Information and Communication Technology in Aboriginal Communities in Canada: Increasing Aboriginal Social Capital

A Discussion Paper

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1. Introduction

What follows is a discussion paper on information and communication technology (ICT) as it relates to Aboriginal social capital. A first draft of this paper was revised to include feedback from project partners (Crossing Boundaries Aboriginal Voice Initiative) and roundtable discussions. A series of five roundtable sessions in different regions across Canada with First Nations, Métis and Inuit experts and stakeholders were organized to discuss the content and direction of Aboriginal community information and communication technology (ICT) networks in Canada. A one-day national symposium was held in January of 2008 with the participation of 23 key stakeholders, experts and practitioners from Aboriginal organizations and other relevant entities, to discuss the document. The symposium focused on the issues raised throughout the study and formulated policy and research priority issues.

Increasingly, developments in information and communication technology (ICT) are having major impacts worldwide. In Canada, the last several years have seen a significant growth in ICT opportunities, particularly in relation to online capabilities. A diverse number of Aboriginal communities have been part of this process. There are numerous experiences where the growth in ICT appears to be having an important impact on socioeconomic realities. Nonetheless, there is still much that is unknown about how ICT affects community life both positively and negatively. Simultaneously, what is known as the *digital divide* (Norris, 2001) is still far from being bridged. The notion of social capital, tentatively defined as the institutions, relationships and norms that shape the quality and quantity of society's social interactions, can assist in assessing this impact. In recent years, social capital has become one of the relevant notions for measuring the impacts of ICT in communities (O'Neil, 2002). Further, it can assist in the understanding of the prerequisites and investments that may enable the successful implementation of ICT in Aboriginal communities.

The study sought to address four main questions: Why social capital can be a useful notion in assessing the impact of ICT? How can ICT impact community social capital? How can the implementation of ICT be impacted by social capital investments? Does the type of ICT development matter in terms of social capital? Building on prior work, the authors conducted an extensive review of the published and grey literature on social capital and on ICT implementation in Canada with a focus on Aboriginal communities. Together with the examination of existing literature, a series of phone interviews with 15 key informants from First Nations, Métis and Inuit communities and institutions in Canada were conducted to gather information on specific cases related to the development of ICT in Aboriginal communities (see list in Appendix 9.4). A first draft paper was written and distributed for feedback among 20 individuals from Aboriginal organizations, government agencies, and university units with experience in this area. Five roundtables were held in different regions of the country to gather further information, discuss real experiences and receive feedback of the draft paper. These roundtables were held in Sioux Lookout, Ontario (K-net); Cranbrook, British Columbia (Ktunaxa); Iqaluit, Nunavut (Qiniq); Edmonton, Alberta (Métis settlements); and

Winnipeg, Manitoba (urban Aboriginal agencies). The roundtables counted between nine and 11 participants each, excluding the research team. Finally, in early 2008 a one-day national symposium was held in Winnipeg, Manitoba, with the participation of 23 key stakeholders, experts and practitioners from Aboriginal organizations and other relevant entities, to discuss the document and identify priority issues.

The paper provides first an overview of terminology and concepts, followed by a summarized environmental scan of the situation of ICT in Canada (a full version is provided in appendix 9.1). The paper reviews the theory of social capital as it applies to Aboriginal peoples in Canada and presents the social capital framework that guides its examination in relation to ICT. The paper then presents a series of case descriptions of ICT implementation in First Nations, Inuit and Métis communities, and one specifically related to urban settings. Using the case descriptions as main background information, the paper discusses the potential opportunities offered by ICT in distinct fields to Aboriginal communities. It continues with an analysis of the potential impact of ICT on social capital using the study's framework. The distinction of three dimensions, bonding, bridging, and linking social capital is central to the analysis. When analyzing the potential for impact the paper provides evidence of the plausibility of impact, not evidence of impact per se. The study design and the data available did not allow for the latter type of evidence. Again with a social capital lens, the paper analyzes enabling and inhibiting conditions that seem to play a role in successful implementations of ICT in Aboriginal communities. The section concludes by revisiting ICT and social capital while examining that both the "what" and the "how" of connectivity seem to matter from a social capital perspective. The final section of the paper discusses policy and research priority issues that for the most part emanated from the symposium. The paper also includes several appendices: the environmental scan of the current situation of ICT across provinces and territories in Canada, particularly as it relates to Aboriginal peoples; an overview of First Nations and northern communities connectivity in Manitoba; a list of documents related to the topics examined in the paper; a list of key informant interviews; a list of the roundtables; a list of the symposium participants; and a list of technical terminology definitions and acronyms.

2. Summary of terms and concepts

Aboriginal peoples are the descendants of the original inhabitants of North America. The Constitution of Canada recognizes three groups of Aboriginal peoples – First Nations, Métis and Inuit. These three separate peoples have unique heritages, languages, cultural practices and spiritual beliefs (Health Canada, 2004).

Information and communications technology (ICT) refers to the tools that enable increased communication and use of connectivity for services. ICT serves to link people, communities, businesses and organizations across regions, nationally, and internationally. Connectivity is a term that describes the degree to which a particular region, province or community has linked its citizens and organizations with each other and internationally.

Connectivity may for example refer to the degree of access to a quality internet connection.

A point of presence (PoP) refers to a node or site where customers can connect into the backbone network. However, when a community has been reported to have a PoP this may not necessarily mean that connectivity is actually in place, only that the potential for connectivity exists. Generally, a large fee (around $3000) is paid to "light" the PoP to provide network access that is then followed by smaller monthly bills.

Broadband networks and connectivity are often referred to interchangeably. Broadband refers to a high quality or large bandwidth connection that enables high speed connectivity, specifically for downloading and uploading (documents, images, video, programs, etc.). Bandwidth refers to how fast data flow through the path to the user's computer. Broadband comes from the words "broad bandwidth" and is used to describe a high-capacity, two-way link between an end user and access network suppliers capable of supporting full-motion, interactive video applications. Broadband networks facilitate for example the transfer of large amounts of data for Telehealth, videoconferencing, distance education, and other applications. The internet refers generally to the World Wide Web. For a more complete list of terms see Appendix 9.5

3. Environmental scan in brief

Initiatives focused on bridging the digital divide have aimed at providing equal access to the internet and have been taking place across Canada (albeit unevenly) for the past decade. Infrastructure and access to networks has been provided in almost every region of Canada increasing the nation's connectivity significantly. Although there is still some debate regarding the meaning of true access to broadband networks, the groundwork for future development is in place. Nonetheless, the non-urban disadvantage is still evident. What follows is a brief scan of the ICT coverage in Canada, especially as it relates to Aboriginal communities. Appendix 9.1 provides a comprehensive environmental scan.

In British Columbia the provincial government created the task force NetworkBC and amalgamated the demand of various government departments for high speed broadband services and partnered with a private company to provide these services while developing the infrastructure necessary to connect rural, remote, and isolated communities. The Ktunaxa Nation Network is an example of Aboriginal owned network in British Columbia. In partnership with the First Nations Technology Council, the Ktunaxa Nation provides connectivity, computer equipment, and skills development programs to members as well as surrounding communities. In Alberta the provincial government created the Alberta SuperNet which includes over 12,000 kilometres of fibre optics and connects 27 of Alberta's largest cities and potentially 429 communities. The Métis communities in Alberta, not unlike other communities, appear to have differing rates and modes of adopting technology. Generally, some of the barriers to adopting new technologies include cost, skills level, accessibility, rate of access (dial up or high speed), level of integration and cultural relevance. A unique situation in Saskatchewan allowed

the provincial government to employ its crown-owned telecommunications company, SaskTel, to implement a province-wide initiative to connect all schools, health units, and government agencies in the province.

