic, political, legal, and technical barriers to set up the infrastructure for ISPs on reservations. Tribes that have managed to either start up their own ISPs or encourage productive competition among non-tribal ISPs to meet consumer demands have had to endure failed attempts and slow starts. Examining cases of tribes that have effectively acquired broadband Internet access provides evidence for understanding both the constraints tribal ICTs champions work through, but also the impacts of their efforts to bring affordable broadband Internet to people on reservations.

Chapter 4. Impacts of Tribal Broadband Infrastructures

A goal of reframing is to show the complexities of social problems that colonial authorities have deemed endemic to reservation life. Reframing means deciding what historical factors shape the background of a problem, and what conditions shape Indigenous possibility within the contemporary moment.

When I began researching the relationship between technology and sovereignty, I was seeking to reframe the way limited access to ICTs in Indian Country had been defined within the information scientific literature. Instead of assuming that Native peoples do not have access to ICTs, and asking what factors and conditions limit access, I asked how individuals design and utilize ICTs toward tribal goals. I found that the leaders of ICT projects continuously assess community needs, and think about ways to apply technical know-how to meet those needs given conditions shaping the local geopolitical terrain. Yet above all, I found that tribal uses of ICTs are constrained by the availability of affordable broadband Internet across reservation lands.

Thereafter, I sought accounts of how tribal leaders acquire broadband Internet infrastructures for their reservation communities. I wove these accounts into narrative threads, and from there, visually mapped out the particular strategies each tribe or tribal association engaged to acquire a regional broadband infrastructure solution. My goal was to identify the problems that these strategies generate and resolve, as well as the resulting social and political impacts. I wanted to be able to understand the changes that building large-scale information systems introduces into reservation communities. I was returning to an idea I had read about early on: that infrastructures are the crystallization of

institutions, and that institutions emerge from the human relationships that form around common work goals.

Imagining weaving against a loom, I was constructing a framework, where the selvage threads consisted of a select combination of theories from Native and Indigenous studies and information science.

Native and Indigenous studies teach us that colonialism is an overwhelming social force comprised of multiple, overlapping government-sanctioned colonization programs. These programs usually consist of efforts to remap and shape the terrain to meet dominant nation-state goals; articulate indigenous peoples as labor or eradicate them as objects of terror; identify a state language by marginalizing all others; and channel acceptable knowledge through authorized institutions while censoring threatening epistemologies. Programs, such as the diversion of waterways in southern California, have a tail—a legacy effect—that continues once the official program, such as dam construction, is ended. (Bauer, 2011) In this way, colonialism is cyclical, and very much influenced by government policies, institutional rhythms, and infrastructural capacity.

It is very difficult to describe and explain the impact of colonialism on reservation life. Indeed, one of the effects of colonialism is that, in the U.S., members of the non-Native privileged class cannot see or grasp the travails of Native peoples. This is recognizable in how the National Broadband Map includes the political boundaries of states and counties, but not of sovereign tribal lands. (NTIA and FCC, 2013) These sovereign lands are invisible on the coverage map, and therefore invisible to policy-makers and technicians.

In the U.S., the national telecommunications infrastructure is one of the only major infrastructures—the others are the interstate transportation system and electric power grid—that has been primarily market-driven. The net effect is that urban and semi-urban locations, and locations neighboring major highways, receive the most robust and competitively priced ICT services—landline, wireless, fiber-optic cable, and satellite connectivity—while many tribes lack the infrastructure for basic phone service. Broadband infrastructures are quite costly to construct. With a price tag in the millions, including a steep learning curve for technicians, and the need for long-term business planning in economically marginalized tribal communities, the decision to invest in building out a network backbone represents a significant commitment for a tribe. It also represents a high degree of resiliency and resourcefulness. It shows how tribal leadership really must conceptualize broadband Internet infrastructures as a solution to complex community problems, problems well beyond simply gaining access to the Internet.

Thinking about tribal broadband infrastructures as solutions, and the resulting impacts of their build-out reminded me of the purpose of reframing. Many times, social problems that are deemed ‘Indian problems’—including that of lack of Internet and ICT access in Indian Country—are done so out of both a misunderstanding of how colonialism works, and out of misapplied generalization. Every tribe is bounded by both a unique historical experience of colonization, and a particular relationship within the landscape. Thus every tribe that identifies broadband infrastructure as a workable solution will innovate a unique strategy for acquiring and advancing broadband infrastructure. Only certain aspects are generalizable. In order to identify the problems that tribal broadband infrastructures generate and resolve, and the resulting social and

political impacts with regard to sovereignty, I cleaved close to the original problem that each project leader identified as the reason for investing in broadband infrastructure for their community. In this way, I culled those aspects that are particular to each tribe from those that ground a greater narrative about the conditions shaping U.S. tribal access to broadband Internet.

TDVnet: Advocacy Reveals Need for Broadband Subsidies and Spectrum

The leaders of the SCTCA framed a tribal broadband network as a solution to the need for community Internet connectivity, economic development opportunities, the means to share cultural knowledge, and the means for youth to use online educational tools.

To provide community Internet connectivity, TDVnet project leaders created community media labs and classes, and established SCTT as an affordable WISP for tribal residents and neighbors.

To create economic development opportunities, TDVnet project leaders conducted Cisco network trainings, and hired tribal members and local Native residents to work on SCTT projects and through the spin-off enterprise, Hi-Rez Digital Solutions.

To share cultural knowledge, TDVnet project leaders created the Tribal Digital Village archive, where tribal members post photos, videos, language lessons, oral histories, and other cultural knowledge.

To support educational objectives for youth, TDVnet project leaders provided free access to the schools, libraries, and community centers across the nineteen tribes.

If we understand broadband infrastructures as consisting of devices, systems, content, policies, and the people that make the whole network function, we can order how we conceptualize the changes TDVnet introduced within the service community across these dimensions.

With regard to devices, building out the TDVnet backbone introduced project leaders to the cycle of testing and modifying devices to fit connectivity needs and environmental constraints. The lack of electricity at some of the mountaintop base stations had construction crews hauling generators and battery packs via four-wheelers and helicopters. To prevent system outages due to loss of power, TDVnet backbone crews innovated a more sustainable electric power solution; they began wiring solar panels and small wind turbines to the generators and battery packs. They also began testing and comparing the wireless dishes to find the ones that could stream the greatest amount of bandwidth through the hill and valley terrain while sucking up the least amount of electricity. Much like the KPYT-LPFM station engineer bending the radio antennas to provide a stronger signal over a greater expanse of the Pascua Yaqui reservation, the TDVnet engineers were adjusting the dishes beyond their original design. They also began testing and innovating new devices, such as wireless mesh transmitters, for their canyon communities, and other communities located out of the line of sight of towers.

With regard to systems, TDVnet programmers worked with community members to articulate an ontology for the Tribal Digital Village intranet archive. As more people began connecting to the Internet from their homes, the demand for bandwidth grew, and network administrators began redirecting available spectrum. With TDVnet being run

almost entirely off of unlicensed spectrum, network administrators began thinking of how to gain access to more spectrum across the checkerboard reservation lands, and how to reprogram the network system and devices to broadcast more efficiently.

To TDVnet administrators, the demand for greater bandwidth signified an increased use of heavier streaming content. In part, this has to do with the changing nature of Internet content and the availability of streaming broadband devices. Rantanen told me about how, from the late '90s through the early 2000s, the tribes had developed a process for handling paper-based government grants applications. But when the Federal Register moved to a primarily online mode of dissemination, tribal departments found that they were missing out on notices of grants opportunities. Ever since the federal government moved to using Grants.gov to accept applications, the tribes have had to adjust their work modes to meet the electronic application cycles. TDVnet allowed tribal departments to move from a paper-based grants application cycle to an electronic application cycle. The next step has to do with increasing bandwidth to handle streaming video content and gaming.

Yet perhaps one of the most compelling impacts of TDVnet—both within the service community and at the national level—has to do with policy changes prompted by the build-out. In seeking funding opportunities for subsidizing access costs, TDVnet leaders discovered that tribal libraries and schools are not eligible for e-rate funds: federal funding designed to subsidize Internet access to public schools and libraries. Part of this is because the funding is administered through the states, positioning state sovereignty against that of tribes, even though tribes have a direct relationship with the federal government. Rantanen has spoken on this issue in tribal telecommunications forums.

Rantanen and others have also advocated for changes to the FCC's policy on allocating spectrum over sovereign tribal lands. (FCC, 2012) The complicated work of obtaining rights-of-way to construct broadband infrastructure within sovereign tribal lands has also prompted discussions about adjusting this federal grant requirement. It is within the sovereign rights of tribes to administer property inheritance and regulate domestic relations according to customary practices. Tribal homeowners may not have deeds or documentation other than through oral history or local knowledge of family lineage. This can make the federal requirement for obtaining rights-of-way within tribal lands nearly impossible to comply with for many tribes, especially when it comes to stringing fiber-optic cable. Even with rights-of-way documentation, tribes still need to work with elders and community leaders to obtain permission for building out infrastructure in a manner that is respectful of the landscape. Rantanen described a scenario in which the SCTT build-out team had to delay plans to lay a tower foundation because of the natural growth of the manzanita plant in the same area. Manzanita is a sacred plant for the Kumeyaay peoples, and could not be cut down to make way for the concrete foundation and surrounding fencing. Interestingly, a seasonal wildfire brushed through the hillside, sweeping away the manzanita in the proposed build-out location. At that point, community leaders gave the SCTT team permission to lay the foundation and set up the fencing. This example shows that while construction teams must comply with a standard environmental impacts assessment requirement, working with tribes also requires understanding customary laws about ways to set up infrastructure—constructing towers, digging for fiber-optic cable, stringing aerial fiber, clearing roadways, and hosting blessings—within the homelands.

Between modifying devices, upgrading systems, teaching community courses on digital content creation, and policy advocacy, TDVnet personnel have developed a new skillset as certified tribal broadband professionals informed by an awareness of Internet access as a sovereign tribal right. At present, the Zero Divide Foundation—a digital rights advocacy non-profit based out of San Francisco—is conducting a community impact evaluation of TDVnet services. Yet the national impact of TDVnet leaders is noticeable. Rantanen advises the FCC Office of Native Affairs and Policy, is active in the NCAI Telecommunications Forum, and presents on tribal broadband issues at TribalNet and Tribal Telecomm. The work of deploying TDVnet has also informed the visionary 2006 document of the Indigenous Commission for Communications Technologies in the Americas. (ICCTA, 2006)

All of these changes have occurred in just over a decade, from nineteen tribes with a colonial legacy of having been disconnected, and having no, limited, or costly Internet service, to the TDVnet leaders agenda-setting in national tribal telecommunications forums.

Red Spectrum: Creating Demand Encourages Investment in Robust Infrastructure

In the early 2000s, Fast Horse and Jones framed a tribal broadband network as solution for the need for connectivity, and the means to support expressions of cultural sovereignty. Establishing Red Spectrum Communications as an ISP, and wiring tribal administration buildings and community computing centers addressed the need for

connectivity. Supporting RezKast and land management efforts through a GIS program positioned Red Spectrum to support expressions of cultural sovereignty.

With regard to devices, the Couer d'Alene tribe has upgraded continuously, with IT personnel wiring tribal administration buildings for a LAN, to network administrators increasing bandwidth for hosting RezKast, to construction crews attaching wireless dishes and positioning towers for a WISP. Now, sub-contractors are in the process of stringing fiber-optic cable across 275 miles of forested river valleys and flatlands for the Couer d'Alene fiber-to-the-home plan, which includes the hardware, digital devices, tools and vehicles to support the long-term 12.3 million dollar build-out.

Fast Horse and Jones made the decision to upgrade to fiber-optic based on community use data that showed users relying on heavier content not only for leisure and entertainment purposes, but also to support tribal administration, such as within the tribal GIS program. Much like what happened with SCTT, as project leaders, Red Spectrum personnel will upgrade the network systems to meet the demands of fiber-optic use. Tribal Chairman Allan describes the goals of the fiber-to-the-home plan as creating opportunities for educational access, economic opportunity, and job growth. (Red Spectrum, 2013)

With regard to policy, when asked to describe the fiber-to-the-home plan, Fast Horse harnessed the language of self-determination:

True economic development won't happen if we only focus on our financial capital while ignoring the human spirit. Our challenge is to revitalize the spirit of our people through true self-determination. It is our hope that by lighting up the reservation with a fiber optic network we will spark our most creative minds and encourage the knowledge-based economy we've been striving to develop. (Red Spectrum, 2013)

Approaching tribal broadband from the perspective of self-determination and cultural sovereignty is part of why Fast Horse represents such a strong voice in forums such as the NCAI Telecommunications Forum and through the FCC ONAP. Red Spectrum leadership impacts broadband policy at the national level.

With the new fiber-optic plan in motion, Red Spectrum operations are expected to increase and expand, creating jobs, training opportunities, and community demand for greater bandwidth, in short, creating the Indigenous knowledge work that Fast Horse references above.

The impacts are difficult to comprehend without recalling the intergenerational struggles of the Couer d'Alene people contending with over a century of industrial pollution in the tribal waterways and mountains. The Red Spectrum fiber-optic upgrade is not only about meeting community demand for bandwidth or about creating local jobs: it is about preparing younger generations of the Couer d'Alene tribe to leverage ICTs toward revitalizing the land, waters, and spirit of the people in spite of ongoing colonization.

