

From Digital Divides to the First Mile: Indigenous Peoples and the Network Society in Canada

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Indigenous peoples interact with the emergent network society in diverse ways that reflect the colonialism/self-determination dialectic. One area where this process unfolds is in the bridging of digital divides. I use the concept of the First Mile to show how First Nations and Inuit peoples in Canada's geographic periphery are asserting their self-determination in the sphere of digital ICTs. While most digital divide literature presumes that a connection to the network society is inherently beneficial, when framed in the context of historic and ongoing processes of colonialism, integration alone is not adequate. An example of a not-for-profit satellite network cooperative demonstrates how three Indigenous organizations shaped the problem of the digital divide into an opportunity to establish a platform for digital self-determination.

Keywords: Indigenous peoples, First Nations, Inuit, digital self-determination, network society, community development, infrastructure, broadband, policy, sociotechnical, media, communication, First Mile

Introduction: Reframing Digital Divides and Indigenous Peoples

Indigenous peoples are interacting with the emergent infrastructures of the network society in diverse ways that are linked to the colonialism/self-determination dialectic. One area where this process unfolds is in the bridging of digital divides. Marginalized communities and individuals are often left outside the flow of goods, services, resources, information, jobs, and data transmitted through increasingly

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ubiquitous digital infrastructures (Castells, 2009, 2010). In the network society, those nodes valorized as “valuable” by dominant actors attract various forms of capital, while those that are not face structural exclusion (Tongia & Wilson, 2011). At the same time, creative agents located on the supposed fringes of these developments are actively shaping their own endogenously managed networks (Longford, Clement, Gurstein, & Shade, 2012; Milan & Hintz, 2013). Describing these examples of “emancipatory communication practices,” Milan (2013) notes that such projects move beyond “the politics of enclosure and control enacted by states and corporations” (p. 10) by creating autonomous platforms of communication, sometimes in combination with advocacy work and policy reform.

Ethnographers of infrastructure explore how such projects emerge (Horst, 2013; Star, 1999). Lentz (2011) provides an overview of this approach, which encompasses a consideration of the physical, social, and symbolic components of infrastructures. In this article, I use this methodology to demonstrate how Indigenous peoples are actively bridging digital divides in ways that reflect their self-determined goals. Projects undertaken by Indigenous communities in Canada show how these diverse peoples draw on their resources as members of politically autonomous nations to assert control over digital infrastructure development. This work reveals some of the tensions embedded in projects of sociotechnical appropriation: While most literature on digital divides presumes that a material connection to the network society is inherently beneficial, for Indigenous peoples integration in existing systems controlled by state and corporate entities is not in and of itself adequate. Indigenous peoples have a historically ambivalent relationship to the diffusion of newly available ICTs in their communities and in several cases rejected them until they secured a measure of control over their appropriation and use (Roth, 2005; Savard, 1998). This focus aligns my study alongside other expressions of self-determined Indigenous media development, from broadcasting systems to social media. Beyond expressions of resistance, these projects reflect the persistence of a long history of sociotechnical innovation:

Indigenous media are made by and for Indigenous peoples eager to take control over media representations of their lives and communities. They are usually closely associated with movements for Indigenous rights, such as struggles over land, control of natural resources and intellectual property, cultural survival and autonomy, and political and economic justice. (Brooten, 2011, p. 257)

In this context, I describe how three Indigenous organizations shaped a not-for-profit, cooperatively managed satellite network infrastructure into a platform for digital self-determination. This example contributes to a growing body of evidence showing how Indigenous communities around the world are addressing digital divides by building and managing their own connections to the network society (see Fiser & Clement, 2012; Mignone & Henley, 2009; O’Donnell, Perley, Walmark, Burton, Beaton, & Sark, 2009; Sandvig, 2012; Schejter & Tirosh, 2012; Whiteduck, Beaton, Burton, & O’Donnell, 2012).² In Canada, these expressions of resurgence are supported by the unique legal status of Indigenous peoples and the inherent, group-differentiated rights that flow from that status (Borrows, 2010). From this perspective, technology developments join activities taking place in arenas such as law

² A recent issue of *Media Development* also profiled projects of Indigenous digital self-determination from around the world. For more information, see <http://www.waccglobal.org/resources/media-development>

courts, parliamentary debates, self-government agreements, and collective and individual expressions of action (Alfred, 2009; Simpson, 2011). In this article, I show how Indigenous peoples are undertaking such interventions in digital divide theory and practice.

Digital Divides and the First Mile

Digital divide literature broadly considers the relationships between inequality and development in the network society. The explanatory concept emerged alongside predictions of a global network society, as researchers explored how and why some individuals and populations remain disconnected from this presumably ubiquitous system (Norris, 2001). They observed that even as network infrastructures and ICTs increasingly spread throughout societies, digital divides persist over time, and in some cases deepen (Van Dijk, 2005). As a result, researchers devised ways to conceive and analyze these processes. Early work focused on the uneven diffusion of physical devices and infrastructures, identifying digital divides across and inside societies (Rogers, 2003). Recent research confirms the persistence of such divides today, including in countries like the United States (Morris & Meinrath, 2009) and Canada (Fiser & Jeffrey, 2013; Imituk, 2011).

Given these conditions, some researchers began to study the dynamic nature of digital divides and consider the offline contexts that shape people's access to and control over them. Sometimes described as "digital inclusion" studies (Hudson, 2011), this research reframed digital divides to highlight social, economic, political, and cultural contexts. Some researchers working in this area theorized that the more that ICTs and network infrastructures pervade everyday life, the more that digital divides reflect and are attached to existing social divisions (Howard, 2011; Nakamura & Chow-White, 2011; Servon, 2002). This work broadened the definition of digital divides to incorporate variables like the quality and cost of connectivity, the types of activities undertaken online, the skills needed to negotiate devices and software, the structures of governance that mediate connections, the design limitations of various devices, and issues of representation in online spaces (Clement & Shade, 2000).