Initiatives involving Aboriginal communities taking place in central and eastern Canada include: connecting 30 northern communities in Manitoba via a two-way satellite connection; Canada's SMART Aboriginal community K-Net which has grown from seven communities to over 60 in the past five years; Inuit communities in northern Quebec have become involved in connectivity research which proved beneficial to individuals and families; and in the Maritimes Aboriginal communities have received connectivity upgrades and some federal funding for connectivity projects.

Qiniq is a high speed satellite based network in Nunavut that provides connectivity to 25 Inuit communities. The Qiniq network has implications for the delivery of education, government services and banking in Nunavut. The Qiniq network has been extremely successful and had surpassed year nine goals, as described in the business plan, in year two. The Yukon has been described as having connectivity comparable to that of southern Canada, although this applies mainly to businesses. Connectivity is essential for many northern businesses and although a quality connection may have been obtained many northern areas continue to struggle with the need for more bandwidth. In the Northwest Territories satellite and wireless connectivity and videoconferencing services are readily available for both residential and commercial customers. This region received a significant connectivity upgrade in 2005 through Industry Canada's BRAND program.

4. Social capital: An analytical framework to assess information and communication technology in Aboriginal communities

This section first reviews the concept of social capital, as well as its potential relation to ICT and Aboriginal communities. It then presents the conceptual framework of social capital that guided the analyses.

4.1 Social capital, ICT and Aboriginal communities

Social capital, to the extent that it is a property of the social environment, takes the form of a relational resource. A common understanding amongst most authors is that social capital is a resource composed of a variety of elements, most notably social networks, social norms and values, trust, and shared resources (Bourdieu & Wacquant, 1992; Bourdieu, 1983; Loury, 1992; Putnam, et al., 1993; Putnam, 2000; Woolcock, 1998b; Woolcock, 1998a; Woolcock & Narayan, 2000; Narayan, 1999; Schuller, et al., 2000; Lin, 2001). Its function appears to be related to the enabling of some societal good within the boundary of that specific societal level (Coleman, 1988; Coleman, 1990). It is mostly considered an aggregate feature that can aid in the characterization of a social system. For Bourdieu (1983), social capital relates to actual or potential resources within a social structure that collectively supports each of its members, and is linked to the possession of a durable network of relationships of mutual acquaintance and recognition.

Social capital has been studied in relation to education, labour markets (Department of Economics, 1999), local economic development (Midgley & Livermore, 1998), microfinance (Rankin, 2002), sustainable community development (Dale, 2005), economic performance (Casey & Christ, 2005), health (Kawachi, et al., 1997; Gooden, 1998; Veenstra, 2000; Rose, 2000; Campbell, et al., 2002; Bolin, et al., 2003), identity, transition to work (Fevre, 2000), communicative competence and human resources (Szreter, 2000), among numerous other outcomes. More recently, studies specific to social capital and ICT have appeared. A recently published multidisciplinary volume (Huysman & Wulf, 2004a) compiles a series of articles that examine this relationship from the fields of computer sciences, sociology, communication studies, business economics, and management studies. One of these papers (Quan-Haase & Wellman, 2004) argues that the effects of the internet on social capital can be conceptualized from three broad approaches. First, "the internet transforms social capital," meaning that it leads to major transformations in social contact and civic involvement away from local and group-based solidarities, and toward more spatially dispersed and sparsely knit interest-based social networks (Barlow et al., 1995; Wellman, 2001) Second, "the internet diminishes social capital," through its entertainment and information capabilities it draws people away from family and friends (Nie 2001; Nie, et al., 2002). Third, "the internet supplements social capital," because as another means of communication it facilitates existing social relationships as well as helps build patterns of civic engagement and socialization (Quan-Haase & Wellman, 2002; Chen et al. 2002). Among the initial studies that have specifically looked at the impact of ICT on social capital, one of them (Norris, 2003) concludes that the internet seems to widen the experience of community, and the other (Steinmueller, 2004) that social networks are influenced by (and influence) ICTs.

It was not until the year 2000 that research concerning social capital and Aboriginal peoples picked up pace. The First Nations Social Cohesion Project of the Population Studies Centre at the University of Western Ontario has been one of the attempts to examine social capital in First Nations communities in Canada. This group has contributed several papers and has been pursuing a research agenda to address the ways in which variations among forms of capital and cohesiveness within First Nations communities generate different outcomes at a population level (White, et al., 2000; Maxim, et al., 2003). A study by Mignone and colleagues developed a conceptual framework of social capital in First Nations communities and validated a tool for its measurement (Mignone, 2003a; Mignone, et al., 2004). As well, Levitte (2004) researched social capital in the context of aboriginal economic development in Canada. Social capital has been used to analyze traditional forms of Indigenous governance (Hunter, 2000; Schwab & Sutherland, 2001), sustainable development (Altman, 2001), welfare reform (Smith, 2001), and Indigenous learning communities (Schwab & Sutherland, 2001). Social capital has also been used as a means to better understand the disconnect between the management of waste in nine First Nations communities in Northwest British Columbia and their traditional relationship with the land (Moody & Cordua-von Specht, 2005).

In the Aboriginal health field, First Nations planners have indicated that "analytical frameworks that attempt to associate factors such as poverty with health outcomes are insensitive to the complex socio-economic conditions that exist in First Nations communities" (O'Neil et al., 1999). In other words, there may be features of the communities, above and beyond individual level characteristics, that are impacting health, well-being and other outcomes but are not being measured by current research. In fact, an Assembly of First Nations document on holistic health policy (AFN, 2005) has incorporated the notion of social capital as a potential determinant of health. This also relates to what Memmott and Meltzer (2005) suggest when they state that "Indigenous people actually invest significant time and energy into building social capital, but that it often manifests in ways that are not registered in terms of 'economic development' or that do not match the mainstream criteria of 'good governance'." A clear description of Aboriginal communities that could be understood as possessing high stocks of social capital can be found in the following quote from the Royal Commission on Aboriginal Peoples. Describing Aboriginal societies of the past it states:

> The economic relations embedded in traditional cultures emphasized conservation of renewable resources, limiting harvesting on the basis of need, and distributing resources equitably within the community, normally through family networks. Since families and clans owned rights to resources and since everyone was connected in a family, no one was destitute and no one was unemployed (Royal Commission on Aboriginal Peoples, 1996).

ICT and social capital are normally discussed as associated with economic development. The relationship between social capital and entrepreneurship has been explored by scholars (Portes & Landolt, 2000) who have pointed to the ability of social networks to pull together financial and other material resources for business development on the one hand, and to apply pressures on entrepreneurs on the other. Social networks have been highlighted as of importance in overcoming challenges to entrepreneurship, such as access to training, access to markets, and the negotiation of community values and norms. (Levitte, 2004). Gertler and Levitte (2005) show that to be innovative and commercially successful, Canadian biotech firms must reach out to both their local and global networks to access both knowledge and capital. The same can be said of Aboriginal businesses. Woolcock (1998a) asserts that strong relationships with formal institutions are instrumental in that they allow groups to access resources, ideas, and information from institutions of power. Dale (2005) argues that "sustainable communities depend on the formation and maintenance of networks, particularly at the bridging and linking level, in order to build any of the imperatives and capital." Evans (1996) believes that the obstacles that poor communities face stem from their members' inability to 'scale up' micro-level social capital and social action to a politically and economically effective level. Levitte (2004) identifies several barriers to Aboriginal business development: access to start-up and growth financing; access to skills such as business training and trained labour force; access to markets and marketing strategies. ICT appears to have the potential to bridge some of these barriers. As an example, there are a number of

experiences using internet based tools to build community capacity that offer promising cases for examination (Fawcett, et al., 2003).