Lakota Network: Infrastructural Command Shapes Tribal ISP Enterprise

A commonly referenced reason for investing in these infrastructures pertains to the need to create economic and educational opportunities for younger generations. This is a key dimension of self-determination that is not often explained. When, in 1978, the U.S. Congress ratified the Indian Education and Self-Determination Act, for the first time in a long time, tribal leaders were able to design and administer their own social service and

other programs on the reservations. Before, many programs were created by federal agencies comprised of individuals unfamiliar with particular community needs—much less the long histories of the peoples within their homeland—especially with regard to the need to create programs to sustain future youth.

This is why concepts like economic self-determination are so powerful in Indian Country. The CRSTTA was one of the first 100% Native owned telecoms operating within the U.S. For years, it has been a source of jobs, training, and affordable telecommunications connectivity on the Cheyenne River Sioux Reservation. Bourland and Williams first proposed investing in Lakota Net to address the need for more local knowledge-based jobs as well as affordable Internet connectivity. The CRSTTA command of Lakota Net allowed Bourland and Williams to both monitor its build-out as well as assess community use and readiness. This level of command prefigured the development of spin-off tribal enterprises—the ISP, credit card billing company, and data digitization company—that proved to be beneficial in different ways.

With regard to devices, shifting the CRSTTA to a telecom and ISP required purchasing the towers and receivers, and setting up the computing facilities and hardware to train local technicians. The data digitization function of Lakota Technologies, Inc. weaves industrial printers and scanners into the Lakota Network ecology of devices. With regard to systems, CRSTTA technicians underwent the same adjustment that Tagaban described occurring at Navajo Nation; IT personnel learned about telecommunications standards and about network administration requirements, adjusting internal work systems accordingly.

With regard to content, Cheyenne River Sioux Tribe personnel now handle different kinds of data through different kinds of knowledge work within the reservation. These include supporting streaming content through the ISP, to designing tribal administrative websites, to digitizing large amounts of data for the National Library of Medicine and other contractors. Add to that the Cheyenne River Sioux Tribe radio station, which is run out of the Lakota Technologies, Inc. building, and we can get a sense for the diverse information flows streaming through the Lakota Network.

With regard to policy impacts, the leadership of the Cheyenne River Sioux Tribe have, for a while, been an active voice with regard to tribal telecommunications matters, expressing topics of interest and raising concerns with the Native American Broadband Association and in different tribal telecommunications forums. Being able to represent telecommunications issues from the perspective of tribal economic self-determination allows Cheyenne River Sioux Tribal leadership to point out critical issues with regard to broadband in Indian Country. In 2004, the FCC issued an inquiry regarding the possibility of providing broadband over existing power line systems. At the time, the FCC ONAP was not yet formed. Concerned that the federal government might undercut tribal efforts to harness their own broadband business solutions, CRSTTA leaders asserted that

only by consulting with individual tribal governments on a case-by-case basis can the Commission as a practical matter determine whether an Indian reservation is underserved, and also determine the manner in which that tribal government may wish to address the question of availability of broadband Internet services within Indian tribal territory. (Cheyenne River Sioux Tribe Telephone Authority, 2004)

This proved to be an important point, and was acknowledged by the FCC, as later FCC Chairman Michael Copps would advocate community-based broadband solutions for tribes, solutions that would best meet tribal jurisdictional limitations and particular community needs. The CRSTTA commentary reminded FCC authorities of the tribal right to self-determination.

Underlying the CRSTTA investment in the Lakota Network is the goal to encourage tribal members to develop the skill to be able to work in a knowledge economy. Developing a diverse knowledge-based business portfolio has allowed tribal business and political leaders to teach and train younger generations about the kinds of knowledge work that can occur through the reservation. For the Cheyenne River Sioux Tribe, command of the local broadband infrastructure has been empowering in this regard. The impact is difficult to understand without remembering that the Indian Education and Self-Determination Act was signed only just over thirty years before.

Navajo Nation: Tribal Command Encourages Long-Term Broadband Investment

Perhaps one of the most difficult aspects to explain about the impacts of broadband in Indian Country pertains to misunderstandings about the originating need for affordable and robust broadband connectivity. Others have written about the difficulties of supporting business in Indian Country. Many of the factors that now preclude many tribes from either launching their own ISPs or contracting with competitively priced providers have to do with these economic constraints. Entrepreneurs must engage with federal Indian law, comply with the taxation and regulation requirements of tribes, obtain

rights-of-way across tribal jurisdictions, and, in some cases, be willing to abide by tribal hiring preferences. Many entrepreneurs do not know how to conduct business with tribes. There are assumptions about reservations as impoverished places that cannot support market demand. Driving through the Navajo reservation—past miles of red and yellow desert, through scrubland, low pine forests and bordering a handful of small towns—it's easy to think this way. The striking juxtaposition of a Macintosh computer, designed for use in the suburbs of wealthy Palo Alto, California, against the Ganado, Arizona landscape highlights this divergent thinking. When the NAATP managers identified satellite Internet access as a reasonable solution for connectivity across the expanse of the Navajo Nation, they were not quite fully considering the particular community information needs of the Navajo Nation.

Various ICT leaders within the Navajo Nation worked together to draft the Internet to Hogan plan specifically to address the unique needs and infrastructural possibilities across the diverse landscape. The goal of the plan was community connectivity over time, with an emphasis on tribal command of the infrastructures and advancement of various tribal administrative ICT goals.

With regard to devices, over time, this resulted in the acquisition of facilities and hardware to support computing labs at Navajo Technical College, wireless towers and devices, and now, a network of terrestrial and aerial fiber-optic cable throughout the Four Corners area. With regard to systems, the Navajo Nation has, within a decade, shifted from administering a series of disconnected LANs to hosting a robust—meaning, wireless, landline, and fiber—broadband infrastructural grid through the Tribal Utilities Authority.

With regard to content, the Tribal Utilities Authority, Navajo Technical College, Diné College, and other workplaces and educational sites across the reservation now host advanced technical skills trainings, courses, and degrees for tribal members. Diné College offers a bachelors degree in computer information systems, and Navajo Technical College offers bachelors degree in computer science, digital manufacturing, new media, and associates degrees in computer aided drafting, GIS, and information technology. KTNN, the Nation's AM radio station is now streaming online, and soon the Nation's KWRK-FM station will also be available online.

Meanwhile, with regard to policy-making, Brian Tagaban is actively involved in Tribal Telecom, and also advises the FCC ONAP. Over time, it will be interesting to see how the Navajo Nations approach to telecommunications and broadband regulation—innovation and affordability through regulation—will shape FCC policies on subsidizing broadband ISPs throughout Indian Country.

Observing the Navajo Nation realize the Internet to Hogan plan teaches us not only about the impacts of intra-tribal planning for broadband connectivity, but it also teaches us about how the tribal command of the infrastructure shapes control over regulatory matters and attentiveness to community needs.

Common Impacts of Deploying Tribal Broadband Infrastructures

When it comes to deploying broadband infrastructure across tribal lands, project leaders work through a few common conditions. Project leaders must account for the inherent, legal/political, and cultural sovereignty of tribes; the technical specifications of devices;

sources of funding; policy and regulation at the local, state, and national levels; the support and investment of the tribal council and other key partners; and the skill and interest of the target communities. Community needs assessments and pilot ICT projects are key steps in the overall strategy for designing and deploying tribal broadband Internet infrastructures. Project leaders possess a unique skillset, including business, political, and technical acumen. They know the histories of their peoples, and engage tribal council and other leaders. They work cooperatively in local and national policy arenas, advocating for the changes they need to realize increasingly robust infrastructural deployment plans. They focus on training younger generations of the tribe, incorporating technical training, digital literacy, and policy awareness into the skillsets of project employees and tribal community members.

As a result, the inherent cultural sovereignty of tribes drives broadband goals, priorities, and next steps, with the legal and political enforcement of sovereignty reinforcing the need for tribal access to licensed and unlicensed spectrum, feasible infrastructural subsidies, and rights-of-way across state and federal jurisdictions within Indian Country. Tribal leaders exercise sovereignty when they assert the right-of-way for constructing towers and laying cables on or near tribal lands. They assert sovereignty when they demand that the FCC create a tribal priority for licensing spectrum, the airwaves across which digital signals travel. They assert sovereignty when they tax providers of Internet services to peoples on tribal lands. They assert sovereignty when they regulate infrastructural uses. They assert sovereignty when they remind federal authorities to respect tribal broadband efforts as a matter of self-determination.

This research shows the critical importance of tribal ICT champions leveraging partnerships in order to guide tribal, regional, and U.S. broadband Internet policy, access, infrastructure, and utilization decisions. At this point in time, there are at least thirteen tribally-owned or Native-owned telecommunications and ISPs within the U.S. While this represents a fraction of federally-recognized tribes, the political and social clout of the ICT champions affiliated with these entities is remarkable. The champions mentioned here—Valerie Fast Horse, Matt Rantanen, Brian Tagaban, Greg Bourland, and J.D. Williams—all serve in advisory capacity to the FCC Office of Native Affairs and Policy, as well as in other spheres including Native media advocacy groups, community technology advocacy groups, and Native business associations. As advisors to the FCC, these individuals will be directly speaking to the areas of Internet governance outlined in the National Broadband Plan, and are called to deliver congressional testimony as notices of inquiry are released and consultation efforts prepared. Over time, every tribe will make their own decisions about how to address advances in broadband technologies. For tribes, gaining access to broadband is not just about plugging into a grid. It's about establishing partnerships to construct that grid from the ground up, and advocating for the policy changes needed to weave this critical infrastructure into the diverse geopolitical ecologies of Indian Country.

Chapter 5. Network Sovereignty: Broadband and the Rights of Tribes

This research shows how the process of building out broadband infrastructures is constrained by the sovereign rights of tribes, both in terms of jurisdictional limitations and with regard to the underlying reasons for implementing broadband as a solution for community needs. What I did not expect to find was how the build-out process creates opportunities for project leaders to convey the obligations of federal and state governments, and other project partners, to Native peoples and governments within the context of sovereignty and self-determination. This research has led me to conceptualize the following premises underlying Native uses of ICTs, and specifically, around the social and political implications of tribal broadband infrastructures.

One is that the histories of ICTs are inevitably intertwined with histories of colonization, sovereignty, and self-determination.

The second is that federally-recognized tribes, having understood this, now exercise their sovereign rights to acquire broadband Internet infrastructure and services for the peoples living on or near their reservations. Tribal leaders command the build-out of broadband infrastructure as part of a greater effort to enable the self-governance of Native peoples.

The third is that the process of network design, deployment, and regulation embeds these infrastructures within the ongoing negotiation of the sovereign rights of tribes within the U.S. This has major implications for how design, deployment, and regulation are enacted.

The Third Network: An American Indian Sociotechnical Landscape

Understanding specific ways that ICTs are interwoven throughout Indian Country helps us to conceptualize how the histories of ICTs are intertwined with histories of colonization, sovereignty, and self-determination.

I share a story by way of explanation, a story about a visit into a leadership and policy-making forum in Indian Country, the NCAI Tribal Leader/Scholar Forum.

In the summer of 2010, I caught a plane with my colleagues in the Indigenous Information Research Group to River Bend, South Dakota. It had been a rough flight coming in over the Black Hills. Thunderheads burned red and orange against the setting sun, and grew dark with lightning. The plane bounced through the storm. I exchanged glances with Ally Krebs and Miranda Belarde-Lewis. Ally clasped her hands together. Her eyes grew big and she whispered, ‘they know we’re coming,’ referring to the descent of tribal leaders of ancestral lineages coming from all parts of Indian Country to this place for sharing knowledge. These dimensions accompany convenings of Native leaders: the acknowledgement of the environment, the Indigenous histories of places, and the reverence for ancestors.

In the shuttle from the airport to the hotel, we discovered that Miranda was friends with a co-worker and relative of another passenger in the van, who was also on the way to the forum. Ally knew another person in the van. We passed a billboard that read, ‘don’t drink and drive. It’s uncivilized.’ Heavy like long hair, raindrops streamed against the vehicle windows. Lightning lit the dark plain.

The next morning, the conference opened with the words of elders. A woman spoke on the need for us to reclaim the sovereignty of the airwaves over tribal lands. Tribes need to share their knowledge, news, and the language through the radio and other means. She described a future where tribes could launch their own communications satellites through their own airspace. She asserted how airwaves, like waterways and forested lands, should be held by the U.S. in trust for sovereign recognized tribes.

When we presented later on the subject of tribal ownership of information and data, a leader from one of the northwest tribes reminded us, gently, not to forget the treaties. I thought about that admonition: don't forget about the treaties. I thought about the role of information as surveillance in the long history of colonization between military authorities, settlers, and Indians. (Drinnon, 1980; Richards, 1996) I thought about Eloise Cobell's painstaking accounting for all of the mathematical mistakes, technical errors, and misreading of regulations by U.S. federal authorities proving the theft of billions of dollars and hundreds of acres of lands from Native and African American farmers. (Merjian, 2010) I thought about how the treaties were so often forged in English—not the Native languages—on paper—the skin of trees felled on Native lands—and locked in U.S. government archives, far from the lands and leaders who negotiated their original intent. I thought about how, in spite of the language of the treaties, we had before us generations of Supreme Court justices who favored the immoral and unjust doctrine of discovery over their comprehension of international treaty-making as an acknowledgement of the inherent sovereignty of peoples. (Deloria & Lytle, 1983; Wilkins, 1997)

At that particular convening in the township settled at the foot of the Black Hills, I learned that there is the policy of sovereignty, there is the material substance of it, and there is its enactment. Where treaties were documented on paper, the paper comprised the materiality of it. Treaties, policies, and court precedents incorporate Native lands, waters, and bodies into the legal system underpinning U.S. law and policy. The rights are not disconnected from the substance. As tribal leaders negotiate and assert the rights of Native peoples across digital media, the supporting digital devices and infrastructures become imbued with the values of sovereignty. The policy, materiality, and enactment of tribal sovereignty exist within the dynamic flux of human relationships.