Digital divide challenges continue today, pushing researchers to suggest alternative approaches to address them. Some recent work incorporates the voices of affected individuals and populations in activities like research design, data analysis, and proposing solutions (Gangadharan & Byrum, 2012; Miller, 2013). This perspective frames people affected by digital divides as creative agents engaged in endogenous development projects (Davidson, Santorelli, & Kamber, 2012). It is deployed, for example, in the field of community informatics (CI), which examines how communities are involved in the design, administration, and effective use of digital infrastructures and ICTs (Gurstein, 2012). CI researchers and practitioners collaborate with people united by common factors such as geography, challenges, values, or experiences to appropriate ICTs and networks to meet their self-defined needs. Proponents of CI research and practice investigate how such endogenously managed development projects consider "the design of the social system in which the technology is embedded as well as the technology system in which it interacts" (Gurstein, 2000, p. 2).³

³ Past CI projects in Canada with ties to Indigenous communities include the Canadian Research Alliance for Community Innovation and Networking (Longford et al., 2012) and Research on ICT with Aboriginal

One emerging subfield of CI that applies this user-led approach to solving the problem of digital divides is called the First Mile (McMahon, O'Donnell, Smith, Walmark, Beaton, & Woodman Simmonds, 2011).⁴ Proponents of the First Mile argue that an endogenously managed approach to infrastructure development, operations, and maintenance can support network sustainability, capacity-building, and community development, among other benefits (Paisley & Richardson, 1998; Strover, 2000; see Collado, 2013 for similar arguments employed in a discussion of municipal fiber optic networks in the United States). Problematizing infrastructure development patterns that originate in metropolitan centers and are extended to users located in the assumed periphery, First Mile researchers instead focus on how users generate infrastructures from their situated contexts. This orientation is distinct from most efforts to bridge digital divides. Wilson (2008) describes how the majority of broadband networks in Canada and the United States emerged from legacy telephone infrastructure that is owned and operated by profit-oriented telecommunications corporations headquartered in urban centers (see also Babe, 1990). More recently, Crawford (2011, 2013) provides a similar description of the extension of broadband infrastructures built and managed by cable companies. These critics argue that such development patterns often fail to address digital divides among areas and populations that do not generate a suitable return on investment (Philpott, Beaton, & Whiteduck, 2014). In North America, researchers, government agencies, and regulators alike agree that in the absence of a regulatory requirement to provide universal broadband service, private-sector initiatives have failed to address digital divides among many marginalized regions and populations (see, for example, Canadian Radio-Television and Telecommunications Commission, 2010). Proponents of the First Mile seek to address these challenges by focusing on ways that public policies, regulations, and other supports enable user communities to generate and sustain their own networked digital infrastructures (McMahon, Gurstein, Beaton, O'Donnell, & Whiteduck, 2014).⁵

Over the past 20 years, various groups have deployed the First Mile concept to leverage the resources, capacities, and input of user communities for such initiatives. In the early 1990s, several projects in rural New Mexico reflected a First Mile orientation; this work continues through a website (www.1st-mile.com) and active LISTSERV. In the late 1990s, the United Nations Food and Agriculture Organization facilitated a number of telecommunications development projects in rural Africa through a First Mile framework (Paisley & Richardson, 1998). Drawing inspiration from the American rural telephone development cooperatives of the early 20th century, the UN First Mile project employed a "communication for development" approach that connected rural constituents with policy makers and network developers. Community members used ICTs such as film, radio, and video to provide input regarding telecommunications infrastructure development to far-off government agencies (Dymond, 1998). A recent

Communities (Walmark, O'Donnell, & Beaton, 2005). These partnerships continue through the First Nations Innovation Project (see <http://fn-innovation-pn.com>) and the First Mile project (see <http://firstmile.ca>).

⁴ The First Mile terminology is positioned against the "last-mile," which is the technical term used to describe the local infrastructure that connects a subscriber to a telecommunications service provider via a point of presence.

⁵ Disclosure: the author of this article is actively engaged in this work through his role as coordinator of the First Mile Connectivity Consortium. See <http://firstmile.ca>.

(spring 2014) issue of the *Journal of Community Informatics* further documented First Mile initiatives taking place in several national contexts.⁶

Indigenous Self-Determination and the First Mile

The First Mile concept complements the work of scholars of Indigenous self-determination who argue for development processes grounded in a recognition of the inherent laws, institutions, and practices of sovereign Indigenous peoples (Borrows, 2010; Irlbacher-Fox, 2009). Integrating telecommunications development and Indigenous self-determination in this way highlights how efforts to bridge digital divides reflect broader struggles. In this context, Indigenous peoples are providing alternatives to sociotechnical development paths that position state and corporate entities as the dominant nodes in a centralized network society. Instead, they argue for the proliferation of centers associated with the endogenous efforts of Indigenous communities rooted in distinct territories and cultures (O'Donnell et al., 2009; Whiteduck, J., 2010; Whiteduck, T. et al., 2012).

Examples of Indigenous efforts to bridge digital divides from the First Mile are evident around the world. In Australia, a satellite-based network set up in the mid-1990s connected four remote Aboriginal communities (Yuendumu, Kintore, Lajamanu, and Willowra) in the Tanami Desert near Alice Springs. Funded by member communities, government, and nongovernmental agencies, the Tanami Network's developers encoded Indigenous control in its technical protocols, management, and use. As Ginsburg (1995) observed, in this system "local areas are the centre from which information emanates, a reversal of the European model that sees the urban cities as the center and the remote communities as the periphery" (p. 131). The norms and design choices deployed in this project helped inform the Australian government's subsequent Networking the Nation initiatives (see Latukefu, 2006). In California, a federation of 19 Indian tribes built and manage a solar-powered regional wireless broadband network called the Tribal Digital Village (TDV) (Sandvig, 2012; Srinivasan, 2007). Member tribes continue to use this infrastructure to deliver public services and provide Internet access. By leveraging start-up capital from public and private sector contributors and federal government e-Rate subsidies to support ongoing operations and maintenance, the TDV developers established an autonomously managed broadband network. This regional initiative reflects another example of how Indigenous governments and communities located on the presumed periphery of the network society established an infrastructure for various self-determined activities, such as to deliver health and education services (Duarte, 2013). A third example from the United States is a satellite-based network built by the Navajo Nation in 2003 to connect five communities in their Alamo Chapter (Cullen, 2005; Landzelius, 2006). Member communities used this Southwest Virtual Alliance to support online applications, including several associated with self-government and public services. By building a network and encoding these functions in its design and operations, this system enabled its Indigenous users to retain greater control over important components of self-determination.