There are scholars (DiMaggio & Hargittai, 2001) that argue that due to the increase of internet diffusion rates, research should shift the attention from the digital divide (inequality between haves and have-nots based on dichotomous measures of access) to digital inequality, by which they mean differences among people with physical access to the internet. Digital inequality encompasses five main variables: technical means (inequality of bandwidth); autonomy (whether users log on from home or at work, monitored or unmonitored, during limited times or at will); skill (knowledge of how to search for or download information); social support (access to advice from experienced users); and purpose (whether they use the internet for increased economic productivity and social capital, or consumption and entertainment). Warschauer (2003) argues that the above multifaceted approach needs to be extended to situations in which internet penetration is low and just beginning. "Indeed, it is precisely in such situation that the promotion of skills, social support, and autonomy, while carefully paying attention to the underlying purpose, can be most important." Other authors (Huysman & Wulf, 2004b) state that a "socio-technological approach" is needed to analyze the relationship between information technology and social capital." The following section provides a social capital framework to help analyze how ICT may impact Aboriginal communities, as well as what investments are required from a social capital perspective to achieve the successful implementation of ICT.

4.2 Social capital analytical framework

In a previous study we formulated a conceptual framework of social capital for First Nations communities and developed a culturally appropriate instrument for its measurement. (Mignone, 2003a; Mignone et al., 2004; Mignone, 2003b) The study was a product of a partnership between First Nations communities in Manitoba and the University of Manitoba. This formulation of a conceptual framework of social capital for First Nations communities emerged from an iterative analysis between existing literature and the ethnographic evidence from the fieldwork. The operational definition of Social Capital derived from the study was the following:

> *Social capital characterizes a community based on the degree that its resources are socially invested, that it presents an ethos of trust, norms of reciprocity, collective action, and participation, and that it possesses inclusive, flexible and diverse networks. Social capital of a community is assessed through a combination of its* ***bonding*** *(within group relations),* ***bridging*** *(inter-community ties), and* ***linking*** *(relations with formal institutions) dimensions.*[1]

[1] Although this definition was derived from an analysis that tested broad theoretical ideas against the specific ethnographic realities of First Nations communities, we believe it is arguably relevant beyond the specific communities from which it arose. This current definition includes minor revisions post publication of papers reporting on the above mentioned study.

Bonding social capital refers to internal community relations. It addresses the networks, ethos, and socially invested resources within a particular society, community or group in question, i.e., the intra-community ties. *Bridging* social capital is essentially a horizontal notion, implying connections between societies, communities or groups, i.e., the inter-community ties. *Linking* social capital refers to a vertical dimension, i.e., the relations with formal institutions beyond the community. Specifically to our study, bonding social capital refers to relations within each Aboriginal community. Bridging refers to horizontal links with other communities, be they other Aboriginal communities, or other communities of place (e.g., urban centres). Linking refers to connections between particular Aboriginal communities and institutions like federal/provincial government departments and public/private corporations (e.g., Indian and Northern Affairs Canada, Industry Canada, Manitoba Hydro, private ICT companies, banks).

Table 2 summarizes the social capital framework, showing each dimension as consisting of the three components and their descriptors. For socially invested resources (SIR) the descriptors are physical, symbolic, financial, human or natural. The central notion is that these resources be socially invested, i.e., that they be potentially accessed by, or of potential future benefit to, any member of the community. Each descriptor captures the resource investment at a particular stage of its development. Physical refers to tangible resources produced by human beings (e.g., roads). Symbolic refers to resources that pertain to the identity of the community as such, and for the most part are intangible (e.g., traditional language). Financial refers to monetary resources. Human resources mean human capacity as a product of formal and informal education. Natural resources are those provided by nature shaped with or without human intervention. Resources are essentially mutable. For example a financial resource becomes a physical resource when money is used to build houses. Similarly, a human resource becomes a financial resource when income potential increases due to the attainment of an education degree. Consequently, these five descriptors seek to capture the different facets of socially invested resources at a given point in time. These descriptors are distinct from other forms of capital (e.g., human capital, financial capital) because they refer to the degree of social investment of resources at the community level.

The term ethos (in the sense of character or disposition of a community) to name a component of social capital is used to capture the notions of trust, norms of reciprocity, collective action, and participation. Trust is self-explanatory in that it means that community members have confidence in one another as well as in community leaders. Norms of reciprocity, although potentially neutral, are considered in this framework as a positive value. Collective action represents the notion that community members may pursue actions that seek to benefit the collective. Finally, an ethos of participation implies the willingness of community members to be involved with others in common activities. The difference from collective action is that the main reason for participation is that of the individual's interest, with no explicit purpose of a collective good.

Networks are understood as "structures of recurrent transactions" (Aldrich, 1982), and are described according to their inclusiveness, diversity, and flexibility. Higher degrees of

these three characteristics would imply higher levels of social capital. Inclusiveness of networks refers to the notion that these structures of interactions are relatively open to the possibility of newcomers and to the exchange of information with newcomers. While there is room for subgroups with high levels of interaction (e.g., communities of interest within a community of place), communities require the existence of diverse networks for higher levels of social capital for the community as a whole. Diversity implies the co-existence of networks that differ from one another, composed of distinct elements or qualities, but that are capable of interacting in a meaningful way. Flexibility of networks implies a ready capability to adapt to new, different, or changing requirements. Inclusiveness, diversity and flexibility are actually interrelated qualities. They are different aspects of a same phenomenon. In general, a correlation among these three descriptors of networks should be expected.

The first level of the framework (the distinction between three dimensions of bonding, bridging, and linking) captures the social reality of Aboriginal communities in terms of their intra and inter-community and institutional interactions. Social capital, understood as a relational resource, cannot truly characterize a community if it only captures within community interactions. Communities do not exist in isolation and their potential stocks of social capital must express this reality because, as Woolcock (1999) indicates, "different combinations of these dimensions might yield different outcomes."

Table 2: Social Capital Framework

Bonding		
SIR*	Ethos	Networks
Physical	Trust	Inclusive
Symbolic	Norms of Reciprocity	Flexibility
Financial	Collective Action	Diverse
Human	Participation	
Natural		
Bridging		
SIR	Ethos	Networks
Physical	Trust	Inclusive
Symbolic	Norms of Reciprocity	Flexibility
Financial	Collective Action	Diverse
Human	Participation	
Natural		
Linking		
SIR	Ethos	Networks
Physical	Trust	Inclusive
Symbolic	Norms of Reciprocity	Flexibility
Financial	Collective Action	Diverse
Human	Participation	
Natural		

*SIR = Socially Invested Resources

Does the notion of social capital include the term "social" because "capital" is collectively owned, or is it because "social" assets are constituted as "capital"? This is not simply a rhetorical question, but is central to the meaning of what constitutes social

capital. There is a difference between capital that consists of social relations (i.e., investment in social relations) and capital that is social because it is a collective investment. The evidence in our earlier study backed an interpretation of social capital that would need to include both meanings. Social capital appeared to be relevant both as a relational investment and as collective asset.[2]

This three-dimensional model considers social capital as a feature of communities, with the caveat that the community of which it is a feature must be clearly delimited. Aboriginal communities in both rural and urban areas can be understood as communities of identity, of place, and of interest. It is the communities themselves that implicitly or explicitly provide the delimitation. As such, the study explores the notion of social capital in First Nations, Métis and Inuit communities both in rural and urban settings. Ultimately, these notions of social capital relate to ideas around power relations. Bonding and bridging social capital are particularly related to power of the collective, whereas linking social capital suggests power relations with formal institutions.