For years, tribal broadband and telecommunications advocates J.D. Williams, Matt Rantanen, Valerie Fast Horse, Shana Barehand Green, Traci Morris and many others have been voicing their concerns to members of Congress and the FCC about the lack of critical telecommunications and broadband infrastructure in Indian Country. In 2010, FCC Chairman Julius Genachowski appointed Geoffrey Blackwell, Muscogee (Creek) to head the newly formed FCC Office of Native Affairs and Policy. (FCC, 2010) In 2011, the authorities of the FCC ONAP began traveling to different places in Indian Country, hosting at least six workshops on federal broadband and telecommunications initiatives designed to assist rural and tribal borrowers, and learning about the issues in building out a durable ICT infrastructure through Indian Country.

In 2012 they walked through a reported broadband wireless zone on the lands of the Confederated Tribes of the Colville Reservation bordering northeast Washington. Sections of disconnected and unused fiber-optic cable lay by the side of the road. They saw how areas reported covered in the National Broadband Map proved to lack basic

infrastructure. (FCC, 2012) They observed first hand how federal policies were not aligning with the geopolitical landscape of Indian Country. They observed how digital devices didn't function in areas lacking infrastructure, or the infrastructure was not placed to function on top of the mesas, as in Hopi, alongside canyons for the Hualapai, through tree lines for the Yurok, amid deep freezes and heavy snows, as in the North Slope of Alaska, or across the checkerboard of the southern California reservations. They heard the concerns of tribal Traditional Historic Preservation Officers, who shared accounts of telecommunications providers building towers on sacred sites, without permission from tribal elders or other authorities. I recalled how, during the summer of 2011, as Mike Wilson and I were leaving the Tohono O'odham reservation in southern Arizona, I spotted telecommunications towers atop Kitt Peak, a sacred mountain—a center of Creation—for the O'odham, and the location of a National Optical Astronomy Observatory (NOAO) funded by the National Science Foundation (NSF). I wondered if credible representatives from the NSF, the NOAO, or the regional telecommunications providers had consulted with the Tohono O'odham elders, Traditional Historic Preservation Officers, or elected leadership before constructing these large-scale systems on sacred sovereign land.

Technological devices are woven throughout Indian Country. There are vehicles, two-way radios, AM/FM radios, televisions, push-button phones, smartphones, and laptops. In some places, there is the infrastructure to make these work: gas station pumps, server rooms, phone lines, telecom towers, solar panels, power lines, and wind turbines. Leaders in Indian Country use these devices to defend and enforce the sovereign rights of tribes. Policy-making is about communicating. Indian Country is, as a matter of speaking,

the legal definition of a place wrought by the overlapping colonial policies of conquest and treaty-making, removal and relocation, allotment and assimilation, reorganization, termination, and now, self-determination. (Deloria & Lytle, 1983) There are the devices, there are the people, and there is the policy as it is negotiated over time. The relationships between these emerge against the backdrop of the geopolitical landscape.

Broadband leaders in Indian Country understand the sociotechnical implications of the tribal command of broadband infrastructures and services. In 2009, members of the Native American Broadband Association described broadband as the third network, a network critical to tribal integrity.

Twice before networks made major changes to Indian Country. In the 19th century a network of railroad tracks were laid across Indian Country resulting in the wiping out of the buffalo herds, providing quick movement of military personnel, and the influx of millions of immigrants. Most of the railroad roadbeds laid down then are still in the same place today over 100 years later. The second network was the system of electrical and telephone lines laid out in rural America in the 20th century. Once gain, once the lines were put in they tended to stay where they were....For tribal government however, broadband service will play a vital role in nearly everything they do....These broadband networks to be most effective need to be shared with neighboring towns and areas off the reservation....While making sure that networks inter-operate, tribes need to protect their tribal sovereignty in the data information age. (Native American Broadband Association, 2012)

This expression—broadband as the third network—highlights an important dimension of these infrastructures: they bear a colonial legacy and a future impact that is closely tied to the history of Native peoples in the U.S.

This meaning is captured in the content flowing across the networks. Tribal personnel transmit information and data transmitted across health databases, accounting systems, fax machines, and via email. There are the ways of knowing elders and leaders share with younger generation, in person, while in the homelands, and now, via Rezkast, streaming radio, and podcasts. Content pertinent to the integrity of the tribe relates to the homeland, and by homeland, I am not referring to a geographic point on a map such as the National Broadband Map. By homeland, I am referring to the histories of beings living in right relation to each other within a landscape slowly shifting over the course of hundreds of human generations. (Deloria, 1999) The Native peoples of the U.S. will not leave or sell a homeland just because it lacks the infrastructure for Internet connectivity. As one Supreme Court justice stated in 1960:

It may be hard for us to understand why these Indians cling so tenaciously to their lands and traditional tribal way of life. The record does not leave the impression that the lands are the most fertile, the landscape the most beautiful or the their homes the most splendid specimens of architecture. But this is their home—their ancestral home. There they, their children and their forebears were born. They, too, have their memories and their loves. Some things are worth more than money and the costs of a new enterprise. (Federal Power Commission v. Tuscarora Indian Nation, 1960)

At their core, tribal governments are comprised of people working through institutions they have struggled to articulate in order to protect and revitalize the homelands. It is an ongoing struggle, and not without critique and the need for meaningful change.

As an Indigenous information scientist, I see Indian Country as an assemblage of devices, policies, and institutions emerging out of Native peoples' unique historical and ongoing relationships with each other, with neighboring non-Natives, and within the

homelands. These relationships are characterized by the qualities of information and knowledge that beings perceive, share, communicate, and experience amongst each other. Ways of knowing shape rules and behaviors. Individuals work through institutions to codify and create forms of information and knowledge. Institutions require infrastructure to function, and at present in Indian Country, robust and durable broadband infrastructures are integral to the functioning of tribal governments.

Indigeneity and Self-Governance in a Network Society

The second idea that has emerged from weaving together the narratives of tribal broadband deployments is that federally-recognized tribes exercise their sovereign rights to acquire broadband Internet infrastructure and services for the peoples living on or near their reservations. Tribal leaders command the build-out of broadband infrastructure as part of a greater effort to enable the self-governance of Native peoples. At this point in history, the sovereign rights of tribes and the policy of self-determination are mechanisms toward this greater effort.

In his 1997 book on identity in the network society, Manuel Castells forecast that as ICTs became locally available, identity-based groups would utilize these tools to organize politically and communicate to a global audience their socially exigent status. He theorized the rise of identity-based communalities amid a globally interconnected network society. Yet it's important to remember that Indigenous peoples political expressions—and especially with regard to sovereignty in the U.S.—are not identity-

based movements, but in fact represent a long-term flexible mode of governance for a land-based people.

To describe this distinction, I'll provide a framework for explaining how to understand Indigenous peoples' uses of ICTs within the context of an imagined global network society.

First, we must acknowledge the political roots of Indigeneity, and that is that Indigeneity cannot be understood without reference to the governmental power and technological advance of modern nation-states. (Niezen, 2003) During the era of discovery, conquest, and treaty-making, it was the practice and habitus of European settlers to classify the indigenous peoples of non-European lands according to the perceived complexity of their tools. On a scale, the indigenous peoples of the Americas ranked lesser than did the indigenous peoples of Africa—who were perceived as being only effective as labor—and greater than the indigenous islanders of the Pacific—who were perceived as idle. (Adas, 1989) These perceptions, written down and codified into social policy, would come to inform the maltreatment and misunderstanding of Native peoples of the Americas and all others on the non-European, and therefore non-Enlightened, scale.

Second, we have to acknowledge how the U.S. history of the colonization of Native lands, bodies, and waters has shaped the ability of Native peoples to socially organize and communicate. Armed with a sacrosanct belief in the correlation between moral progress, private property, and technological advance, settlers purveyed public and Christian schooling, surveyors tools and map-making, dam-building, telegraph communications, agricultural work, factory work and the internal combustion engine as

the means to settle indigenous lands, waters and bodies in the Americas. (Turner, 1893) While Supreme Court Justice Marshall was utilizing *Worcester v. Georgia* to define the domestic dependency of the Native peoples of the U.S.—pre-colonial wards of a technologically advancing state—Samuel Morse was refining the electromagnetic telegraph and Morse code. (*Worcester v. Georgia*, 1832; Mumford, 1934) Thirty years later, the Pacific Railroad Acts (1862, 1864, 1867) abetted the era of removal, relocation, and warfare against Native peoples whose lands were tied up in the build-out of the railroad and associated logging

and mining enterprises.

Telegraph operators worked with railroad entrepreneurs to set up telegraph posts at each railroad station, signaling to military authorities perceived movements in Indian Country.

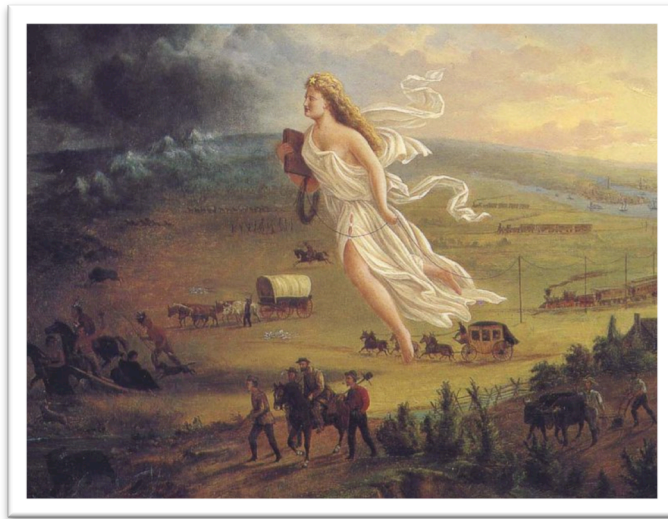


Figure 10. Gast's (1872) *American Progress*

The 19th century painting *American Progress*

captures this gestalt. (Figure 10) She is “floating westward through the air, bearing on her forehead the ‘Star of Empire’...she carries a book...the emblem of...national enlightenment, while, with the left hand she...stretches the slender wires of the telegraph that are to flash intelligence throughout the land.” (Gast, 1872) Depicted in the lower left corner, Indians flee westward under a dark cloud, trailed by the telegraph and railroad. At the time of the painting, Native peoples of the southeast were enduring removal through

the Trail of Tears, the people of the plains were being confined by military force to reservations, federal authorities and missionaries were kidnapping children into boarding schools, and in the burgeoning U.S.-Mexico borderlands, former Confederate soldiers were paid government money for Indian scalps and captives. The Colt revolver was a key technology of this era.

By the era of allotment and assimilation, church rolls, government accounting systems, and libraries of court proceedings represented systems integral to the subjugation of Native peoples of the U.S. Their original names misrepresented in these systems and the original treaties ignored as the supreme law of the land, the original indigenous inhabitants of Turtle Island became codified into an exceptional sub-class of American citizens: Indians, or American Indians. Native peoples were prohibited from speaking their languages. There are many accounts of the ways teachers abused Native children for speaking their language while in school. We can relate the era of allotment and assimilation—with its industrial and agricultural job training programs, forced schooling, theft of Native lands, and prohibition of the languages and spiritual practices—to a particular phase of colonialism through which indigenous bodies are inscribed as labor or eradicated as objects of terror; indigenous languages are marginalized to sanction a state language; and government-authorized institutions build systems to channel useful knowledge while censoring indigenous epistemologies.

Finally, to understand Native peoples' uses of ICTs within the context of an imagined global network society, we must acknowledge how, in spite of waves of modern nation-state colonization, Native peoples have organized to protect their homelands. Native youth learned from their parents' experiences of removal, relocation,

allotment, and assimilation. Communicating in the privacy of living rooms, while hunting, on the edges of ceremonial grounds, during work hours, or while in military service, Native peoples share their experiences of colonization.

Linda Tuhiwai Smith writes about this dimension of Indigenous peoples' knowledge. It is not confined to an ecological awareness of the homelands; it is also comprised of knowing how to survive the worst abuses of colonization. (Smith, 1999) It includes lessons of resiliency and endurance. Regardless of where they are from in the world, Native and Indigenous peoples shared experience of nation-state methods of colonization—most often couched under the veil of the economic imperative to industrialize—binds a highly politicized awareness of what it means to be Indigenous, with a capital I. Now a global and supranational political expression, the mobile and diffuse self-governance of Indigenous peoples got its start from localized expressions of the Native and aboriginal peoples of different countries undergoing phases of severe colonization. At their core, the mechanisms of colonialism are designed to curb the ability of Indigenous peoples to communicate among each other, mobilize, and recreate political institutions for reclaiming occupied terrain.