These three examples demonstrate how partnerships between Indigenous peoples, researchers, and practitioners are addressing digital divides through First Mile development. In doing so, they all

⁶ See <http://ci-journal.net/index.php/ciej>

sought to encode principles of Indigenous self-determination in the shaping of network infrastructures. However, such projects are not always successful or sustainable over time. Landzelius (2006) writes of “cases of Indigenous-run ICT networks used to boost civic infrastructures at the local level, yet in a normative fashion that largely converges with the dominant order of things” (p. 9). In line with past Indigenous media development projects (see Baltruschat, 2004; David, 2012; Roth, 2005), First Mile initiatives face many challenges. The small, diverse, geographically dispersed and remote nature of many Indigenous communities means they often rely on support from state and corporate entities for both capital and operational costs. Many small, isolated communities also lack access to the technical and administrative capacities required to manage and develop digital infrastructures. Network managers and service providers must contend with a lack of material support from constituent users who may face socioeconomic and other challenges that restrict their ability to contribute to this work. Remote and isolated communities also lack access to an installed base of electrical, transportation, and communications infrastructure, which makes development initiatives logistically challenging and expensive. Finally, network developers must engage with complex policies, litigation, and institutional frameworks arising from centuries of colonial policies and practices (Duarte, 2013; MacDonald, Longford, & Clement, 2012; Sandvig, 2012). As a result of these challenges, First Mile networks are often not sustainable over time. For example, despite the efforts of the Navajo Nation, the National Telecommunications and Information Administration found that in 2011 60% of Navajo homes still did not have basic telephone service and most lacked connectivity services (Wilhelm, 2011).

In the next section, I explore the challenges and opportunities that arise from a similar initiative in Canada. I also discuss the partnerships with public and private sector organizations that generate and sustain this work. This foregrounds the role of policy and regulation in First Mile projects. Employing an ethnography of infrastructure approach, I draw on documentary research and 68 semistructured interviews conducted in 2011 and 2012 during field visits in the provinces of Ontario, Quebec, and Manitoba to reveal these complex relations.

Canada’s Policy and Regulatory Supports to Address Digital Divides in Indigenous Communities

State policies and regulations can help create the conditions that establish First Mile initiatives. Hadl (2011) notes that when media and telecommunication policies “foster access to affordable technologies and telecommunications infrastructures, as well as to technical and critical media skills, they tend to offer opportunities for alternative media making” (p. 34). She notes that in such projects “the devil is in the details” because creative agents must negotiate the highly technical idiosyncrasies of governmental funding, licensing policies, and regulatory decisions. In this section, I outline such details in the context of digital divide policies and regulations affecting satellite-served remote Indigenous and Northern communities.

In Canada, a body of research describes the persistent digital divides facing many Indigenous (and non-Aboriginal rural and remote) communities (Shade, 2010). High sunk costs, combined with an absence of regulatory pressure to establish infrastructure, have contributed to this situation (Canadian Radio-Television and Telecommunications Commission, 2010; Imaituk, 2011). As a result of these challenges, in 2001 the government of Canada began to regularly monitor progress on digital divides in

Indigenous communities, utilizing a definition of “broadband” as a 1.5 Mbps symmetrical connection (Industry Canada, 2001, p. 10). These evaluations consistently revealed discrepancies between typically densely populated, urban non-Aboriginal communities, and typically rural and remote Indigenous ones. Several recent reports confirmed these digital divides persist and noted the need for innovative policy solutions to address them (see, for example, Fiser & Jeffrey, 2013).⁷ The federal government continues to monitor this issue. For example, Aboriginal Affairs and Northern Development Canada (AANDC) measures variables like capacity, latency, reliability, capital costs, operational costs, last-mile (local) networking technology, and backhaul (transport) infrastructure. Aggregated data collected in May 2010 is presented in an interactive map that also shows planned infrastructure builds to 2012.⁸ Figure 1 represents this map.