5. Case descriptions

This section presents the five case studies conducted for the study. The cases were selected in a way that included First Nations, Métis and Inuit communities and organizations, and at least one case that covered ICT Aboriginal experiences in an urban setting. As well, the cases chosen were from different regions of the country. The cases were K-Net (Ontario), Métis settlements (Alberta), Qiniq (Nunavut), Ktunaxa (British Columbia), and Winnipeg (Manitoba).

5.1 K-Net (Ontario)

K-Net (the Kuh-ke-nah Network) is the only Aboriginal network in Canada to be awarded funding through Industry Canada's SMART community program. The development and experiences of K-Net have provided insights into best practices, prerequisites for successful implementation, and the importance of community specific service delivery of technology. K-Net is unique and when compared to other similar networks in Canada it appears to be the most established and successful network of its kind.

During the mid 1990's, a First Nations' organization in northwestern Ontario called Keewaytinook Okimakanak (KO) Tribal Council, which means Northern Chiefs, implemented K-Net in seven First Nations communities. By 2006, this network was serving 60 Aboriginal communities across Ontario and Quebec. K-Net primarily serves a "high cost serving area". The Canadian Radio-Telecommunications Commission (CRTC) defines a "high cost serving area", as an area where the telephone company's monthly costs to provide base telephone service are greater than the associated revenues that the telephone company receives for providing the service" (Fiser et al., 2005). K-Net

[2] This incorporates both "hard" and "soft" social capital, as termed by House and colleagues (House, 1999).

primarily serves the Sioux Lookout district which is a sparsely populated region that consists of approximately one person per square kilometre and includes 25 First Nation's communities. Of the 25 First Nation's communities only one has year round road access and many are only accessible by small aircraft. Prior to the emergence of K-Net, many communities did not have telephone service or had, for example, one public telephone to serve a community of 150 people (Fiser et al., 2005).

The populations of the K-Net communities range from approximately 300 to 900 residents. There was no connectivity in the K-Net communities before the establishment of the K-Net bulletin board system in 1994. The seven original communities and their populations are as follows; Deer Lake, population 850, North Spirit Lake, population 314, Popular Hill, population 316, Fort Severn, population 470, and Keewaywin, 539 (Communications Today, 2003).

The establishment of K-Net began in 1994 when the chiefs of the seven communities began to leverage local and federal monies to establish K-Net, originally intended as a Bulletin Board System (BBS). The purpose of the BBS was to enable children who left the community to complete their schooling to text message home with the hope of providing support while away. The program was a success and within one year 25 additional First Nations communities in the area were participating. In 1996, schools in the communities began to utilize the BBS system. At that time, K-Net did not offer any internet services and the BBS system was a dial-up messaging system whose services were provided by Bell Canada.

In 1996, K-Net received funding from both Industry Canada's SchoolNet program and Community Access Program (CAP). The SchoolNet program provides an internet connection and computer for the community's local schools. The CAP also provides funding to establish an internet connection and to provide computers for schools, libraries and other public venues. The establishment of backbone infrastructure was funded through a Bell Canada infrastructure upgrade. During this time, K-Net was also involved in CRTC hearings in which the K-Net group sought the decision that phone lines in high cost service areas should be mandatory. The group was successful; however, the victory on this issue only served to provide low speed dial-up internet services which were and are unreliable and very costly (Fiser et al., 2005).

In 1997, K-Net partnered with Industry Canada's First Nations SchoolNet program and Telesat. Between 1996 and 2000 K-Net began to provide internet services to the schools and email service over the BBS. Additional public access sites were set up during this time and were financed through Industry Canada's CAP. Between 1996 and 1999 K-Net began offering internet services beyond the original seven communities. In 1998, K-Net received funding though the Federal Economic Development Initiative in Northern Ontario (FedNor). Industry Canada, in 1999, provided funding to establish additional infrastructure which enabled "band offices, nursing stations, constabulary, and other public institutions to internetwork with the school and access the internet" (Fiser et al., 2005). K-Net now provides telecommunications services to 23 remote First Nations in

northwestern Ontario (occupying the Sioux Lookout district) and 14 fly-in First Nations and Inuit communities in northern Ontario and Quebec. An additional 11 First Nations have Points of Presence (PoPs) in central and southwestern Ontario" (Fiser et al., 2005).

Further, K-Net also has PoPs in several urban centres including Sioux Lookout, Thunder Bay, Timmins, and Toronto. PoPs assist in supporting the various technological applications available through K-Net. Each First Nation community manages and operates a Municipal Area Network (MAN) and trains and employs local people as network technicians to cover repairs, upgrades, and general maintenance of the MAN. The MAN provides services to community residents, businesses, and regional service agencies and usually utilizes the band office as a base for these services. An informal social network has emerged among technicians working with the BBS system. Technicians from different communities can text message each other to pool or share knowledge about the system and assist each other with technical problems and best practices.

The northern chiefs envisioned K-Net as a means through which to meet certain economic, educational, and health needs in the original seven communities. Knowing that the needs of each community differed and that meeting these needs required broadband access, the northern chiefs applied for funding though Industry Canada's SMART Communities Initiative and were awarded $5 million. One requirement of the program was that the $5 million of federal government funding be matched with an equal amount from other sources. K-Net was the only Aboriginal community selected for the SMART Community program in Canada. Other sources of funding include Indian and Northern Affairs Canada (INAC) and the Office of Learning Technology, and Human Resources Development Canada (Communications Today, 2003). K-Net services were able to mobilize funding from many different sources and levels of government to achieve the vision of the northern chiefs.

There are 25 Telehealth stations in K-Net communities that are linked to 70 hospitals across Ontario and to the Health Sciences Centre in Winnipeg, Manitoba. Telehealth enables local people to have regular doctor's appointments that take place in the community. Telehealth "facilitates therapy sessions for telepsychiatry and special needs education programs" (Candian Research Alliance for Community Innovation and Networking, 2005). Telehealth operates via a polycom videoconferencing unit and utilizes medical equipment such as an otoscope, a stethoscope, and a patient view camera. The otoscope can reveal a patient's eardrum or other internal cavities to a health care specialist hundreds or thousands of kilometres away. With the stethoscope, a distant health care provider can assess a patient's heartbeat or breathing. The patient view camera can magnify a patent's skin rash or wound up to 50 times (Canadian Research Alliance for Community Innovation and Networking, 2005). Telehealth has also provided a means through which to deploy an art therapy program which helps young children discuss difficult subjects such as physical or sexual abuse.

The introduction of Telehealth in the K-Net communities has improved the quality of health care and has enabled the provision of additional services that were not provided in the past. Two examples of additional services include X-ray services and speech and language therapy. The Keewaytinook Okimakanak Research Institute (KORI) has studied the "comparative costs of calls over the public switched telephone network versus K-Net VOIP" and the preliminary results show that the use of K-Net Voice over Internet Protocol (VoIP) by administrative offices in the communities resulted in a 40% savings of long distance fees between 2003 and 2005 (Candian Research Alliance for Community Innovation and Networking, 2005).