During the post-1960s era of self-determination, the telecommunications industry in the U.S. was characterized by aggressive free market capitalism, resulting in monopoly ownership over infrastructure and service providers. By the time the Telecommunications Act of 1996 allowed for the entrance of newcomers—and especially ISPs—through a regulatory process, Native peoples were only twenty years into setting up tribal programs independent of federal government authorization and control. (Indian Education and Self-Determination Act, 1978) It is no coincidence that the discourse of Internet

entrepreneurship is marked by the discourse of Manifest Destiny. (Turner, 1893) Consider the terms and phrases ‘information wants to be free,’ ‘Electronic Frontier Foundation,’ and ‘Internet pioneer.’ For Native peoples, it is as if the imperial urge to westward expansion moved into the cybersphere. Understanding the contemporary ICT landscape in Indian Country with regard to the governmental power and technological advance of the U.S. reveals the roots of factors that continue to preclude Native peoples from acquiring sovereign control over their own telecommunications and Internet service provision efforts.

Consider the tension between assertions that ‘information wants to be free,’ and that tribes need to claim the sovereignty of the airwaves. Imagine what it must have been like for the members of the Native American Broadband Association to review federal broadband subsidy programs designed with tribes in mind: ‘a century ago they wanted us dead. Fifty years ago they wanted us to be quiet and assimilate. Now they are asking us to help build a major national communication infrastructure across some of the most remote lands within U.S. borders. What new era is this?’

From an elite nationalist perspective, Indigenous peoples’ political expressions—most often made visible to a global audience via media channels—may appear to be disparate, fragmented, ephemeral, and based on the politics of identity. But this is not the case. To be Indigenous is to be a member of a community with a centuries-long relationship within a living landscape. Out of this relationship emerges a particular spirituality, and a particular philosophy of self-governance. Where Indigenous peoples from around the world relate to each other politically on the basis of a shared experience of modern colonization, the many Native peoples of the U.S. relate to each other on this

point and with regard to the responsibility to care for the homelands and peoples therein. What appear to be disparate and disconnected uses of ICTs actually represent a gap in the published literature about Native peoples' means of communicating across divergences effected by generations of colonization programs. Native peoples have many ways of knowing, and in the past thirty years or so, ICTs have served as a means for sharing these ways of knowing, and for negotiating intertribal and tribal-federal policies towards the treatment of Native homelands. Commanding the build-out and uses of their own broadband infrastructures allows tribes to also build their own information systems, policies, and programs to meet tribal self-governance goals.

Network Sovereignty and the Rights of Tribes

As a result, the process of broadband network design, deployment, and regulation embeds these infrastructures within the ongoing negotiation of the sovereign rights of tribes.

To understand this, we have to examine the ways in which the build-out of tribal broadband infrastructures intersects with the sovereign rights of tribes. Federally recognized tribes exercise the following eight legal/political rights: the rights to self-govern, determine citizenship, and administer justice; the rights to regulate domestic relations, property inheritance, taxation, and conduct of federal employees; and the right to sovereign immunity. (Cobb, 2005) Native peoples also exercise cultural sovereignty: they share information among themselves and with other Native peoples to strengthen knowledge of the homeland, histories, Native languages, spiritualities and ceremonial cycles, and ancestral lineage. While these legal/political rights have been negotiated in

U.S. courts and through treaty-making processes over the several generations, the rights to cultural sovereignty emerge from the will of Native peoples.

The first, and perhaps, cornerstone, right, pertains to the right of tribal peoples to self-govern. While self-governance refers to the cultural sovereignty of a people, meaning, referring to pre-colonial modes of governance, it also refers to modes of self-governance in the context of the domestic dependency within the US. We must recall how the present colonial arrangement is based on the policy of self-determination: federally-recognized Native peoples should and can determine the course of their own social services and civic arrangements within the federally-recognized boundaries of their land. (Indian Education and Self-Determination Act, 1975)

The principle of self-determination plays out in the ways tribes choose to deploy their own broadband infrastructures or negotiate more affordable solutions based on existing commercial infrastructures. It plays out in the way project leaders frame the need for broadband infrastructures, whether for purposes of strengthening cultural sovereignty, economic self-determination, administrative effectiveness, or for educational opportunity.

The principle of self-governance plays out in the decision-making around project planning. For example, for those tribes who do not have the capital to invest in setting up their own ISP, in order to compete for government grants and loans, they must first accrue sufficient credit. For tribes without major gaming operations or other sources of income, borrowing against trust and fee land becomes one way to acquire credit for loans. However, this kind of investment takes long-term strategic planning among tribal leaders and with community members, who must come to an agreement about appropriate uses of

the land. It is a matter of self-governance to decide in what ways to leverage the tribe's natural resources.

The practice of self-governance also plays out in the ways tribes decide to approach costly network upgrades and technical training. Part of the Navajo Nation's Internet to Hogan strategy includes continually investing in local technical skills training through Navajo Technical College. Likewise, part of the Cheyenne River Sioux Telecommunications Authority strategy is to advance the local skill set by setting aside a portion of profits to invest in community computing centers and job training for Lakota Technologies, Inc. employees. In both of these cases, community and business assessments are key to planning for upgrades, build-outs, and technical skills certifications. These approaches are markedly different from the Gates Foundation NAATP program, where non-tribal teams granted the hardware and set up the LANs, but did not partner with local community members to undergo a long-term technical training or upgrade and maintenance plan. Ultimately, the NAATP provided a learning experience for both the tribal participants and the NAATP program officers as to the magnitude of the planning required for US tribes to leapfrog. Recognizing that the maintenance of tribal broadband infrastructures represents a long-term investment for tribes also means recognizing the sovereign right of self-governance: tribal leaders are best positioned to make decisions about the feasibility and sustainability of these large-scale infrastructures.

Another key right of tribes is the right to regulate domestic relations. This means asserting jurisdictional boundaries, and setting up systems and policies for managing domestic relations within tribal lands. The right to regulate domestic relations pertains to the strategies tribal leaders employ to make sure that state and regional infrastructural

plans benefit or do not impede tribal infrastructural plans. At present the Navajo Nation Tribal Utility Authority, Gila River Telecommunications (Gila River Indian Community), and leadership from the Hopi Tribe are working with the state of Arizona Digital Arizona Council to make sure that the state broadband infrastructural plans align with their own tribal broadband infrastructural plans. (Digital Arizona Council, 2012) This highly coordinated effort requires joint broadband mapping projects, shared visioning, and attention to future build-out goals.

Where neighboring tribes, states, and municipalities do not work together, the potential for acrimonious relationships can contribute to spectrum-squatting, refusal to permit construction, and the development of non-competition clauses that may enable predatory business practices on tribal lands. An example is found in the Bresnan Communications, Inc. 2009 application for federal funding to construct middle-mile infrastructure across sovereign tribal lands in Montana (Dampier, 2010) Local, smaller ISPs and tribal members objected, pointing out how the Bresnan Communications middle-mile plan would replicate services smaller ISPs were already providing, and would not carry broadband Internet service into the more remote parts of the region that it claimed it would. Ultimately, the Bresnan Communications bid for \$70 million was denied by federal grants and loan program officers. In part, these kinds of acrimonious relationships result from lack of coordination among stakeholders early on, but with regard to tribes, can have resounding effects around future access, use, and infrastructural regulation. Tribes partnering with regional infrastructure teams must be clear about sovereign rights to taxation, obtaining rights-of-way, tribal environmental standards,

conduct of non-tribal personnel, and other practices for solidifying sound business practices pertaining to the right of tribes to regulate domestic relations.

Another sovereign right critical to telecommunications and broadband deployment plans is the right to taxation. Non-tribal ISPs may expect to pay a state tax and a tribal tax for infrastructures and services crossing sovereign tribal lands. At present the Law Office of Randal T. Evans, and the Mobius Legal Group are writing a handbook of communications regulation and taxation in Indian Country. Their efforts stem from lawyers in both firms recognizing the ways federal Indian law intersects with telecommunications taxation laws. Much work remains to be done in this area. Indeed, part of Navajo Nation's strategy for setting up the Navajo Nation Telecommunications Regulatory Commission is to clarify tribal taxation and licensing procedures for Native and non-Native ISPs seeking to provide services within Navajo Nation. Their experience shows how a crucial first step toward encouraging competition through telecommunications regulation in Indian Country is to clarify regulations for investors and entrepreneurs seeking to conduct business with tribes.

The tribal right to regulate the conduct and duty of federal employees also relates to local broadband deployment efforts as well as federal policy-making and agenda-setting. This is demonstrated through the development of the FCC ONAP, a development that occurred in large part out of both the efforts of advocates of tribal media as well as the 2000 Clinton administration Executive Order of Tribal Consultation. (Clinton, 2000) The recent meetings between members of the FCC ONAP and tribal Traditional Historic Preservation Officers present a lightweight example of the exercise of this particular right, as the Traditional Historic Preservation Officers reminded federal employees of the

need to create policies that require the recipients of subsidies to respect the laws around the protection of tribal sacred sites prior to constructing towers and stringing fiber-optic cable. Indeed, this research shows how tribes that build out their own broadband infrastructure gain political clout with various governmental and other institutional partners regarding telecom matters and the rights of tribes.

Undergirding all other tribal rights are the peoples' relationships within their homelands. This dimension of cultural sovereignty—deep knowledge of the homeland—applies to the decisions broadband project leaders make when deciding where and how to construct infrastructures. Broadband construction teams have to assess the lay of the land to identify the optimal locations for setting up towers and dishes for line-of-sight wireless technologies, feasible locations to dig for terrestrial fiber-optic cable, and stable locations for stringing aerial fiber-optic cable. Tribes must cut new trails and roads for construction crews in addition to obtaining materials and hardware that can withstand extreme terrain and climates—rock-strewn canyons, boulders, hills, valleys, mountains, waterways, impenetrable forest, permafrost, high winds, mesas, monsoons, freezing snows, wildfire seasons, and desert heat. This is why working with the Traditional Historic Preservation Officers, tribal archaeologists, and land management personnel is so important. Locations of sacred sites, plant life, ecological restoration areas, and migratory paths of wildlife must also be considered.

The history of colonial policies also in part influence treatment of the land in Indian Country, and this affects broadband deployments specifically with regard to obtaining rights-of-way for construction. Presently, many of the federal grants and loans criteria include a rights-of-way requirement wherein construction teams must acquire

signed permissions from all landowners whose property will be crossed in the laying of terrestrial fiber-optic cable or other necessary hardware. Unfortunately, for tribes, obtaining these rights-of-way can be exceedingly difficult, in part because of issues over tribal and state jurisdiction, unique treatment of customary tribal property inheritance rules, and property inheritance since the Dawes Act (1887). In some cases, tribes will want to build an infrastructure adjacent to state roads or state lands, but to do so requires obtaining rights-of-way to utilize cable that has already been laid under highways. This is where tribes must work closely with states, private landowners, or private business owners to gain permissions, and in some cases, to align their infrastructural plan with that of neighboring municipalities. (Cutright, 2012) Other tribes must demonstrate to grants and loan program officers that customary tribal practices of property inheritance, such as matrilineal property inheritance, mean that there are no documented property surveys or assessments per se, but rather local oral history of land claims. Other tribes must contend with trying to obtain rights-of-way from multiple signatories who have inherited fractions of land since the General Allotment Act, or Dawes Act, of 1887, and who continue to reside on the family plot, but who do not have title to the land other than through genealogical evidence.

Both the tribal right to regulate property inheritance and cultural protocols around treatment of the land can conflict with U.S. expectations of titled property claims, making it difficult for broadband teams to comply with rights-of-way requirements. Community members with deep knowledge of the homeland can help broadband teams understand how the construction of a broadband network backbone interfaces with the geopolitical rhythms of the land.

It was with reference to the history of colonization and the ongoing negotiation of sovereignty that J.D. Williams, along with many other individuals working in tribal telecommunications, testified before the FCC in 1999, identifying tribal telecommunications and ISP enterprises as an example of true self-determination. (Williams, 1999) At present, for the Native peoples of the U.S., social and political power is crystallized in the form of tribal sovereignty. Within the flux of human relationships, the nature of power is such that it cannot be stored—it is not a given—but rather it manifests through hundreds of smaller enactments across many interpersonal relationships. (Clegg, 1989; Law, 1991; Latour, 1991) Native peoples know that if they do not exercise the rights of sovereignty—legal/political and cultural—they will lose them to the U.S. colonial imperative. This is why the first elder to speak at the 2010 NCAI Tribal Leader/Scholar Forum asserted the need for tribes to claim the sovereign right to airwaves. As Native peoples we cannot expect that the federal authorities will give these to us, or hold these for us in reserve. Rather, we have to assert their obligation under the context of prior policies and court precedents, and strengthened by cultural sovereignty, make use of both the claims and the airwaves. Tribal leaders listened to this elder's important words. Now, in 2013, the FCC ONAP is investigating processes for creating a tribal priority to access spectrum over tribal lands. (FCC, 2012)

This research has shown me how tribal command of broadband infrastructures and services undergirds the greater goal of helping Native peoples to connect, communicate, and share information and knowledge critical to the survival of Native peoples after a century of the disconnection enforced by early U.S. industrialization and technological advance.