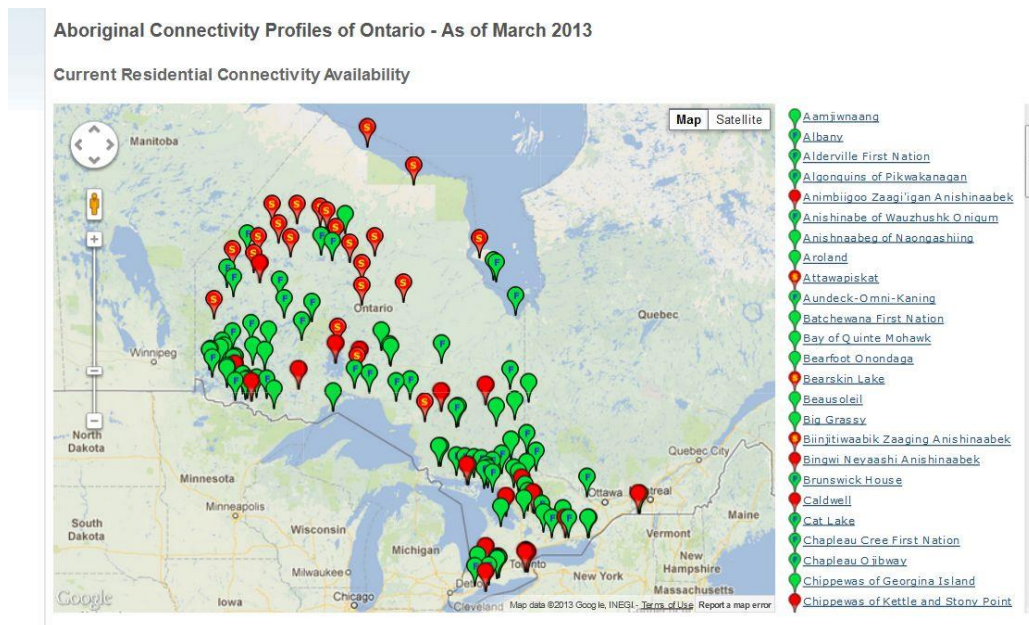


Figure 1. AANDC Connectivity for Aboriginal and Northern Communities in Canada: Map of Ontario First Nations (image capture captured April 12, 2013).

Original source: <http://www.aadnc-aandc.gc.ca/eng/1352214337612/1353504776242>.

⁷ Some scholars have commented on the challenges of securing valid and up-to-date data in this area (Fiser, 2010a). No conclusive or comprehensive connectivity data archive exists, and researchers face difficulties in reaching isolated communities to collect and verify data.

⁸ This data was researched, collected, and validated by multiple stakeholders, including federal departments, provincial ministries, private sector groups, and First Nations organizations.

Along with monitoring diffusion levels in Indigenous communities, the federal government has put in place a number of funding programs to address these digital divides. For example, from the late 1990s to the mid-2000s, a comprehensive national agenda to connect all Canadians led to an array of funding initiatives. Consolidated in Connecting Canadians, this work was administered by Industry Canada, and provided close to \$600 million (Cdn) to six broadband programs targeted at public organizations such as libraries, schools, and community access points. Through these initiatives, not-for-profit institutions and private sector entities could apply for funding to roll out infrastructure (Industry Canada, 2001). In the context of remote regions, community advocates argued that along with failing to incorporate input from user populations, corporate-led initiatives often resulted in insufficient service levels over time: Once (subsidized) infrastructure was built, there was little incentive for profit-oriented service providers to maintain and operate it, unless they received ongoing operational subsidies (Canadian Radio-Television and Telecommunications Commission, 2011; Imituk, 2011). However, government also made funding available for not-for-profit organizations to administer infrastructure projects. To construct a viable business case, nonprofit funding recipients partnered with network users, aggregating demand and revenues from anchor tenants (often public service delivery organizations) and residential/business Internet customers. Several regional organizations established by First Nations used these resources to build and operate their own networked digital infrastructures (Whiteduck, 2010). Although this approach led to several successes (including the NICSN network profiled in this article), in the context of government austerity measures and a regulatory environment focused on market forces, it failed to generate a long-term connectivity solution. As a result, digital divides persist in many remote and Indigenous communities today, although government is presently exploring potential policy and regulatory solutions to address this condition.

These funding initiatives were accompanied by various regulatory conditions that different parties leveraged to address digital divides. I focus here on those associated with Canada's satellite industry, because they reflect the technology utilized in my chosen example. Geostationary orbit satellites occupy a fixed position on the geostationary arc, and because satellite providers are assigned one of a limited number of orbital slots, they are regulated by state governments (Industry Canada, 2005). While many of these regulations are technical in nature, the government of Canada also uses them to meet defined policy objectives, such as supporting national security and sovereignty, and providing services to remote and Northern communities (Industry Canada, 2012; Jelly, 1993). The mechanisms provided to fulfill these objectives are known as "public benefits" attached as a condition of satellite licenses. They include a fund generated from a percentage of satellite revenues and the provision of satellite bandwidth to support services in underserved regions. In this article, I focus on the allocation of public benefit bandwidth to not-for-profit organizations that was a condition of the licenses that Telesat Canada secured to launch two satellites: Anik F2 and F3.

The combination of funding and regulatory support described here provided key enablers for First Mile development projects undertaken by Indigenous peoples in several Canadian regions. In the next section, I focus on how three Indigenous organizations combined public benefit satellite bandwidth with infrastructure funding to build a not-for-profit network that not only connected more than 40 remote communities across three Canadian provinces, but also generated a platform for digital self-determination.

Formation of the Northern Indigenous Community Satellite Network

The Northern Indigenous Community Satellite Network (NICSN) development story reflects the balancing of state and Indigenous interests in the bridging of digital divides, as they played out in the formation of a large-scale infrastructure. This example demonstrates a dialectic between Indigenous attempts to encode self-determination in the structure and operations of a satellite network, and the state's efforts to guide this process through policies and regulations. Using the First Mile as a conceptual framework, I track these developments by highlighting key points of negotiation among the involved actors.

This story begins in the forests of Northern Ontario, where the Keewatinook Okimakanak Tribal Council (which means "Northern Chiefs" in Oji-Cree) represents six remote First Nations. Two of these communities did not have basic residential phone service as late as the early 1990s. The Chiefs mandated their Tribal Council to connect their communities, and several federal and provincial government agencies provided financial support for this work. Joining with a coalition of community groups operating in the region, the First Nations secured \$20 million (Cdn) for the regional incumbent telecommunications provider, Bell Canada, to extend its existing networks to the unserved First Nations (Bredin, 2001). However, the company did not use this funding to build any new infrastructure, citing the lack of either a business case or a regulatory obligation to provide services in these so-called high cost serving areas (Fiser, 2010b). The commercial incumbent telecommunications service provider's failure to provide services to the First Nations illustrates the correlation between the logic of profit-driven infrastructure development and the geographic features of digital divides. It also reflects the productive opportunities that sometimes arise from these conditions.