Community 'buy-in' refers to the notion that community networks must be created by people in the community itself rather than by an outside company that is not familiar with needs of the community. Establishing an interest within the community in creating and sustaining a local Internet Service Provider (ISP) is central to the success of the network. In many cases, a community champion emerges to promote broadband internet and discuss with residents how the technology could benefit them and others in the community. K-Net is a link in an emerging national Aboriginal network. It facilitates multipoint videoconferencing and quality of service for counterpart networks in British Columbia, Alberta, Saskatchewan, Manitoba, Quebec, and the Maritimes. K-Net's users have virtual access to Aboriginal communities across Canada (Fiser et al., 2005: 14).

The communities involved with K-Net have begun to realize the benefits that can be derived from a combination of broadband internet access and ICT training, coupled with ongoing community participation in the process. K-Net is an example of a successful Aboriginal owned community network. The success of the project seems to be related to the fact that the community: 1) pools resources, thus enabling the communities to sustain broadband services in a high-cost service area; 2) shares expertise and experiences that enable the communities to build a local IT sector and maintain local loops (the MAN) at their own initiative; and 3) strives for projects beyond their individual abilities, while maintaining local autonomy, which in turn enables each community to determine which ICT applications will be beneficial to their unique community's local social needs (Fiser et al., 2005).

Existing evidence suggests a positive impact associated with the opportunities provided by linking southern institutions with their northern counterparts to solve problems quickly and to communicate complex information related to health, economy, and social services. K-Net in Ontario, the Kativik Regional Government in Quebec, and the Keewatin Tribal Council in Manitoba are partners in the Northern Indigenous Community Satellite Network (NICSN). Infrastructure Canada announced $20.65 million in funding for this network to increase services to 43 northern communities. The funding will enable these communities which currently have connectivity in administration offices to offer residential connectivity to community members. The increased amount of bandwidth is greatly needed to meet current and future bandwidth needs in the communities. The $20.65 million funding will supply "two satellite transporters and the required earth station and local access network upgrades." Other funding sources include

the Northern Ontario Heritage Fund, the Government of Quebec's Villages branches program and Telesat Canada (Infrastructure Canada, 2007).

5.2 Métis connectivity (Alberta)

The Canadian government has identified 50 Métis communities across Canada in five different provinces including; Newfoundland and Labrador (6), Ontario (1), Manitoba (5), Saskatchewan (30), and Alberta (8). Although fifty communities in Canada are designated as Métis, a much larger number of Métis people live in other rural and urban centres. The Métis population in Canada, as reported by Statistics Canada, was 390,000 in 2006.

The circumstances of the Métis people in the province of Alberta are unique in Canada. Nationally, Métis are considered non-status Indians under the Indian Act and consequently are not entitled to the same rights and benefits as status-Indians. However, in Alberta, the Métis Settlement Accord was signed on July 1, 1989 making Alberta the only province in Canada to enter into a formal partnership with a Métis organization. Some of the highlights of the accord include: the transfer of ownership of specific lands from the province of Alberta to the Métis Settlement General Council; the protection of the land by the province; legislation that provides the foundation for practical and democratic forms of local self-government; and the settlement of current land claims. "Alberta is the only province that passed legislation through the Métis Settlement Accord. It established the only form of Métis government in Canada" (Métis Settlements General Council, 2006).

According to the Aboriginal Canada Portal only three of the 50 recognized Métis communities in Canada have no access to the internet (Government of Canada, 2006a). Twenty of the 46 connected communities have a connection described as 'dial-in no charge'. Dial-in no charge refers to a dial-up or 56k internet connection for which long distance phone charges are not incurred. However, many Métis communities in Canada are not recognized as such or are undefined. The following is a breakdown of Métis connectivity in Canada according to the Aboriginal Canada Portal:

- Newfoundland: four of the six communities already have high speed internet, the fifth community is reported to have a 'dial-in no charge' connection which will be upgraded to a high speed connection by 2008. No information was available for the sixth community.
- Ontario: the one community has a 'dial-in no charge' connection.
- Manitoba: four of the five communities have a high speed internet connection; the fifth community is reported to have a 'dial-in no charge' connection.
- Saskatchewan: 10 of the 30 communities already have a high speed internet connection and five more will be upgraded from 'dial-in no charge' to high speed by 2008. Seven communities are reported to have 'dial-in no charge' connections, five communities have reported their connectivity situation as 'other' and the three remaining communities have no access to the internet.

- Alberta: five of the eight communities are reported as having a broadband quality internet connection and a Point of Presence (PoP) on site. The remaining three communities are reported as having high speed connection to the internet.

The Métis Nation of Alberta (MNA) exists to "advocate on behalf of and meet the needs and aspirations of Métis people in Alberta" (Métis Nation of Alberta 2007). The MNA represents the Métis communities in Alberta and provides a platform for participation in government policy and decision making, implements projects and provides programming for Métis people, and facilitates "the advancement of Métis people through the pursuit of self-reliance, self determination, and self management" (Métis Nation of Alberta 2007).

The Métis Nation of Alberta (MNA) has recently (2006) connected their 17 provincial offices via high speed fibre infrastructure. After being denied access to the Alberta SuperNet (the MNA was ineligible as a provincial body) the MNA was able to secure funds to establish infrastructure and to provide last mile solutions for each of the 17 regional offices. The Government of Alberta does not provide grants for last mile solutions to complement the SuperNet. The cost of the last mile is the responsibility of the community interested in becoming connected. Many smaller communities indicated that they were not interested in having access to the SuperNet due to the cost of activating or 'lighting-up' the PoP coupled with the cost of maintenance and administration. For some communities the overhead cost was too large an amount to take from their monthly operating budget.

The Métis communities in Alberta differ in connectivity, adoption of technology, and also in the challenges faced regarding the (potential) adoption of technologies. The money available to fund connectivity projects also differs substantially by community. Some communities have been able to engage in particular economic initiatives with the private sector while others have not had the opportunity or have chosen not to. While each Métis community has access to the SuperNet via a PoP, this does not imply access to the internet because the PoP may not be 'lit' or active. Some communities have chosen not to access and promote high speed internet for a variety of reasons including; cost, possible reduction of community activities and relationships, possible negative outcomes such as gambling or pornography, and also the unknown effects of increased time with technology on children, culture, and tradition.

On the contrary, some communities have made the decision to bare the cost and become involved. "Technology and connectivity comprise a critical new form of communication in our region and around the world and we will not be left behind" (Participant, 2007). One community was able to allocate the money from within their operating budget to connect the band administration office (which houses approximately 15 related agencies, such as police, health, youth centre, computer labs, women's centre, etc), and three other nearby buildings. The community plans to extend the high speed broadband connection to residents within the next two years. The atmosphere in this community is one of hope for the future, grounded in programs and progress. Community leaders have focused on

education and training to ensure better life chances and successes for all community members.

5.3 Qiniq and the Nunavut Broadband Development Corporation (Nunavut)

Before the territory of Nunavut was created, the region was part of the Northwest Territories. Nunavut was formed April 1, 1999. Its territory extends over approximately 770,000 square miles or about one fifth the size of Canada and has a population of approximately 30,000 (2005 estimate) Inuit and 4,000 non-Inuit people in 25 communities (Lundberg, 1999). Transportation in Nunavut is only by air (which can be difficult in the stormy winter months) or by sea in the summer months. The broadband initiative in Nunavut encompasses 25 communities that range in population from 140 people in Grise Fiord to 5,236 in the territory's capital Iqaluit. The description of the establishment of broadband connectivity in Nunavut describes the implementation of a community internet network. The construction of Nunavut's network Qiniq, although similar to other initiatives taking place in Canada is unique in its approach. This initiative encompasses the entire region of Nunavut.