This research has also shown me how moving into the future, reliable and robust broadband Internet infrastructure and services in tribal lands will be integral to the exercise and ongoing negotiation of tribal sovereignty. Enforcing sovereignty means communicating with surrounding federal, state, and municipal authorities. It means building systems to transmit key information quickly and efficiently. It means building systems to archive knowledge for future generations of tribal leaders. These systems will be built based on Native peoples' ability to access affordable and robust broadband Internet. We are fortunate to have in our midst leaders with the know-how and political savvy to guide the rest of us.

Chapter 6. The Research Contribution and Future Research

One of the most difficult aspects of entering into this line of inquiry—broadly, the impacts of ICTs in Indian Country, and specifically, the infrastructures underlying their use—pertains to accurately ascertaining the social and political context of Indian Country, and then structuring analytical frameworks for making sense of ICTs within this particular context. Achieving these two objectives has, for me, yielded more than a few insights into why the field of information science has only as of late begun to productively integrate questions of political power, social difference, and access into lines of inquiry. I have articulated this research as a bridge between what the field of Native and Indigenous studies has to say about Indian Country and the nature of colonialism, and what the field of information science has to say about information and devices in daily life. Doing so has led me to conceptualize the mechanisms of intellectual decolonization within the field of information science in very tangible ways. Standing at the crossroads between Native and Indigenous studies and information science with an activist academic's gaze brings into focus a number of research questions and lines of inquiry pertinent to the scholarly advancement of understanding about forces of colonialism, the phenomena of information through the human will to organize labor, as well as what befits my personal interest, articulating the mechanisms for decolonizing Native and Indigenous communities through applied knowledge of how information works.

What Tribal Uses of ICTs Reveals About Conceptualizing ICTs in Marginalized Communities

It's important to acknowledge not only the dearth of scholarly literature on the intersection of ICTs in the lives of Native and Indigenous peoples, but also the degree and nature of the inaccuracies in the literature that is available.

A good amount of inaccuracy in the scholarly depiction of Native peoples' uses of ICTs emerges out of the prevalence of colonial logics at play in many social scientific fields of study. Researchers in the broad field of information science are not necessarily trained to account for the realities of colonialism or, more specifically, the sovereignty and autonomy movements that underpin the Indigenous experience. Similarly, researchers in the broad field of science, technology, and society studies, while able to engage social scientific accounts of power to explain social difference, have contributed few studies dealing with the particular forces inscribing the American Indian experience. Media studies researchers—communications, journalism, arts and aesthetics, film and media, and cultural studies—have in their archive descriptive studies on topics such as film and media in Native American communities, community radio initiatives, and quite a lot on the topic of media representation of Native peoples. Yet the disciplinary orientation of media studies precludes the pragmatic engineering orientation—emphasis on design, policy, and behavioral outcomes—that guide much of the inquiry in information science. Thus there is much description of possible media effects and the matter of gaze, but less on the functionality of information and devices as habitus in Native peoples lives.

There is one body of work that effectively sidesteps these challenges, and this is comprised of the research and scholarly articles arising out of informatics researchers' and legal scholars' engagement with the K-Net project in northern Ontario, Canada. The research and writing of Brian Beaton, Susan O'Donnell, Michael Gurstein, Richard McMahon and their colleagues are among the first to bridge information scientific methods and discourses with an understanding of the policies and histories shaping uses of ICTs within First Nations reserves.

Nevertheless, though there are more information schools in the U.S. than in Canada, few information scientists in the U.S. have engaged such an approach with regard to the unique policies and histories shaping uses of ICTs within American Indian reservations. As Native and Indigenous scholars well know, the social policies that the authorities of modern nation-states employ to deal with their indigenous 'subjects' very much shape the ways Native and Indigenous peoples generate corresponding modes of governance toward community resilience and survival. To the untrained eye, aboriginals, Indians, American Indians, Native Americans, and indigenous peoples are all marginalized ethnic minorities of more perfect modern technologically-advancing nation-states. The temptation is to compare their cases regardless of time and place, and worse, with disregard for their diverse geopolitical contexts and distinct philosophies, histories, languages, and spiritualities. U.S. policies shaping ICT infrastructural access across American Indian reservations must differ from Canadian policies shaping ICT infrastructural access across First Nations reserves. Furthermore, the peoples governing each unique American Indian tribe will deploy, adopt and apply ICTs according to the manner most beneficial for the continuation of their cultural sovereignty within their

tribal community. While early on I saw that it was theoretically possible to compare at an abstract level American Indian and First Nations experiences with national ICT policy, I realized that a) I lacked the baseline data to do so, and b) I would first need to adapt methods, logics, theories, and discourses from other fields and disciplines to help me give meaning to the investigation of tribal uses of ICTs within the field of information science.

Thus through this study I have sought to reveal what undergirds the phenomena in question—tribal uses of ICTs—as well as what undergirds the existing social scientific explanations of this phenomena. The tribal command of affordable and robust broadband infrastructures across reservation lands undergirds tribal peoples' uses of ICTs and the development of corresponding information systems and social programs. Applying an Indigenous orientation to the review of the literature and conceptual framework reveals the colonial logics at play in prior studies, and opens the field to hearing alternative explanations rooted in the experience of the Native peoples' building these systems and devices. This investigation of tribal uses of ICTs reveals a) how alternative histories and governmental paradigms are embedded in the design values and uses of ICTs by Native peoples, b) how the colonial conditions shaping Indian Country in turn shape access to information, systems, and devices, and c) how issues of access are deeply political and historical. The social and economic policies of a dominant governmental hegemony very much constrain access and uses of ICTs by that government's marginalized citizenry.

This means that, if as information scientists we are to teach our students about the social dimensions of access to information, we must be able to explain how a global elite class of technologically-advanced government and industry leaders sustain social and economic policies to productively marginalize particular vulnerable populations. Poverty,

lack of infrastructure, distinct cultural values, physical geography, and other commonly cited explanations are not causes for the lack of access to ICTs in marginalized communities, but rather, are symptoms and conditions of long-term social policies that depend on limiting flows of data, information, and knowledge within these communities. In this study, I identified the forces of colonialism and tribal moves toward sovereignty as the causal logics shaping Native peoples' labor to acquire broadband infrastructures across reservation lands. Marginalized peoples all over the world are not marginalized by ghosts and paper; the active leaders of governmental regimes write and enforce oppressive policies every day. Thus to understand uses of ICTs in marginalized communities requires understanding the root of policies affecting the mode of oppression operating within that community.

Reframing Toward Intellectual Decolonization

As I mentioned before, one of the most difficult aspects of entering into this line of inquiry had to do with first identifying those causal logics—in this case, forces of colonialism and sovereignty—grounding social and political moves in Indian Country, and second, with structuring analytical frameworks for making sense of ICTs within that context. Reframing allowed me to bridge what the field of Native and Indigenous studies has to say about colonialism with what the field of information science has to say about information and devices in daily life. Doing so consisted of positioning myself, both physically and conceptually, in particular places, in the company of particular thinkers, and within a particular orientation toward the literature and application of information science.

The first assumption I had to challenge was the social scientific researcher's fear of 'going native,' a racist phrase and concept stemming from early anthropological practice of living among Natives for purposes of ethnography, yet rejecting the perceived Native customs of interacting, dressing, and thinking, for fear that the white adaptation of the Native manner of relating in the world might skew the white researcher's objective assessment of Native culture. Veiled in the language of science, the threat of 'going native' is still written about in qualitative methods texts as a concept indicating a relational distance that a researcher must maintain from the company of human subjects.

As a Yaqui woman who is also a researcher, I find the concept of 'going native' troubling and illogical, both for its denial of the power dynamic between the researcher and the researched, and for the tacit assumption that not only do Native peoples have nothing to teach university social science researchers, but that their very manner of relating with the world somehow negates the credibility of social scientific research methods. (Imagine the reaction in the social scientific community if an elite set of Indigenous editors were to support the systematic publication of qualitative methods chapters on maintaining theoretical credibility by avoiding 'going white.')

In short, what I indicate here is I entered the field of information science with a keen awareness of positionality. I see information science as a 20th century applied science, and as such, the foundation of its theory-making, practice, and field-building is bound up in the 20th century global circulation of goods, labor, and currencies that depend on the continual exploitation of Native lands, waters, and bodies. The gift of my people's histories and spirituality helped me perceive a dimension that prior studies of Native uses of ICTs failed to inscribe, and that relates to the inherent sovereignty of Native peoples choosing

to use ICTs and build the infrastructure for it across their sacred lands toward their own tribal goals.

Formed through feminist thought, and frequently employed through critical race theory and gender studies, the methodology of positionality requires the researcher to identify her own degrees of privilege through factors of race, class, educational attainment, income, ability, gender, and citizenship among others before seeking the epistemological basis of her intellectual craft. Doing so helps the researcher understand how her way of making meaning—of framing research—within her conceptual universe is tied to her positionality within an unjust world.

Though reframing is conceptually related to the methodology of positionality, it is more specific in orientation as its precise goal is intellectual decolonization through the correction of white supremacist explanations of a social problem or challenge within an Indigenous community. Before a researcher can reframe a social problem and diagnose an intervention, she must see herself and her conceptual universe with relation to the nature of problem, and from that point, make decisions about what to foreground in the assessment and depiction of the problem. Through my first phase of fieldwork, I learned that I had to re-orient my discourse, values, and thinking away from that of academic information science and toward the values of Indian Country. The people I spoke to in Indian Country did not talk about devices, design, information systems, information flows, or information as power. They talked about creating jobs for tribal youth, respecting the stories of the elders, complying with the White House tribal consultation order, and driving ATVs up sacred mountains to find safe places to build towers for their people. I had to think about how to use the methods and concepts of information science

as tools to advance intertribal goals in Indian Country. Only by doing so was I able to perceive how Native moves toward sovereignty align with Native uses of ICTs. This is what makes reframing a decolonizing methodology: it reorients the techniques of applied science to meet the goals of tribal communities. What emerges from that reorientation is a reframing of the nature of the challenge. In this case, I shifted the inquiry away from, ‘why don’t Indians have access to the Internet?’ to one of ‘in what ways do tribal leaders acquire Internet for their communities, and what can we learn from their approaches?’

Future Research Questions and Lines of Inquiry

Opening up the phenomena in this way—‘in what ways do tribal leaders acquire Internet for their communities, and what can we learn from their approaches’—also set the stage for a series of interconnected research questions and potential lines of inquiry. Residing at the intersection of Native and Indigenous studies and information science lie questions relating information flows to vectors within the greater array of the forces of colonialism, conceptualizations of access and intellectual freedom in Indian Country, questions about where and how ICT innovation happens in Indian Country, and functions and goals of Indigenous knowledge work.

Decolonizing methodologies are designed to cultivate Indigenous, and more precisely in this case, tribally-centered, solutions to community challenges. My work investigating tribal broadband issues has led to my current appointment as co-chair of the Tribal Telecom 2014 annual conference, in which over three hundred participants working in tribal law and policy, federal telecommunications standards, broadband,

systems administration, community development, cyber-security, and tribal enterprise will convene next spring at the Gila River reservation in southern Arizona to discuss ways to leverage knowledge work toward tribal economic development. I have also obtained a fellowship through the American Indian Studies program at the University of Illinois at Urbana-Champaign, in which I will further conceptualize sociotechnical dimensions of Indian Country, specifically with regard to uses of seamless technologies—sensors and mobile devices—toward tribal governance. These conversations will happen in the company of Native and Indigenous scholars whose work is community-based and tribal-centric. The weaving metaphor is apt. The ideas and directions tribal leaders speak of when discussing ICTs in Indian Country are vast and complex, and more than any one person can write about, describe, or analyze from either the standpoint of practitioner or theorist. My challenge as I continue working at the intersection of these two fields will be in shaping the scholarly discourse by introducing descriptive accounts to ground the context for this work, as well as analytical frameworks for understanding information phenomena in the context of Indigeneity. I will map specific research questions as I cultivate and realize new lines of inquiry in the field.

However, with regard to broadband in Indian Country, there are specific research questions requiring further investigation for purposes of advancing network functionality, policy, and theory.

As tribes support more ICT-based enterprises, they are likewise encouraging the design of information systems, work practices, and devices for tribal uses. At the TribalNet 2013 conference in San Diego, California, I observed quite a few of these systems and devices designed to run on and support broadband connectivity in Indian

Country, including wireless mesh technologies, transmitters and receivers, billing systems, data offload systems, database administration systems, and technical training operations. At the upcoming Tribal Telecom conference, tribal affiliates working out of Sandia National Labs will be raising the issue of acquiring and sponsoring top-level domain names for tribes, such as .hopi or .navajo, rather than the current –nsn.gov designation. Research questions centered around the unique conditions shaping system and device functionality and uses in Indian Country are needed in this space, as there are few practitioners in the field, yet many tribal leaders seeking to deploy and adopt network technologies.

Broadband policy continues to be of prime importance as each of the federal agencies charged with deploying infrastructure through Indian Country comply with the tribal consultation order. The constraints of working in telecommunications in Indian Country, particularly around developing tribal enterprise, taxation, acquiring spectrum licensing and rights-of-way, federal subsidy programming, and protecting tribal members data, privacy, and intellectual property, will continue to be issues debated in Congress in the years to come. Compelling research questions rise out of the need for more specific and accurate broadband coverage data in Indian Country. Who should gather this data, and how? How can it be verified? How might this kind of data, visually expressed in the National Broadband Map, shape the nature of discussions around access, use, and connectivity? I suspect that in this data there will be evidence of ISPs inflating coverage and subscription rates to Native communities for the purposes of acquiring federal subsidies to improve services to other locations.