Drawing on the state's treaty and fiduciary responsibilities to First Nations, the Tribal Council secured additional government funding to extend connectivity to its six member communities. Importantly, this digital divide solution began as a community-driven initiative; wary of their past challenges with the commercial telecommunications provider, Bell Canada, the group ensured that the project would remain under Indigenous control. To this end, in 1994 they founded the Ku-Ke-Nah Network—named after the Oji-Cree word for "everybody" and shortened to KO-KNET (Carpenter, 2010). Between 1996 and 1998, KO-KNET worked to connect 11 remote First Nations in the region, and though their network faced frequent data transmission failures and high long-distance charges, member communities quickly used up available bandwidth (Fiser, 2010b). When Industry Canada launched Connecting Canadians in the early 2000s, KO-KNET received contracts to deliver associated programs such as First Nations SchoolNet and the Community Access Program. Funding from these programs paid for connectivity costs, online health and education applications, and local networks. These synergies between Indigenous control over the KO-KNET infrastructure and the delivery of public services (like education and health) provide an example of digital self-determination.

Around this time, the regional incumbent Bell Canada upgraded its terrestrial infrastructure. Regulatory conditions enabled KO-KNET to access this infrastructure (for a fee), but this arrangement failed to reach those remote communities—including KO member Fort Severn—that lacked access to terrestrial networks. When Industry Canada awarded KO-KNET additional funding through its SMART

Communities funding stream in 1999, the organization used it to upgrade infrastructure in its member communities, including Fort Severn (KO-KNET, 1999a; Rowlandson, 1999). Despite their differing local contexts, the Chiefs agreed to develop a cooperative regional network that provided equitable connections to all six communities, regardless of size, location, or type of infrastructure (KO-KNET, 1999b). This arrangement reflects an expression of solidarity: Cognizant of their shared challenges in bridging digital divides, these groups united to secure a degree of First Mile control over connectivity infrastructures and services.

In the specific context of the satellite-served community of Fort Severn, this process also leveraged a “public benefit” regulatory condition. Given the prohibitively high cost of commercially available satellite bandwidth, KO-KNET worked with Telesat Canada and several government agencies to connect Fort Severn with Slate Falls in Ontario and Anaheim Lake in British Columbia through an experimental network that combined public benefit license conditions and government funding (KO-KNET, 2001). Figure 2 illustrates this early satellite network, which was managed from KO-KNET’s hub in Sioux Lookout, Ontario.

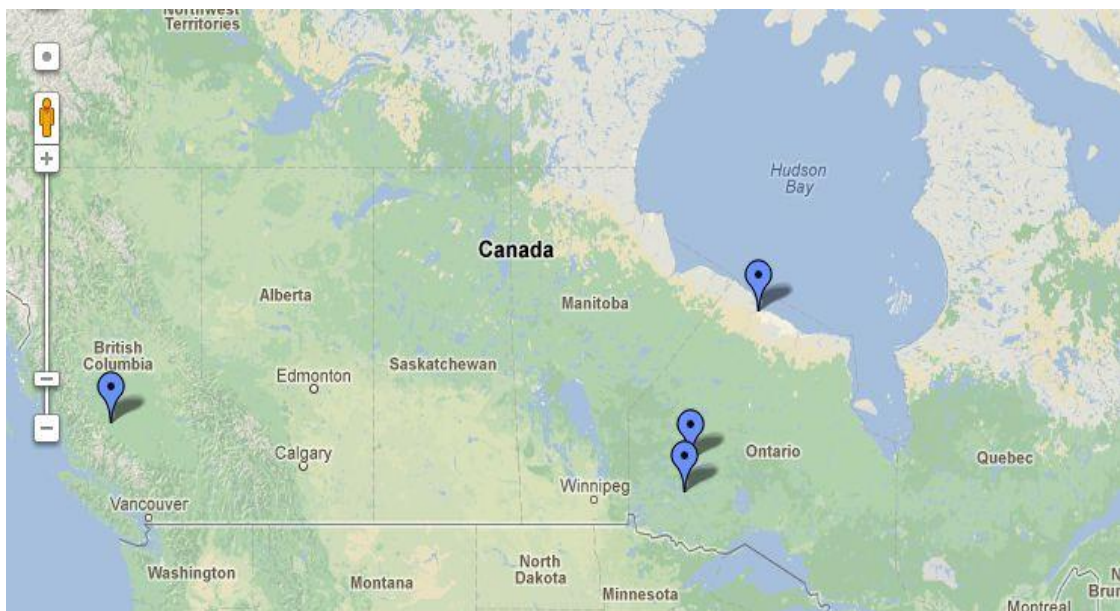


Figure 2. Early KO-KNET satellite network (circa 2000).

Once the Indigenous parties established this nascent satellite network and assumed control of the regional hub, they expanded it to include other Indigenous communities. Strong support for local autonomy shaped this diffusion process: Consultations with residents of the First Nations revealed the importance that they placed on ownership and control of community networks, and their desire to see the technology used to deliver public services and support economic development (Jansen & Bentley, 2004). Highlighting their awareness of links between infrastructure and self-governance, consultation participants also established local organizations to manage connectivity services, govern local bandwidth allocations, set network usage policies, and address technical and financial matters.

Over time, they also began to sell Internet and voice-over-Internet protocol (VoIP) telephone services, using revenues to fund network operations and staff. At the regional level, KO-KNET continued to assist with administration, bandwidth management, and operations and maintenance, partly through revenues generated through anchor tenants like health and education service providers managed by First Nations organizational entities (Keewaytinook Okimakanak Research Institute, 2005).