The severe weather coupled with geographical distance and terrains have made connectivity a considerable issue in the Canadian north for the past two decades. A conference called "Connecting the North" was held in 1994 to promote the use of technology and connectivity in northern communities in the areas of Telehealth (Telemedicine at the time), business, distance education, and in bridging the digital divide between Aboriginal and non-Aboriginal people and between northern and southern regions in Canada (Nunavut Broadband Development Corporation, 2004). In 1994 there was no internet connectivity in Nunavut. In 1995, as a result of the conference, the document "Northern Voices on the Information Highway" was produced. The document discussed how the region would benefit from internet connectivity and what were the issues and challenges associated with becoming connected. However, the costs of becoming connected in the North were high while potential profits were low due to small populations and economies.

In 1999 ISPs began to emerge. At the time, there were three larger organizations that provided internet services in Nunavut including Sakku Artic Technologies based in Rankin Inlet, Polarnet based in Cambridge Bay and Nunanet Worldwide Communications based in Iqaluit. Sakku was able to offer basic dial-up and email service to local community members. Polarnet was created in 1997 and initially employed dial-up technology to serve five Nunavut communities. Rankin Inlet and Iqaluit are Nunavut's largest communities and consist of a customer base strong enough to provide a business case for the ISPs. Sakku, Nunanet and Polarnet are still in operation today and act as local service providers for the new Qiniq network (Lorraine Thomas, 2007).

During this time internet use around the world increased exponentially and the internet promptly became a necessary service rather than a luxury. The ability to connect to world markets, access information in real time, and to be constantly connected for

communication became as essential as in the south. Consequently, people in the north were not satisfied with dial-up which was slow and could cost up to $500 per month.

The deployment of broadband in Nunavut would require a unique solution as the geography of the region makes it impossible to develop the basic backbone infrastructure utilized for these purposes in the south to support broadband connectivity. In Nunavut there are "no highways, no power or phone lines, no fibre optic networks, and no microwave relays linking communities" and the most common method of supplying communities with goods is air or barge (Qiniq, 2005).

Industry Canada announced Broadband for Rural and Northern Development (BRAND) in 2002. At this time Nunavut officials had already created the Nunavut Broadband Task force to address the issue of connectivity in Nunavut communities. The Nunavut Broadband task force members saw the program as an opportunity for people in the North and formed the Nunavut Broadband Development Corporation (NBDC) which consisted of private sector companies, government of Nunavut officials, and Inuit organizations interested in developing a sustainable broadband network. The NBDC is a non-profit corporation representing members of the public (Qiniq, 2005).

After funding was secured the NBDC produced a business case for broadband in Nunavut and requested proposals form companies with experience designing networks in the North. NBDC selected SSI Micro, a Yellowknife based company that had experience delivering broadband and satellite services in remote areas. Additionally, SSI Micro had already worked with all three Nunavut ISPs and had established a network in northern Quebec which has a similar climate. SSI Micro was required by Industry Canada to build the network in one year.

Once Industry Canada's BRAND program had been announced the NBDC was able to secure funding from Industry Canada and INAC. As well, various contributions from Nunavut-based organizations were received. The initial funding enabled the NBDC to produce the business case for broadband in Nunavut and was also used to develop infrastructure. The total cost to build the Nunavut network was $9 million of which BRAND contributed $3,885,000. SSI Micro offered $1.6 million worth of equipment already installed in 10 of the communities. Many Inuit organizations were involved including the Atuqtuarvik Corporation which provided $3 million worth of debt financing. Additionally, an Inuit organization called the Kativak Association "provided a critical loan guarantee" in order to secure the funding from Industry Canada.

Once the funding was in place and the selected vendor (SSI Micro) was on board, the establishment of a Nunavut broadband network began. In December of 2004 the infrastructure was installed and operational in 15 communities (Qiniq, 2005). The network is called Qiniq and today Nunavut residents have an affordable broadband network (Table 4).

In every Nunavut community one local person received training and is able to install wireless modems, handle basic troubleshooting and involve people in the initiative. This person is called a Community Service Provider (CSP). In 2004 the local people selected to be CSP's were involved in a training workshop. The conference enabled local people to share their ideas of what types of services would provide the most benefit for their home community and what types of knowledge would be needed for them to perform their function as a CSP. Involving local people was seen as one of the key factors in achieving success.

As of 2007, one quarter of all internet subscribers, approximately 3600 people or 12% of the population in Nunavut have subscribed and are using the Qiniq network. The president of NBDC suggests this is a sustainable rate that is continuing to grow (Smith, 2006). Qiniq is a satellite based system serving the remote Artic. The system is critical in connecting communities throughout Canada's newest territory. As a new system in place for just under two years its impact at the community level merits to be studied.

Table 4
Inuit Connectivity in Canada

	Point of Presence	High Speed	Dial-in No Charge	No Access	No Access – HS	DINC – HS	Total # of Inuit Communities Per Region
NWT	0	2	0	0	1	3	6
NU	0	25	0	0	0	0	25
QC	0	10	3	1	0	0	14
NL	0	2	0	0	0	3	5

NWT= Northwest Territories; NU=Nunavut; QC=Quebec; NL=Newfoundland & Labrador

5.4 Ktunaxa Nation (British Columbia)

The Ktunaxa Nation Broadband Network is comprised of communities in south eastern British Columbia, including five band locations and thirty-two areas in the Regional District of East Kootenay. The project's area is located in the Kootenay and Columbia valleys surrounded by both the Rocky Mountains and the Purcell Mountains. The network area is approximately 17,871 square kilometres in size and includes 13,989 people, 8,602 dwellings, 182 businesses, five band locations, and 58 unincorporated communities (Ktunaxa Nation, 2005).

The network was initially conceived by the traditional language and culture sector as a means through which to disseminate the disappearing Ktunaxa language. Prior to the

establishment of the broadband network connectivity was limited to dial-up. The capacity of a dial up connection (56K) was not sufficient for the delivery of online language programs. People in the Ktunaxa communities facilitated by the traditional language and culture sector had been recording the language for many years. Usually this was accomplished by bringing a tape recorder to community meetings and recording the elders speaking their native tongue. The director of the traditional language and culture sector was aware of the pressing need to record as much of the language through meetings and storytelling as possible as there were less than 30 speakers of the Ktunaxa language alive.

In 2001 funds were secured through the First Peoples Cultural Foundation to begin to digitize all of the previously recorded material from the past twenty years. Once a significant amount of language had been recorded the project then turned to working with the fluent elders to make interactive language CDs. Next, the dissemination of the language using the digital archives was to be made possible with the introduction of broadband connectivity. The idea was to have the archives broadcast on an online radio or television show through the internet with hopes that people would listen. Because the communities were equipped with 56k dial-up internet connections they did not have enough capacity or bandwidth to broadcast the proposed material.

Around the same time, Industry Canada's BRAND program was providing federal funding for selected applicants who could submit a business case for a self-sustaining network and matching funds for a proposed broadband project. Ktunaxa Nation applied for funding and was successful. Federal funding in the amount of $3.8 million was awarded to the Ktunaxa Nation contingent upon the completion of two conditions. They first had to develop a feasible business plan for a community ISP which proved difficult due to the small population and geographic terrain. Second, they had to secure funds to match the 3.8 million dollars in order to claim their award (Maki, 2006).