With regard to theory, the work of understanding dimensions of the Native cybersphere continues to be of interest. What devices and systems undergird the design of this place removed from the physical environment, yet deeply ingrained with messages about homelands and sovereignty movements? How do Native and Indigenous peoples utilize an array of broadband technologies toward the furtherance of explicitly Native and Indigenous goals? What might this contribute to our knowledge about the ways marginalized social groups politically and socially organize and mobilize via the availability of broadband systems and devices, particularly across locations where broadband is rare or unaffordable? How are broadband, the world wide web, the Internet, smartphones, unmanned aerial devices, and other such systems theorized within specific Native ways of knowing? More than once throughout the course of this research, I heard tribal peoples, especially of the southwest, refer to the Hopi prophecy of Spider Woman weaving a web around the world, indicating an era when the original peoples would come back together. I am not Hopi. It is not my place to undergo the intense linguistic, spiritual, physical, and philosophical training needed to fully understand this prophecy. Yet many times I have observed the shift in conversation that occurs when this prophecy is referenced during discussions of pan-tribal adoption of broadband systems and devices. There is a spiritual and philosophical dimension to the work of deploying and designing broadband systems throughout Indian Country. Finding ways to teach pragmatic information scientists to hear and make sense of this level of data—sacred homeland and sovereignty, or place and spirituality—as they consider the particularities of information system design, policy-making, and information flows in Indigenous communities is central to this work, both in theory and in practice.

Conclusion

Heidegger and Deloria share this in common: they wrote about how exercises of power pertain to human will, and more specifically, when it comes to governance, to the will of a people. (Heidegger, 1977; Deloria, 1999) Native peoples know that colonization programs are not realized through the will of an individual, but rather require the sanction of state governments, authorized institutions, and their associated personnel. Tribal leaders know that sovereignty is a work in motion and that, if, as inherently sovereign Native peoples we do not exercise our legal and political rights—enforcing treaty obligations—we face the threat of colonial encroachment on Native lands and waters. Information scientists conceptualize how individuals use ICT devices as extensions of themselves. Heidegger wrote about this threat: that technologically advanced people will begin to see the technological advance as their purpose for being, forsaking the means for more morally upright purposes. (Heidegger, 1977)

Here is where Heidegger and Deloria depart: where Heidegger sees man as a technological being separate from the natural world, Deloria sees humans as deeply in rhythm with a constantly unfolding cosmic natural order. When it comes to individuals using ICTs en masse to self-govern and politically mobilize, Heidegger views ICTs as a large-scale means for dominating nature, and in so doing, fashioning humanity toward a superior, though deeply flawed, state of technological advance. Deloria reminds us that as Native peoples, our obligations in utilizing technologies are to strengthen our relationships to our homelands, and to cultivate wisdom from the patterns we experience there. (Deloria, 1999)

As there is an ecology to exercises of power, so is there an ecology to the manner in which we, as humans, build ICT infrastructures and the accompanying devices into our landscapes. Through this research, I have had the opportunity to learn how ICTs and exercises of tribal sovereignty shape and are constrained by the policies, histories, and landscapes demarcating Indian Country. By framing contemporary build-outs of tribal broadband infrastructures against the history of U.S. colonization, as information scientists we can appreciate why, in 2012, the United Nations General Assembly determined that affordable Internet access is a human right, critical to democratic citizen government participation. (United Nations General Assembly, 2012) I find affordable and robust broadband infrastructures to be an infrastructure critical to self-governance and the exercise of sovereignty in Indian Country. Advocates for tribal media and broadband are working now to make sure that U.S. federal authorities adjust policies and practices so that tribal leaders can weave this critical infrastructure into their homelands in accordance with community needs.

It is particularly important that tribal leaders retain command of the design, implementation, and maintenance of broadband networks. Commanding the build-out process, decisions about hardware, network upgrades, content management, policies, and the work of personnel gives tribes the ability to evaluate timing of upgrades, new enterprise, and agenda-setting at a national level. Making decisions about broadband policies, infrastructures, uses of ICTs, and information-sharing practices within the ecology of the reservation imbues broadband infrastructures with meaning. In Indian Country, the soil is not without meaning; even dust, heat, and rainclouds bear the significance of cultural sovereignty. The organizers of Idle No More conscripted

smartphones, digital cameras, and laptops into the labor of Indigenous political mobilization. While at present there is a dearth of data on both the availability of these devices and broadband coverage rates in Indian Country, it is apparent that the devices and connectivity are to some degree present, and useful for governance goals.

Above all, this research shows how weaving broadband infrastructures into Indian Country isn't for general purposes of education, enterprise or entertainment, but rather, it is about educating younger generations in Native, Indigenous, and tribal ways of knowing, supporting tribal enterprise, and encouraging the creativity of Native peoples in spite of colonization. Native youth have a consciousness—an awareness and sensation of exigency—and this Indigenous consciousness is the basis of future exercises of cultural sovereignty. As inherently sovereign peoples, this is the reason for our right to know. (Deloria, 1978) As Native educators, we have a responsibility educate future youth in the ways of our survival and continuation within the homelands. As information scientists we can ask, what new kinds of theories, design approaches, systems and devices do we need to support the long-term goals of Native and Indigenous peoples? What can we learn from their experiences of colonization? What does this teach us about ourselves, working to create deeper understandings of the impacts of ICTs and information in our everyday lives?

Glossary

4G: 4G refers to the fourth-generation of mobile phone telecommunications standards. 4G mobile phones support a range of functions, from mobile television to wireless modem, as well as applications designed to run on a WiMax network. Older mobile phones operate on 3G and 2G standards. 4G mobile phones only work in regions with system-compatible 4G and 3G WiMax network providers.

8(a) certification: In 1953, Congress passed the Small Business Act (15 U.S.C. 631) to promote opportunities for small and disadvantaged business to acquire loans and government contracts. Presently, the Small Business Administration hosts the 8(a) Business Development Program, in which businesses at least 51% owned and controlled by socially and economically disadvantaged individuals are eligible for business mentorship and enrollment as sole source government contractors. Businesses that apply for 8(a) certification must prove feasibility, sustainability, and increases in revenues for a few years prior to receiving certification. In Indian Country, the Native Procurement Technical Assistance Program (Native PTAC) is a resource for Native-owned and tribal enterprises seeking 8(a) certification.

airspace: Airspace refers to the territory over a sovereign country's political boundaries. In the U.S. the Federal Aviation Administration manages the sovereign use of airspace. U.S. federally recognized tribes do not have control of the airspace over tribal reservation lands. Airspace is not to be confused with airwaves.

airwaves: Airwaves is a shorthand term for radio waves: the portion of the earth's electromagnetic spectrum that, measured in wavelengths range from 1 millimeter to a 100 kilometers. The Federal Communications Commission maps and licenses the rights to use particular frequencies of radio waves for different purposes, including television broadcasts, AM/FM radio, and wireless broadband communications. See also **spectrum** and **unlicensed spectrum**.

American Indian: American Indian is now a legal term that emerged out of common use by colonial authorities and settlers who, since the late 1500s, were erroneously describing the original indigenous inhabitants of what are now the Americas as '*indios*,' or 'Indians.' The term 'American Indian' is used in many of the treaty documents negotiated between tribal peoples and U.S. colonial authorities, even though tribal peoples continue to recognize themselves as a people by the names of their tribe, i.e. Navajo or Diné, for Navajo Nation, and not according to the generalized population of indigenous peoples of the Americas or the English language term 'American Indian,' as neither of these articulates the inherent sovereign rights of tribes. In the 1960s, organizers of the American Indian Movement reclaimed the nomenclature as a source of intertribal, shared identity and empowerment among the indigenous, non-Settler peoples of what is now the U.S. U.S. federal authorities continue to use the term 'American Indian' and the updated term 'Native American' to define indigenous peoples of what is now the U.S. as an exceptional class of minority citizens. Because of early treaty negotiations and the U.S. policy of just treatment toward non-white socially disadvantaged citizens, American Indians and/or Native Americans are granted certain rights and support mechanisms,

including federal funding for education and healthcare services, in exchange for the wrongful, unjust, and ongoing claim of sovereign Native lands. For theoretical and scientific purposes, it's important to understand the term 'American Indian' as a colonial tool for describing an indigenous U.S. population in aggregate, regardless of the social and political distinctions of the many peoples of the U.S. It is also important to recognize that American Indians are not ethnic minorities like Asian Americans, African Americans, or Hispanic Americans, but are actually the modern descendants of the self-governing Indigenous peoples of what are now the Americas.

American Indian Movement (AIM): The American Indian Movement is an organization that grew out of activism among young tribal leaders in the 1960s. AIM activism followed on the heels of 1950s civil rights era movements, and coincided with the separate and distinct Chicano (Raza), Second Wave feminist, and Black Panther organizing. Most notable for the 1970 occupation of Alcatraz and the televised broadcast of U.S. federal counterintelligence and blockading at Wounded Knee, AIM goals and values continue to inveigh Native and Indigenous modes of leadership, scholarship, and political organizing. These include an emphasis on strengthening understanding of U.S. histories from intertribal American Indian perspectives, reclaiming sovereign tribal lands, freeing American Indian political prisoners, and sustaining a critique of U.S. occupation and colonization of Native lands and lifeways. See also **Indigenous**.

Assembly of First Nations (AFN): The Assembly of First Nations is an organization of the leaders of the inherently sovereign aboriginal peoples of what is now Canada. The

AFN convenes for purposes of intertribal discussion, decision-making, and organizing on matters affecting the sovereign rights of First Nations, and the binding treaties between First Nations, Canada, and the United Kingdom. The goals of the AFN somewhat parallel the goals of the National Congress of American Indians (NCAI), although the mechanisms shaping the emergence and authority of these organizations differ significantly.

autonomy: In the context of Indigeneity, autonomy refers to the potential for the enactment of the political will of a self-governing Indigenous people. While in the U.S. and Canada, this most often takes shape via the mechanisms of legal/political sovereignty, in Mexico, this takes shape via the mechanisms of the legal/political activism of autonomous Indigenous pueblos. For theoretical purposes, it's important to understand that in the context of Indigeneity, autonomy occurs via the free will of a people, and not at the level of the individual. Group membership—meaning affiliation and established kinship with a spiritually distinct and land-based and/or linguistically-unique people—is therefore an integral component of Indigenous autonomy.

bandwidth: Bandwidth refers to the rate that information, measured in bits, is channeled through digital media devices, i.e. 200 megabytes per second of streaming broadband. With regard to wireless network systems, bandwidth is also measured in hertz, and this refers to the spectrum frequency. In this regard, see also **spectrum**. In this document, I've utilized the word 'bandwidth' within the context described by participants, which is most often with regard to needing devices and systems that can channel greater bandwidth for

handling heavier streaming content, or more bytes per second. When participants describe needing greater access to bandwidth in terms of hertz, I've referred to this in terms of needing greater access to spectrum.

broadband: Generally speaking, broadband refers to a digital communication channel of at least 256 kilobytes per second. 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. Since the late nineties, broadband has come to refer colloquially to high-speed Internet, or Internet over 256 kilobytes per second and operating in distinct contrast to former modes of single channel dial-up.

Broadband Initiatives Program (BIP): In 2009, President Obama signed the American Recover and Investment Act (ARRA) into legislation. Under ARRA, 2.5 billion dollars was allocated to subsidize the build out of broadband Internet infrastructures in rural communities. This subsidy program was named the Broadband Initiatives Program, and was administered in three rounds beginning in 2010 through the US Department of Agriculture's Rural Utility Service. Thus far, two rounds of funding have been administered. See also **Broadband Technology Opportunities Program**.