By the early 2000s, the satellite network faced high demand for services coupled with scarce bandwidth. This problem illustrates the tenuous nature of First Mile projects, which are often dependent on continued financial, policy, and regulatory support from governments or other funders. In a networked cooperative arrangement, one solution to this challenge is to increase the size and scope of the organization to share benefits, secure economies of scale, and strengthen advocacy efforts. To this end, when Anaheim Lake left the network, KO-KNET refocused its efforts on expanding its network in Northern Ontario, supported by an additional infusion of state funding through Connecting Canadians. Parallel to this new funding, Industry Canada announced a competition for a new satellite orbital position license. As a condition of securing this license, Telesat Canada agreed to contribute a full public benefit transponder on its Anik F2 satellite to nonprofit organizations (Czerny, 2004). Leveraging these converging opportunities, KO-KNET connected an additional 11 First Nations in Northern Ontario to their satellite network (Keewaytinook Okimakanak Research Institute, 2005). This expanded cooperative is illustrated in Figure 3.

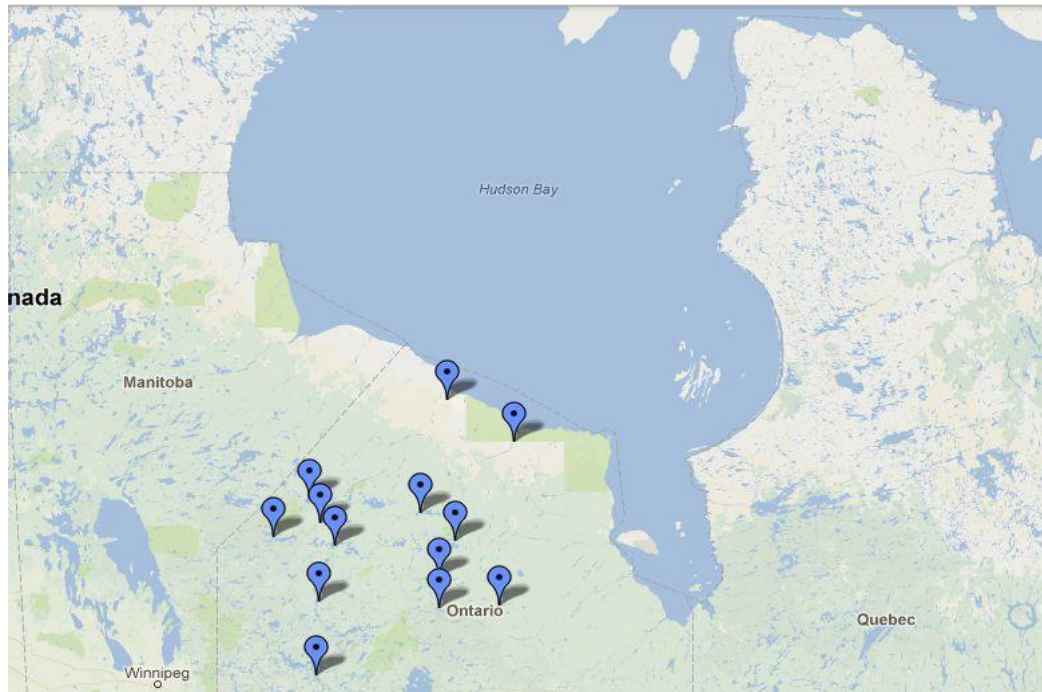


Figure 3. NICSN Member Communities—KO-KNET (circa 2002).

These diffusion patterns accompanied focused efforts on the part of the Indigenous parties to establish a governance structure for their cooperative. As a condition of their access to the public benefit bandwidth, KO-KNET set up a formal management structure and outlined plans to internally cross-subsidize revenues and bandwidth to ensure that all member communities gained equitable access to the resource. Member communities also received capacity-building opportunities and retained ownership of their local networks. Eager to expand their network and strengthen the cooperative, KO-KNET hosted a conference in Winnipeg in spring 2002 to showcase their business model and invite new members. The event piqued the interest of two other Indigenous organizations facing similar digital divide challenges: the Keewatin Tribal Council (KTC) from Manitoba and the Kativik Regional Government (KRG) from Nunavik.

As in Northern Ontario, remote First Nations in Manitoba faced significant digital divides. In the mid- to late-1990s, the province's incumbent telecommunications provider MTS Allstream provided dial-up Internet service in some communities, but it was slow, expensive, and unreliable. These conditions pushed a regional Tribal Council to take on infrastructure development. KTC, which represents 10 First Nations, administered several Connecting Canadians programs in the early 2000s. After developing a regional strategic development plan, the Tribal Council used funding from several federal agencies to build infrastructure in its member communities, but faced an array of logistical, staffing, funding, and governance challenges. As a result, Manitoba's satellite-served communities remained disconnected until the late 2000s.

In the Nunavik region of Quebec, the Kativik Regional Government (KRG) was also engaged in building its own infrastructure after more than a decade of failed attempts to connect the Inuit territory (Blair Christensen, 2003; Kativik Regional Government, 2002). As was the case in Ontario and Manitoba, the incumbent telecommunications provider Bell Canada did not intend to service the region, given the high costs and low profit margins. As a result, the regional government decided to take on the networking project and undertook a development model that aggregated revenues and demand from households and businesses in Nunavik's 14 villages and territorial public service providers such as the Nunavik Regional Board of Health and Social Services and the Kativik School Board (Kativik Regional Government, 2002; McMahon & Mangiok, 2014). Funding for the project came from a combination of provincial and federal governments.

When representatives from these three regional Indigenous organizations met in 2002 at KO-KNET's conference in Winnipeg, they discussed their frustration with the lack of available satellite bandwidth and high demand for connectivity. The organizations also shared a desire to secure control over the design and management of digital infrastructures. To access satellite bandwidth too expensive to purchase independently, they outlined plans to pool resources, knowledge, capacity, bandwidth, and infrastructure. To undertake this work, KTC and KRG set up new organizations: Tamaani Internet in Nunavik and Broadband Communications North (BCN) in Manitoba. They requested funding support for their development initiative on the grounds that satellite systems can be shaped into platforms for public service delivery and economic development (National C-Band Benefit User's Group, 2004). Their business plan followed that deployed by KO-KNET in Ontario, and aimed to expand the existing satellite cooperative into Quebec and Manitoba. To pay for operations and maintenance, the cooperative consolidated revenues generated from anchor tenants and the sale of Internet services. A shared network management plan governed the distribution of bandwidth across the cooperative: All member communities received equitable access, regardless of location or size. Local organizations assisted with network operations, maintenance, and governance.