The Ktunaxa Nation was able to raise the matching funds and submit a successful business proposal for the complete project which included the five bands and 32 external communities. The communities with successful business cases were provided with a fibre optic cable or a hard line right to the user. Of the three other communities one has a 10 megabit internet connection, the second has a wireless internet system, and the third has fibre optic cable to the band office, child care centres, and the main office centre. The third centre has the potential to become a wireless site. Today the infrastructure proposed for the project is in place and ready for use (Maki, 2006). Further, the initiative is unique among Aboriginal community networks in that internet modems, which carry an initial cost and may cause resistance to adoption, were provided free of charge to residents in the Ktunaxa communities (Maki, 2007).

Another challenge to the establishment of a business case was competition from national telecommunication's companies, including one that had previously been the communities only ISP providing the 56k dial-up connections. People in the communities had previously been refused high speed internet connections despite numerous requests.

However, during the development of the business case for the Ktunaxa Nation Network the same national telecommunication companies began providing high speed internet in the communities, which selectively removed the business case for the broadband network in the smaller communities of 300 or less (Don Maki 2006).

The Ktunaxa Nation has recently been selected as the model community network for the Fully Integrated Technological (FIT) community program. In essence, Ktunaxa will receive in-kind support from the First Nation's Technology Council (FNTC) of British Columbia and in return will document their experiences in order to provide a successful model and best practices for other communities to follow. One program organized by the FNTC focuses on providing the necessary IT skills to people in the communities. Select individuals, usually youth, from Ktunaxa communities have traveled to Alert Bay, BC, to participate in training workshops that enable the community members to maintain the technical equipment used to provide high speed internet connectivity and support broadband applications. The workshops consisted of three weeks of 'A plus' computer technician training, two weeks of hands-on training in Alert Bay followed by five months of online instruction. The FIT program has also provided support for other projects such as the Community Technology Plan, which is currently underway. The Community Technology Plan ensures that every individual has a computer and is provided with the necessary tools to utilize the technology in an optimal way. This is done through the provision of training and educational programs such as computer users' skill training courses (Maki, 2006).

Another initiative taking place in the communities is the creation of learning centres that will hold technical skills training and educational sessions for community members. The learning centres are funded through a research grant from the Canadian Institutes for Health Research in partnership with the University of British Columbia's Continuing Medical Education Branch. The aim of the project is to connect elder's health and youth knowledge. In the future, the learning centres will be used to provide other educational courses such as Accounting and Business Administration. IBM held informational sessions in Cranbrook, a nearby town, and provided participatory workshops with various topics ranging from the basic inner workings of computers or 'demystifying the box', to basic computer skills sessions, and technical skills sessions. Another project supported by the Canadian Heritage Gateway fund and an organization called SMART choices focuses on the establishment of a Traditional Language and Cultural Web Portal called "Ktunaxa: I Remember" which will assist with the dissemination of the language and culture of the Ktunaxa Nation. Lastly, a program called the 'Home Wiring Upgrade' addressed a problem that was initially unanticipated. Although the Ktunaxa Nation Network provided the optical fibre right to the homes of community members many of the homes had wiring that was out of date. Making the connection from the customer premise equipment outside the house to the computer inside of the house became a problem. The electrical wiring in many homes was old and not compatible with the wiring needed to connect to the internet. Fortunately, the Home Wiring Upgrade provided the funding to purchase the necessary material supplies and train local individuals to upgrade the wiring (Maki 2006).

The Ktunaxa Nation Broadband project has fully utilized the FirstVoices initiative. FirstVoices "is a suite of web-based tools and services designed to support Aboriginal people engaged in language archiving, language teaching, and cultural revitalization" (First People's Cultural Foundation, 2003). The FirstVoices webpage was created in 2003 to archive and document Indigenous languages using text, sound, pictures and video and includes educational tools such as online interactive language games (First People's Cultural Foundation, 2003). The archived language files were digitized and new files were created by providing elders with microphones and recording the language at community meetings and whenever the chance arose. These efforts resulted in one of the largest archives on the FirstVoices system, and may have played a key role in the acceptance of the new technology by community members.

Today the network has been established, and while initially for the purposes of preserving language, the network can be utilized in many different ways. Other agencies such as the health department, child and family services, the band offices and the local school systems will have the opportunity to build onto and use the network to develop various applications such as Telehealth and videoconferencing facilities and will be able to link to other urban agencies and band offices in order to provide more effective services to people in the communities. Videoconferencing units for Telehealth systems are already slated for two of the Ktunaxa Nation communities and an additional two communities are currently searching for recycled units.

In February of 2008, two of four planned community learning centres (CLCs) were opened in the Ktunaxa Nation communities as a result of a partnership with the University of British Columbia's Division of Continuing Professional Development and Knowledge Translation (UBC CPD-KT). The University has been funded by the Canadian Institutes of Health Research to pilot, implement, and evaluate the project. The objective of the project is to create "a sustainable resource for rural and remote health education by providing culturally relevant health information online and engaging community members to build to content leading to improved community health outcomes" (Slonowski, 2008).

Although the project has not been formally assessed to-date the Ktunaxa Nation is in an optimal position to be used as a model community. An assessment was completed before the project began asking community members various questions related to ICTs and connectivity. This assessment will be conducted again in two years in order to measure the impact of ICT's in the Ktunaxa Nation communities.

5.5 Urban Aboriginal initiatives (Winnipeg)

The following case description provides an overview of the issues associated with equitable access to connectivity, equipment, and technologies for Aboriginal people in Winnipeg, Manitoba. Specific initiatives are highlighted to showcase different approaches that address digital inequalities in urban centres and how these approaches relate to increasing social capital among Aboriginal communities.

The issue of access to ICT in urban centres is not based on lack of infrastructure as is the case in rural areas. Urban centres in Canada are, for the most part, well equipped with connectivity infrastructure and have many internet services providers (ISPs) that compete for customers. In urban centres, access to the internet and computers can be seen as a function of income or the ability to purchase a computer, the necessary software, and a connection to the internet. While a connection to the internet may cost as little as $25 per month, computer equipment may remain out of reach for many people as a result of the cost. Other factors that may discourage the use of ICTs and the internet in urban centres include computer maintenance, basic technological skills, the cost of upgrading software and the obsolescence of computers and technologies.

Differential access to ICTs and computers among different groups in society creates a paradox. Are social inequalities further exaggerated or newly created by lack of access to ICTs, the internet and computers? Or is this phenomenon simply an extension of pre-existing inequalities in society? In history whenever a new technology has been introduced into society, it is generally the case (as with telephones, televisions, cell phones etc) that the more affluent members of society are quicker to obtain and utilize the technology than those with little or limited income.

Winnipeg is the eighth largest city in Canada and had a population of 648,600 in 2006 (City of Winnipeg, 2007). Aboriginal people account for 52,000 or 12.4% of Winnipeg's population (Wilkinson 2007). In Winnipeg, wireless corridors have recently been created at the University of Manitoba, University of Winnipeg, Red River College, the Forks, the Aboriginal Centre, the Centre for Aboriginal Human Resource Development (CAHRD), the International Centre, and include many downtown hotels and coffee shops. One focus of these initiatives is to provide free wireless internet services in high traffic and sometimes low income areas. To supplement these initiatives other programs, such as Computers for Schools, aim to teach computer skills and provide computers to students and low income families that can demonstrate financial need (Winnipeg Roundtable 2007).