Broadband Technology Opportunities Program (BTOP): Under the 2009 ARRA, 4.7 billion dollars was allocated to subsidize the build out of broadband Internet infrastructures, public computing centers, and data-gathering, with the infrastructural and computing center funding directed to unserved and underserved communities. The BTOP

is administered through the National Telecommunications and Information Administration, with the data-gathering monitored by the FCC, and made publicly available through the online publication of the National Broadband Plan and the National Broadband Map. See also **Broadband Initiatives Program**.

casinos: At present, casino gaming as a tribal enterprise represents a significant source of income for gaming tribes. For a number of reasons, not all tribes support gaming operations. Some tribes find gaming out of step with tribal spiritual practices. Others have chosen to invest in other forms of enterprise. Others have not focused on gaming within their strategic plans. Casinos represent a source of controversy in Indian Country and at its borders. Almost annually, elected officials representing counties within the state of California—which has a unique relationship with the tribes—call for a tax on tribal gaming operations. What these officials fail to understand is that the state of California already benefits significantly by having taken the lands and waters of California tribes. Casinos are, for many tribes, the only means for acquiring the capital needed to pay for basic social services to tribal members: health care, early childhood education, scholarships for adult learners, law enforcement equipment and personnel, paved roads, legal services, schools, libraries, and, with regard to this study, telecommunications and Internet infrastructure and services.

colonization: Colonization is the verb—the enactment—of colonialism, which is at once a social policy and an expansionist ideology. Historically, colonialism has manifested in many different ways in many different communities, but at its core, it emerges as a set of

relationships in which one social group continually and habitually profits by exploiting the living environments, bodies, social organization, and spiritualities of another social group. Colonialism, however, is distinct from occasional exploitation or profiteering, as it is marked by generations of subjugation such that the profiting social group begins to build all social structures and institutions around them to support the belief in their superiority as well as their means of exploitative and violent profit-making. While Native and Indigenous scholars are currently in an era of analyzing the pathways and mechanisms of colonialism, and thus have not produced a single sufficient account of how it works, I find Anibal Quijano's (2004) analysis of the colonality of power most useful for studies in information science. In this study, I have operationalized colonization based on the following four overlapping mechanisms: 1) the classification of indigenous peoples as a single lower-class of sub-humans worthy of social subjugation at best and extermination at worst, 2) the theft and settlement of indigenous lands and social spaces by the so-called elite class, 3) the articulation of institutions to support this caste system and elite control of the environment, and 4) the disciplining of elite forms of knowledge through the marginalization of all indigenous languages, philosophies, spiritualities, and modes of self-government.

community: I admit I use the word community rather loosely in this writing, but not without awareness of Benedict Anderson's (1983) conceptualization of social groups of individuals not being comprised of just face-to-face interactions, but also of shared beliefs about ancestors, hopes for future generations, and social customs and mores that bind them into a community, regardless of whether or not they interact in person each

day. In tribes, there are many individuals who are members of the tribal community, but who are not enrolled tribal members, for example, non-tribal business owners, folks who have married into the tribe, neighbors who live near the reservation and have developed deep ties in that landscape with the people, and so forth. Generally speaking, when I refer to community needs in this research, I am referring to the social groups and individuals that the project leaders perceive as being consumers or users of the technology project they are building. Community information needs in tribes are also very much connected with the goals of cultural sovereignty. When I write about tribal communities, I am also making a tacit reference to the dimensions of peoplehood (Holm & Pearson, 2003), in that tribes are comprised of an inherently sovereign people or confederated sovereign peoples who relate with each other every day on the basis of a long history of kinship, a shared indigenous language or languages, shared spirituality or ceremonial cycle, and a relationship with the landscape that goes back to time immemorial. In this way, a community of feminist booksellers—a la Burnett, et al (2001)—is significantly different from a tribal community.

constraints: Constraints are those factors in an environment that shape the design, functionality, content, and uses of a system.

content: Content is information that is channeled through a particular series of devices and designed to appear on a digital interface for human consumption. For example, the data of ones and zeros is channeled through fiber-optic cables and reassembled on a PC

to appear as a digital black and white photo my friend sent me. The photo is the content, where the ones and zeros is a kind of information, specifically, a form of metadata.

cultural sovereignty: Cultural sovereignty refers to the reality of the existence of contemporary Native peoples as self-governing peoples free to live by their ways of knowing developed over millennia within the ecologies of their homeland. Thus cultural sovereignty relates to the ability of elders and experienced members to share ways of knowing with younger members. These ways of knowing pertain to the long history of kinship among the people, the people's indigenous language or languages, spirituality or ceremonial cycle, and ancient yet continuously unfolding sacred relationship with the landscape. Cultural sovereignty is often explained in comparison to legal/political sovereignty, which refers to the political rights contemporary Native peoples have negotiated with the federal government.

design: I'm surprised at how much I speak about design in this writing. I've come to understand design from a sociotechnical perspective laden with a bit of Deloria's explanations of Native modes of creation. In this dissertation, when I write about design, I'm not just describing the decisions project leaders make about the workplace goals and objectives, functionality, usability, and aesthetic appearance of a system. I'm also referring to the social policies, customs, habits and norms, and consideration of the landscape that shapes individuals' decisions to build a system in the first place. In this way, the requirements of cultural sovereignty become a part of the process for designing the layout and functionality of tribal broadband networks. I think this is best

demonstrated in the design of the TDVnet backbone. I had originally wanted to include in this document a section on Native design methodologies, but I decided to save that for a separate future writing project.

devices: Devices are the pieces of tangible hardware that comprise an information system. Devices are necessarily designed to operate with each other, and where they do not, humans modify devices or innovate new ones to encourage efficient system compatibility. A smartphone is a device, a fiber-optic cable is a device, a wireless modem is a device. A police car is a device. Even a pencil is a device. Devices are ultimately predicated on human use.

digital devices: Digital devices are pieces of tangible hardware that comprise a digital information system, meaning a system built to function on the high-speed transmission and calculation of binary code. See also **devices**.

Federal Communications Commission (FCC): In 1934, Congress established the Federal Communications Commission as an independent government agency regulating interstate and international telecommunications. The FCC now regulates radio, television, wire, satellite and cable communications, and focuses on areas such as consumer protections, law enforcement, broadband, ICT innovation, spectrum regulation, and supporting ICT enterprise.

FCC Office of Native Affairs and Policy (ONAP): In August of 2010, the FCC established the Office of Native Affairs and Policy. The FCC recognized the need for ONAP out of a number of workshops on telecommunications issues in Indian Country, notices of inquiry on connectivity issues in rural locations, and also through meetings with the FCC Native Broadband Task Force. Geoffrey Blackwell (Muscogee Creek) now heads the FCC ONAP. Since 2010, Blackwell and his team have been documenting issues with telecommunications and Internet service provision in Indian Country, and have been forwarding a number of policies and regulatory adjustments to ensure that tribes have access to federal subsidies and spectrum licensing.

federal recognition: The federal recognition process is an intriguing process for Native and Indigenous scholars because on the one hand, it is the point at which the U.S. federal government acknowledges the original sovereign status of an indigenous people—meaning, it acknowledges the primacy of the people’s claim to the land—however it does so through bestowing an array of legal rights that embed the people’s mode of governance within the dominant U.S. colonial apparatus. U.S. federal authorities acknowledge that because they have illegitimately occupied the original lands of an original nation of people, they must either hold in reserve or pay out to the original people lands and other resources that they have been holding in trust for them. Furthermore, because the U.S. federal government will continue to operate in a fashion that colonizes Native lands, waters, and bodies, those recognized as Native Americans within sovereign U.S. borders have rightful access to various resources held by the U.S. in trust for them, as a kind of exchange for the illegitimate settlement of the land. Thus, it

is with a strange irony that self-governing Native peoples of Turtle Island enter into the federal recognition process. On the one hand, they become eligible to receive a certain amount of resources that Native peoples need, in many cases, to survive under the contemporary unfavorable and oppressive colonial political arrangement. On the other hand, they also enter into an agreement to hold U.S. federal authorities accountable for honoring the sovereign rights of tribes, including those not yet codified human rights that many tribes exercise through their own modes of self-governance, including practice of customary laws and lifeways. (Alfred, 2005) Entering into a relationship of trust with the same colonial federal government and all her states, institutions, and citizens who normatively settle Native lands, waters, and bodies induces a unique conflict of interest for leaders of Native nations who must, on the one hand, contribute to the lifeways of their people, while at the same time respecting the fundamentally colonial legal, political, and economic exercises of the dominant hegemonic government. (Barker, 2005; Kauanui, 2008) It is perhaps for this reason that, after years of research, esteemed Indigenous studies and legal scholar Johnathon Goldberg-Hiller regards the politics of recognition as, inherently, a politics of violence. (Goldberg-Hiller, 2013)

fiber-optic cable: Fiber-optic cable is a key broadband technology in that it allows for multiple kinds of information to be transmitted across multiple channels through a single medium. Referred to as ‘fiber’ in the colloquial, fiber-optic cable is made of bundled strands of glass or fabric sewn around a core and housed by a durable rubber coating. Fiber-optic cable represents one of the most durable means for transmitting broadband

across great distances, and can be buried by roadsides or strung along phone poles. These are referred to as terrestrial and aerial deployments.

fiber to the home (FTTH): Fiber to the home is a shorthand way of referring to the method of deploying regional broadband by burying or stringing fiber-optic cable from anchor institutions to houses within a service community. Though the fiber may be available for home hook-up, residents may still have to subscribe for broadband Internet service through the regional ISP.

geopolitics: It's a wonder to me that more sociologists haven't described American Indian tribal politics from the frame of world geopolitics. Native and Indigenous studies historian Paige Raibmon (2006) described this in her analysis of the genealogies of Native land dispossession in the Pacific Northwest. Since reading that important essay, I have found this to be a useful analytic frame for understanding tribes as borderland societies, where tribal borders and boundaries indicate more than just jurisdictional limitations, but also refer to long-term, cyclical, and overlapping social policies and programs that reinforce a politics of social difference as well as conflict over land uses and moral claims of ownership. Understanding the conflicts of Native and Settler land claims from a geopolitical perspective also allows for the explanation of patterns of colonization and dispossession from a global historical economic perspective. I rely on Wallerstein's (1984) world-systems theoretical approach quite a bit in this regard, but also appreciate Mignolo (2012) for the analysis of dispossession in the colonized Americas.

homelands: When I use the word homelands I am making a tacit reference to Holm & Pearson's (2003) conceptualization of peoplehood, in which they describe tribes as comprised of an inherently sovereign people or confederated sovereign peoples who relate with each other every day on the basis of a long history of kinship, a shared indigenous language or languages, shared spirituality or ceremonial cycle, and a relationship with the landscape that goes back to time immemorial. Therefore, I am not referring to a homeland in a nationalist patriotic sense, but rather from a more Indigenous perspective, which finds homelands to be comprised of a peoples' deeply ecological relationship with mountains, mesas, grasses, constellations, seasons, and animal beings. For many Native peoples, one bears allegiance not on the basis of a social contract of citizenship, but on the basis of ancient sacred instructions and, therefore, an experience of cosmic belonging. (Deloria, 1999; Nabakov, 2007)

Indian Country: Indian Country is a legal term that refers to the federally-recognized tribes, state-recognized tribes, pueblos, rancherias, bands, and Alaska Native villages and corporations within the political boundaries of the U.S. Used colloquially and not in a legal sense whatsoever, Indian Country also refers to Native peoples' habits and norms in this somewhat parallel society. As a legal term, the phrase Indian Country has come to have meaning out of the basis of over a century of treaty-making and recognition processes between Native peoples and U.S. federal authorities. It inherently refers to an intertribal state of being for Native peoples in the U.S.

Indigenous: There are two ways of approaching this term: indigenous with a lower-case i, and Indigenous with an upper-case I. Indigenous with a lower-case i refers to the native species of a particular terrain. Early European explorers used indigenous to describe the native flora and fauna, including the people. Over time, to be considered an indigenous person was to be considered of a lower-class. This is especially true in the Latin American countries. This is somewhat equivalent to how, for many years, to be considered an indian in the U.S. was to be considered lesser. Through many years of activism and international organizing, Native and Indigenous peoples around the world reclaimed the derogatory word ‘indigenous,’ and replaced the lower-case i with an upper-case I. Indigenous with an upper-case I now refers to individuals witnessing a global consciousness of the state of political exigency of Native and Indigenous peoples, specifically with regard to colonization abetting the industrial and technological advancement of modern nation-states. In this way, Indigeneity represents a deeply modern and global mode of social critique. Indigenous scholars are trained in two ways: by respecting and learning from their own peoples’ tribal and spiritual histories and by leveraging the tools of Western academia to stage a strategic critique of nation-state colonial policies. Because of the global, politicized nature of Indigeneity, many people within tribal communities do not use this term to describe local spiritual activities or day to day work practices. This is done out of respect for the homelands and beings therein; at times the stridency and political urgency of Indigeneity is out of step with local ceremonial and spiritual obligations.

information: Though I haven't stated it in the dissertation, I find information to be any item—tangible or intangible—that can function as a form of currency charging and reproducing loosely bound networks of humans and devices. This is something of a break from the information scientific hierarchy of meta-data builds up to data builds up to information builds up to knowledge. As an Indigenous information scientist, I cannot agree that there is an objective measurable distinction between data, information, and knowledge, because for centuries Native peoples have been considered to be lacking ways of knowing. Whole cultures have been broken apart—part separated from whole—and treated as pieces of information available for exploitation as a form of currency in the world markets. One society's information is another's sacred ways of knowing. Data to a human is electrical power to a machine. Without walking through a subjective hall of mirrors, I can, however, theorize that in an imagined network society—in which humans and devices continually interrelate and reproduce institutions, technical devices, social policies, and norms—any item that is useful to this reproduction can be somehow broken down into a bit (pun intended) of useful information.

information and communication technologies (ICTs): I use this term broadly to refer to digital devices that allow for the synchronous and asynchronous exchange of digital content between humans. ICTs encapsulates smartphones, laptops, tablets, mobile phones, streaming radio, and so forth.

information-sharing: I use information-sharing in this dissertation to refer to the intentional human to human exchange of information and knowledge. This can occur face

to face or via the media of ICTs. I made this writing decision hoping to draw attention to the relational aspect of information: it is only meaningful when it is shared.

information system: An information system as an intentional assemblage of humans, devices, and policies designed to guide the flow of specific kinds of information to support workplace goals and objectives. Some information systems can be quite small and localized, such as an office's system for handling internal mail. Some are of a much larger scale, such as the Red Spectrum Communications fiber to the home network. One of the most challenging aspects of this research has been developing a way for understanding how policies as complex as the Indian Education and Self-Determination Act of 1975 shape the design of information systems within tribal administrative workplaces.