The conditions to put this plan into action coalesced through a combination of new funding and regulatory conditions termed the National Satellite Initiative. In 2004, this initiative supported ground infrastructure builds in 35 communities: 14 in Quebec, 11 in Ontario, and 10 in Manitoba. Due to a regulatory requirement linked to the launch of a new satellite, Telesat Canada also released a new lot of public benefit bandwidth. KO-KNET and KRG managed this resource through their regional network gateways, while KO-KNET administered the cooperative from Sioux Lookout. (KTC in Manitoba continued to face financial and administrative challenges, and so its satellite network was not yet operational). This stage of the network is illustrated in Figure 4.

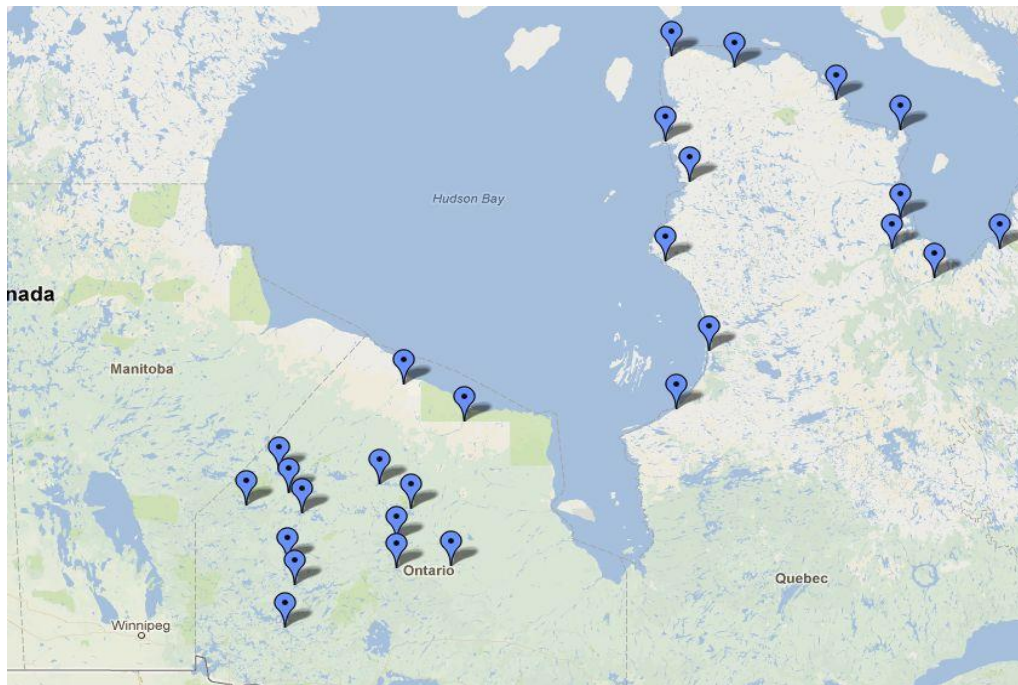


Figure 4. NICSN (circa 2004).

In 2005, the three Indigenous partners announced “the first inter-provincial community-owned and operated broadband satellite network in Canada,” which they named the Northern Indigenous Community Satellite Network (NICSN) (National C-Band Benefit User Group, 2005, para. 1). The cooperative proved an immediate success: For example, when Tamaani Internet launched residential Internet in December 2004, during the first two weeks of operation, staff completed 120 installations and villages quickly ran out of modems. But despite high demand, limited bandwidth and construction delays meant that fewer than half of the 43 planned NICSN member communities could access Internet services at the time (KRG, KO-KNET, & KTC, 2007). The partners began looking for opportunities to secure additional funding and bandwidth, and learned that the federal government was contemplating a new round of infrastructure funding. The partners collectively lobbied for, and received, additional funding. (Table 1 summarizes the funds raised in this project.) During this process, the partners also formalized NICSN into a Joint Venture (KO-KRG-KTC, n.d.). They continued to equitably distribute bandwidth to all member communities, with operations and maintenance costs supported through revenues generated from public service anchor tenants and the sale of Internet services. (Any surplus was placed in a public benefit contingency fund.)

Table 1. NSI Round 2 Funding Contributions.

| Region | Funder | Amount (M\$)(Cdn) |
|---------------------------------|---|--------------------------|
| National | Industry Canada (via Infrastructure Canada) | 20 |
| National | Telesat Canada | 2.88 |
| Ontario, Manitoba, Quebec | NICSN partners | 0.03 |
| Manitoba | Manitoba Rural Infrastructure Fund (Federal Economic Development Program) | 0.5 |
| Ontario | Northern Ontario Heritage Fund Corporation | 1.8 |
| Quebec | Villages Branches | 2.2 |
| TOTAL | | 27.41 |

Behind the scenes, administrative and technical setbacks meant that the three partners ended up waiting almost two years to secure funding and finalize the project. Challenges included organizational issues, lack of infrastructure, legal requirements, conflicting jurisdictions among layers of government, and difficulties in raising matching funds.