inherent sovereignty: Inherent sovereignty refers to the will of a people to self-govern, regardless of the official recognition of an overarching federal or colonial authority. One of the harshest ways I have seen this phrase used was in the expression of a congressman exclaiming how Cherokee peoples chose to walk the Trail of Tears—suggesting an inherent sovereignty and capacity for self-governance—that was beyond the reach of the burgeoning U.S. federal government.

institution: When I use the word institution, I am referring to the ways that sociologists have conceptualized certain social structures—organizations, social practices, ideologies, social classes—crystallizing in the form of governing, useful, socially reproductive, and

disciplinary bureaucracies. Universities are institutions. Hospitals are institutions. Prisons are institutions. For contemporary Native peoples, the federally-recognized tribal administration represents an institution, a concept that inherently sovereign peoples tangle with as they undergo the paperwork and politicking required for the federal recognition process. Tribal colleges are institutions. The National Congress of American Indians is an institution.

knowledge: Hawaiian studies scholar Manulani Aluli Meyer (2003) has pointed out the distinction between knowing and knowledge, where ways of knowing represent the motion of Indigenous elders and leaders imparting the keys to understanding philosophies and spiritualities alongside youth, and where knowledge represents the observable products of this motion. Both ways of knowing and knowledge bear qualities of information that has been agreed upon as legitimate or ‘true’ many times over, possessing a reverential or experiential aspect, and worthy of being recorded, codified, or passed on for purposes of either institutional continuation, moral rectitude, or the survival of a people.

landscapes: I use landscapes to refer to ecological environments imbued with human histories and experiences.

leapfrogging: Leapfrogging refers to the phenomena by which certain communities have been able to advance technologically by skipping a stage of infrastructural capacity-building. For example, some of the tribes within the Southern California Tribal

Chairmen's Association leapfrogged when they acquired broadband Internet services before landline phone lines were put in.

legal/political sovereignty: At present, federally recognized tribes within the boundaries of the United States exercise the following eight rights as sovereign governments: the rights to self-govern, determine citizenship, and administer justice; the rights to regulate domestic relations, property inheritance, taxation, and conduct of federal employees; and the right to sovereign immunity. These rights have been negotiated over more than a century of treaty-making, court cases, and entanglements with the federal recognition process.

Local Area Network (LAN): A local area network is a system of cables and wireless connections set up to distribute Internet services to a number of nearby workstations, usually within a single office building.

National Congress of American Indians (NCAI): In 1944, a number of tribal leaders, lawyers, and American Indian studies scholars met in Denver, Colorado, to found a non-profit organization dedicated to advocating for the rights of Native peoples in the U.S. The NCAI hosts two meetings per year, in which the leadership of Indian Country shares ideas and prepares to advocate for policy changes before the U.S. Congress and within their tribal communities.

Native American: The term Native American is the latest term that the U.S. federal government has designated to refer to the exceptional class of U.S. citizens descended from the original Indigenous peoples of what is now the U.S. The term was changed from American Indian in around the mid-90s, when the U.S. began to adopt the social policy of multiculturalism. Unfortunately, somewhat because of this change, many people mistake Native Americans for ethnic minorities, as the term is similar to the terms African American and Asian American. See also **American Indian**.

Native and Indigenous: Native and Indigenous is a phrase that Indigenous studies scholars began using in the last decade or so to refer to the articulation of American Indian studies alongside global Indigenous studies.

network: I have used the word ‘network’ in two different ways through this dissertation. I have used the term to refer to the assemblage of humans, devices, and policies that make broadband infrastructures function in useful ways. Because broadband infrastructures are digital, network systems are digital information systems dealing with broadband technologies, i.e. spectrum, fiber-optic cables, wireless dishes, etc. I have also used the word network in reference to Manuel Castells’ description of a network society, in which networked ICTs are enabling the global articulation of local social movements, work patterns, government policies, and the like. Underlying all of this, I have also relied on uses of actor network theory, which holds that sociologists can understand the impacts of technologies by analyzing all technologies as assemblages of human technicians and non-human technical devices oriented toward a purposive work goal. In this way,

contemporary society—a networked society, Castells might say—is really sociotechnical, as there is no longer any real division between man and machine. In this way, a technical network system is related to a networked society, but the ways they are related in terms of scale and meaning must be localized to the context of the technical system’s purpose for being. The Couer d’Alene Tribe’s network backbone exists for the purpose of cultural sovereignty. Incorporated as Red Spectrum Communications—Red referring to the symbolic color of the American Indian Movement and Spectrum referring to the airwaves over tribal lands—the Couer d’Alene network backbone as a technical system has been positioned by its project leaders as a kind of political statement within the global dynamic shaping American Indian cultural sovereignty. Fortunately for all of us, I removed all references to social networks and relationality, both analytic frames for understanding kinds of societal power. Those are for future writings.

reframing: Reframing is a decolonizing methodology through which a social problem often diagnosed as ‘an Indian problem’ is subverted to show how it is actually an outcome of overlapping patterns of colonization. (Smith, 1999) Reframing means learning about the history of an ‘Indian problem,’ and making decisions about what to foreground for the purposes of revealing the conditions that are shaping the colonial misdiagnosis of a social problem as the fault of Indigenous peoples and their ways of life. It is a decolonizing methodology because the act of rewriting the history not only allows the writer to learn a new more hopeful perspective on a complex social issue, but also allows the writer to surface keys to more durable long-term solutions. These solutions usually must emerge from the Indigenous communities themselves. Reframing is also a

decolonizing methodology because it encourages the readers to rethink their position on the subject, and to see the problem from an Indigenous perspective. As a decolonizing methodology, its purpose is to reveal and subvert colonizing logics while at the same time creating the conditions for imagining Indigenous community-based solutions.

reservation communities: I should mention the difference between reservation communities and tribal communities. It is a fine but important distinction in Indian Country. Tribal communities consist of the members of a tribe, inclusive of their relationships. Tribal governments form on the basis of serving tribal communities, regardless of where tribal members reside. Reservation communities, however, consist of all of the individuals who reside on or near the reservation, regardless of their affiliation with the tribe. While these can feel like one and the same on occasion, people who have grown up on or near reservations understand all too well the fine distinction between those folks who are working to support the tribal community around the basis of cultural sovereignty and those who profit on the violence that occurs at reservation borders. I am thinking of the high number of liquor stores, drug dealers, and other exploitative sorts who plague reservation communities. Sometimes they are tribal relatives, and family and friends. But if you were to ask a tribal leader, he or she would be more likely to speak of serving a tribal community.

reservation system: I refer to the reservation system as a system because of the rigorous method by which all Native peoples of the U.S. were coerced into this socially detrimental manner of living on a small number of acreage out of step with the peoples'

natural manner of living and moving across the homelands. The reservation system was introduced through hundreds of treaty documents, federal recognition agreements, and federal Indian policies over the past century or more. Reservations were, almost as a rule, placed on what federal authorities perceived as untamable, unusable, or polluted land, with military forts on site or nearby. LaDuke (1999) published a map of reservations collocated with U.S. mining and nuclear power operations. Even those tribes that have managed to revitalize and create healthy homelands within the reservation boundaries experience the stifling conditions of reservation life under the coercive laws and policies enforced by the U.S. federal government and courts.

right relation: To live in right relation, or, for all my relations, is a phrasing often heard in Indian Country. It stems from an understanding of how all beings are connected in a cosmic dynamic, including those who have passed and those yet to be born. To live in right relation is to live in a state of humility and with deference to others and to the living landscape. In this sense, man is definitely not at the forefront of a hierarchy of species evolution, but is actually no more meaningful than a dust mite or a sea otter. To live in right relation is to recognize one's place in an ecology of beings, and to have respect for the purpose of beings other than oneself, and cycles other than one's own.

self-determination: Self-determination is a shorthand way of referring to the social policy underpinning the 1975 Indian Education and Self-Determination Act. Before this Act, social service and other programs on reservations were designed and administered by federal personnel, such as employees of the Bureau of Indian Affairs. Social services

and basic infrastructural programs were poorly designed. Federal authorities had no interest in strengthening Native communities. *Cobell v. Salazar* demonstrated the degree to which federal authorities stole funds and other resources from tribes. After the Act, tribal peoples could create and implement their own programs. We are at present still in the era of self-determination, in which the federal government is charged to consult with, support and assist tribes as necessary, but not to intervene.

self-governance: To understand self-governance, we have to realize how pre-colonial Indigenous modes of self-governance differ from the colonial form of government. To retain this memory, a free and autonomous Native people will share information among themselves and with neighbors to strengthen their knowledge of their homeland, shared history, Native language, ceremonial cycle, and lineage. Out of these centuries of sharing ways of knowing emerges a particular spirituality, and a particular philosophy of self-governance. While self-governance refers to the cultural sovereignty of a people, meaning, pre-colonial modes of governance and social organization, it also refers to modes of self-governance in the context of the domestic dependency within the US. The present colonial arrangement is based on the policy of self-determination: federally-recognized Native peoples should and can determine the course of their own social services and civic arrangements within the federally-recognized boundaries of their land. How tribal leaders opt to design and manage domestic relations is a matter of self-governance.

sociotechnical: Through this writing I have relied quite a bit on uses of actor network theory, which holds that sociologists can understand the impacts of technologies by analyzing all technologies as assemblages of human technicians and non-human technical devices oriented toward a purposive work goal. In this way, contemporary society is really sociotechnical, as there is no longer any real division between man and machine. These have become quite intertwined in contemporary society. This is even more interesting from an Indigenous perspective, which, generally speaking, does not find a real difference between man, or nature, and machine, or technology. Since humans are of nature, and it is within their disposition to create, they will create out of nature for nature. Actor network theory is actually quite helpful in this regard, in that the analytical method is based on understanding interactions between human and non-human actors. Though I haven't investigated fully, I am interested in understanding how this might be a useful analytic to teach non-Indigenous thinkers about human and animal relationships, human and mountain relationships, human and star-being relationships, etc. Though it is useful for teaching thinkers about human and technical device relationships—revealing how technical devices are actually deeply human in design and purpose and also how humans are capable of behaving systemically—it also strangely reifies the differences between humans and the devices they create.

spectrum: Spectrum is a measure of the wavelengths across which communications signals travel. The FCC distributes licenses to particular frequencies for broadcasting radio, television, broadband satellite and wireless signals. See also **airwaves** and **unlicensed spectrum**.

state recognition: State recognition is a process by which tribes are recognized by state authorities as Native peoples. It is a somewhat parallel process to the federal recognition process, but quite different in terms of the resulting legal rights. Many California tribes are state-recognized but not federally-recognized. Some of the tribes receiving Internet service through TDVnet are state-recognized but not federally-recognized. See also **federal recognition.**

stories: Stories, for Native and Indigenous scholars, represent a particular kind of incontrovertible evidence that is not to be triangulated, but rather folded into a broader understanding of a complex and multi-perspectival phenomena. Stories are accepted as a medium for 1) passing on knowledge, 2) building an interpersonal relationship, 3) providing witness to an event, 4) guiding right thinking on a matter, and 5) expressing a sensation or experience.

system: In this work I utilize system in two different ways. I refer to information systems, which are intentional assemblages of humans, devices, and policies designed to guide the flow of specific kinds of information to support workplace goals and objectives. I also refer to social systems, i.e. the reservation system, which can be understood as a series of interoperable practices and norms guiding the disciplinary work of institutions. I also make tacit reference to Wallerstein's (1984) world-systems analysis, in which geopolitical societies in the world can be broken into cores and peripheries that exist in an economically capital-productive, yet inherently violent, power dynamic.

Understanding pathways and mechanisms of colonization means understanding through a systems approach economic reasons for the global circulation of people, goods, and currency.

technology: I have actually tried to avoid using the word technology in this dissertation in favor of the more specific terms devices, digital devices, and ICTs, when speaking more generally. Of technology, I agree with Deloria (1999), who reads to the Greek root of the word—*techne*—to arrive at the significance of a human bringing a tool into being. Through its making, the tool becomes imbued with the goals and intentions of the designer. Heidegger refers to the functionality and values embedded in the creation of a silver chalice. (1977) Deloria refers to the methods—techniques—by which spiritual people were able to bring into being the sensation of cosmic order and purpose, and reminds Native students that their purpose in designing technologies is to restore the health of Native bodies, minds, and homelands. See also **sociotechnical**.

tribal council: Tribal councils, generally speaking, are a contemporary mode of self-governance in Indian Country, in which tribal government leadership is shared among a number of elected officials with limited terms of appointment. Tribal council members are most often positioned to act as liaisons, idea people, entrepreneurs, and policy advocates between the tribal community and federal government agencies. Their difficult work is never done.

unlicensed spectrum: While the FCC administers licenses for some frequencies, others remain unlicensed, and these have been left as such for the purpose of innovation and emergency uses. TDVnet now runs almost entirely off of unlicensed spectrum. As designated spectrum licenses can be quite expensive, and as some ISPs have been known to squat on spectrum, holding on to it but never using it, the FCC is looking into creating a tribal priority for licensed spectrum, a use it or lose it policy, and opening up frequencies for more unlicensed uses. See also **airwaves** and **spectrum**.

ways of knowing: Native and Indigenous studies scholars refer to ways of knowing to articulate the dynamic nature of Native philosophies, histories, and land-based spiritualities. Ways of knowing is used in counterpoint to the immobile ‘knowledge.’ This is done partially in reaction to the ways Native peoples have been depicted in museums and libraries as dead and gone, objects of knowledge, rather than as living and continually creating ways of knowing. See also **knowledge**.

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