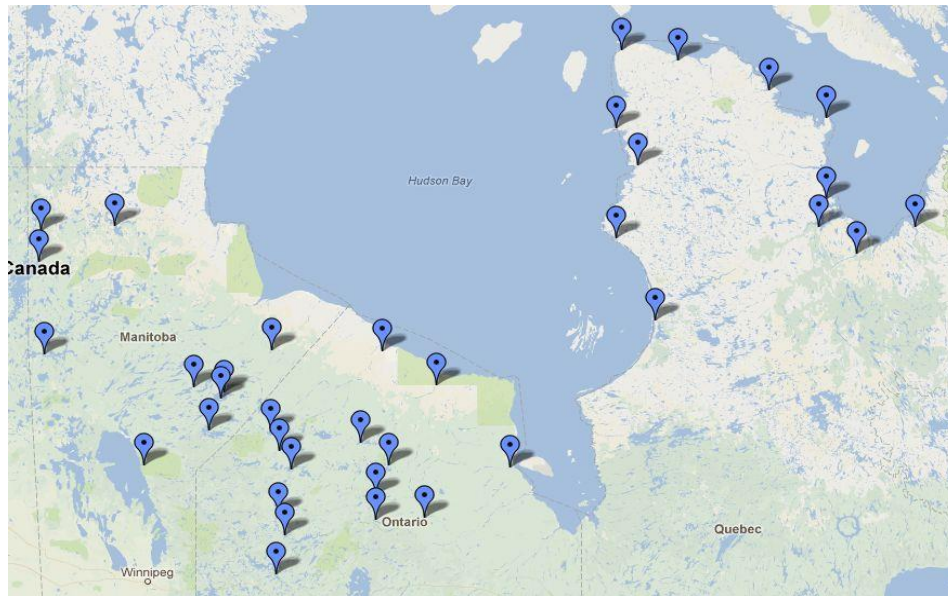


Figure 5. NICSN (circa 2008).

However, by 2008 all three partners had secured their funding and the organizations hosted an event in Kuujuaq to launch the joint venture. NICSN could finally access the infrastructure and satellite bandwidth required to deliver residential and commercial Internet and broadband-enabled services like telehealth, e-learning, e-justice, videoconferencing, and VoIP telephone services to all 43 of their member communities. Figure 5 presents the cooperative network at that time.

Between 2009 and 2011, all three partners continued to build on the NICSN project, securing additional support through federal initiatives like Broadband Canada: Connecting Rural Canadians. The cooperative generated enough revenue to cover operations and maintenance costs, and even accumulated a small annual surplus. But despite its economic, technical, and organizational successes, like other First Mile initiatives, NICSN faces several challenges that threaten its long-term sustainability. The three partners compete for limited funding and resources, and the membership (and associated revenues) has shrunk as some communities migrate to terrestrial infrastructure. The partners also face challenges linked to the dynamic nature of Canada's regulatory and funding environment. Recent federal funding initiatives reflect declining levels of support tied to shorter time frames and fewer opportunities for nonprofit service providers. Regulatory frameworks are also in flux. Over time, the regulation of satellite systems in Canada has shifted to embrace trends like globalization, privatization, and an increased focus on market forces. Among other changes, this opened Canada's satellite market to international competitors (Industry Canada, 2005). As of mid-2013, to level the playing field for domestic satellite companies, consultations were underway that may further reform satellite regulatory conditions—and the public benefit obligations associated with them. These uncertainties reflect new challenges for the NICSN partners as they work to sustain their cooperative network. Yet forthcoming announcements provide hope for the continuation of the NICSN project. The 2014 federal government's budget included \$305 million (Cdn) for rural and remote broadband, an amount reiterated in the Digital Canada 150 plan released by Industry Canada in spring 2014 (Industry Canada, 2014). The federal agency has been consulting with private and public sector partners to gather information on how to best implement this initiative, which is slated for 2014/2015. It remains to be seen how these developments may affect the NICSN cooperative's digital self-determination efforts.

Conclusion: From Digital Divides to Digital Self-Determination

The outcomes of shifts in policy and regulatory frameworks present challenges to the long-term sustainability of First Mile projects like NICSN. My discussion of the cooperative's development trajectory shows how Indigenous organizations, government agencies, private sector organizations, and constituent user groups successfully partnered to address digital divides facing remote First Nations and Inuit communities. This work was contingent on a set of structural conditions linked to the broader political economy. In many contemporary societies, including Canada, state governments are turning toward an increased reliance on market forces and implementing an array of austerity measures. As demonstrated in this article, the policies, regulations, and institutional frameworks guiding the emergence of the network society are impacted by these trends, sometimes to the detriment of organizations representing marginalized individuals and groups.

At the same time, the state remains an important resource as a container and enabler for democratic action (Held, 1996). One field where state governments remain important political and strategic actors is in the shaping of domestic networked digital infrastructures and the bridging of digital divides (Crawford, 2013; Wu, 2010). As Milan (2013) notes, despite the emergence of a globalizing network society led by powerful transnational actors, much of the communication sector is still regulated at national or regional levels. This suggests that proponents of First Mile projects can focus on securing regulatory and policy supports for their initiatives, while also continuing to do the important on-the-ground work of building and managing their infrastructures. In Canada, this activity is evident in the efforts of Indigenous communities across the country. A national coalition of Indigenous nonprofit service providers are working together to intervene in the formation of policy and regulatory frameworks to ensure that their voices are heard (McMahon, Hudson, & Fabian, 2014). At the same time, residents of remote and rural Indigenous communities are setting up the infrastructures and applications that support their digital self-determination in areas like community and economic development.

This work may be of interest to parties working toward similar goals. It is true that there is a certain specificity guiding the activities of Indigenous peoples in their interactions with state governments, given their distinct legal and political status. However, other communities of interest can leverage their own resources and capacities when taking on similar First Mile projects. In this article, I demonstrated how Indigenous organizations leveraged funding support and regulatory conditions to creatively bridge the digital divides facing extremely remote communities that are challenging to service. Framed as a First Mile initiative, the NICSN case study shows how government agencies, civil society organizations, and private sector entities can partner to support endogenous networked digital infrastructures. This work is anchored in a long history of community-based media and telecommunications development. Since the earliest years of media technologies, marginalized groups have worked to secure control over communication infrastructures. These efforts continue today, albeit in new forms expressed in emerging technologies. A First Mile approach may provide an organizing framework that parties can use to bridge digital divides in ways that showcase the creativity and tenacity of those individuals and groups located at the putative margins of dominant networks.

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