A pilot project in Winnipeg called LeaningCiti provides wireless internet to the University of Winnipeg, Red River College, the Aboriginal Centre, the International Centre, CARHD, and the Point Douglas area. This two year initiative operated in conjunction with another program called the Computer Lending Library, which is an educational digital information literacy program. The computer lending library program provided a series of computer literacy classes that aimed to increase the technological skills of new immigrants, Aboriginal people and others. Once an individual completes the program which includes 30 hours of computer literacy classes, they would be given a refurbished computer on loan for two years (at which point they would be asked to make payments on the computer). The computer lending program was envisioned as a way to increase skills and provide access to the internet. While the LearningCiti project provided free wireless internet access in the areas named above, the free service allowed access to specific sites only. Namely, the City of Winnipeg website, Red River College website,

University of Winnipeg website, the CAHRD website and the SMART partners of Manitoba website (SMART partners is an Industry Canada supported initiative that aims to develop connectivity infrastructure in different areas in Canada). Once an internet user tries to leave the sites listed above, they are challenged with a password and asked to provide a credit card number to purchase surfing minutes. An individual that completes the library lending program is given a password, free of charge, and can surf the internet at their discretion. The next steps for the LearningCiti project are to secure additional funding to extend the two year pilot project and also to partner with a commercial ISP to offer the service in a larger area of downtown Winnipeg. The ages of people taking the computer lending program range between 12 and 60. The only restriction is that one must be at least 18 years old to receive the free refurbished computer (Winnipeg Roundtable 2007).

Another initiative taking place in Winnipeg is the Wiichiwakanak Learning Centre located on Ellice Avenue. One of the most popular and successful programs at Wiichiwakanak Learning Centre is the Elders sharing circle. The centre provides a venue for Aboriginal individuals to hear elders speak about Aboriginal history and the oral traditional. The room used for events at Wiichiwakanak has a capacity of about 45 people. On nights when there will be a sharing circle the room is at capacity and often there are 30–35 people on a waiting list. Reportedly, all the courses and programs at the centre are at capacity and have waiting lists. The centre will be offering a lecture series provided by professors from the University of Winnipeg. The series will include a variety of topics such as economics, aboriginal spirituality, physics, sociology, or business. These introductory lectures are meant to interest community members, promote post-secondary education, and prompt listeners to seek further information at the University of Winnipeg. Digital literacy should be perceived as a predecessor to equitable access. Many visitors of the centre come in initially to use the computers, usually for email, msn, and maybe to complete a homework assignment. Later, youth and adults, presumably after a period of time when the technology does not seem as foreign, become interested in other programs and courses offered through the centre.

The Wiichiwakanak Learning Centre was envisioned and created with stable and ongoing funding and provides culturally relevant programs to Aboriginals in Winnipeg. The Centre has also integrated the use of computers and technology into their programming. The centre has 20 computers, Cree language courses, and a homework program.

The Computers for Schools program in Winnipeg has a variety of objectives. The program was initially created to provide computers to schools in Winnipeg. The program has reached a point where the demand is dropping as schools become saturated with computers and other equipment. Another objective of the program is to provide technological training for young people. This training includes courses that teach youth how to refurbish computers, how to use the internet and computers, and how to troubleshoot different software programs. The courses provide students with valuable skills and also create a supply of refurbished computers for schools and students. University students can request to be given a refurbished computer free of charge. Also,

the Computers for Schools program assists in facilitating the recycling of computers and other computer equipment such as printers, scanners, and faxes, also known as e-waste.

Technological skills are necessary in today's job market. Manitoba jails, such as Headingley Correctional Institution, offer computer courses including the IC3 course that teaches inmates to use computers, troubleshoot certain programs, and to develop ICT skills. Providing these skills to inmates is one way of disseminating valuable technological skills that may promote employment and may provide certain life chances. Inmates in this program have been less likely to re-offend, and some have gone on to be employed in this sector (Winnipeg Roundtable 2007).

Programmes exist to assist in the dissemination of technological knowledge and ICT skills in Winnipeg. However, these programs are usually conceived on a pilot project basis and need ongoing funding to make a significant impact on the integration of these skills. Government has supported a variety of projects related to increasing access to computers and related skills in Winnipeg. In Winnipeg, the Aboriginal population is growing at a rate much faster than that of the non-Aboriginal population. Future labour market strategies target the young Aboriginal population. Ensuring that the Aboriginal population has equal access to training and equipment is vital to Winnipeg and Manitoba's economy.

6. Information and communication technology in Aboriginal communities: A social capital analysis

Using the case descriptions and roundtable meetings as main information sources, we initially discuss the opportunities afforded by ICT to Aboriginal communities in distinct fields. We then analyze the potential impact of ICT on social capital using the framework presented in section four. When analyzing the potential for impact we provide evidence of the plausibility of impact, not evidence of impact per se. The study design and the data available does not allow for the latter type of evidence. Again with a social capital lens, we analyze enabling and inhibiting conditions that seem to play a role in the successful implementation of ICT in Aboriginal communities.

6.1 Opportunities offered by ICT to Aboriginal communities

Better access to information and communication technology in Aboriginal communities has the potential to enhance opportunities in a diversity of areas, many interrelated. The main ones are education, economic development, health, cultural continuity, governance, services, socializing and leisure.

Education

Increased connectivity opens the way to a variety of educational opportunities, both within formal and informal settings. Often, schools in northern communities are not able to provide the same opportunities for student education and learning as schools in the

south. Today, the technology exists to establish high speed internet classrooms which offer many different media of instruction delivery. Students can access online content that may assist them in their studies. Northern communities do not have libraries as extensive as those found in urban centres. Internet access can provide a means through which to obtain such information. In relation to literacy, some initiatives, such as the Apple Computer Distinguished Education program existing in some First Nations in British Columbia appears to have significantly improved literacy skills among children.

Many Aboriginal communities have difficulty attracting and retaining qualified teachers. Videoconferencing allows teachers in higher grade levels to teach students while physically distant using a two-way broadcast. For example, science may be taught by a teacher from community A while being broadcast to communities B, C, and D, and math may be taught by a teacher from community B while being broadcast to communities A, C, and D. Further, children who currently must leave their home community to attend high school could complete their schooling via on-line classes. Also, adults can more readily complete high school education from home. Continuing education and higher education is also facilitated with internet connectivity (Walmark et al., 2005).

One example of the educational successes that have resulted from internet connectivity and various technological applications is the Kewaytinook Internet High School (KiHS) which is connected through K-Net. In the 2000/1 school year, when the KiHS was introduced only 30 students were enrolled and the number of course credits granted were 53. In the 2003/4 school years, 141 students were enrolled and 269 course credits were granted. The courses provided are for secondary students in grades nine and ten as well as some adult education courses. Providing courses for grade nine and ten students enables these children to remain home during critical years of maturation so that they are better equipped to cope with the challenges of city life when they choose to complete high school education in the south (Fiser et al., 2005). The main differences between internet high school and the previously available distance education are the interactive component and the aspect of having a structured classroom environment and the supervision of a teacher resident from their community (Fiser et al., 2005).

The experimental projects currently being conducted by the Broadband Visual Communication (BVC) and the Communications Research Centre (CRC), using high speed networks in schools in Aboriginal and non-Aboriginal communities in rural, urban and remote areas are particularly instructive of future capabilities. The experience of Music Grid, where music education was delivered to a remote northern Quebec Inuit community was particularly successful. This education included violin, piano, throat singing, and traditional drum dancing. Success in student learning was noticeable, and the ICT capabilities allowed for Christmas concerts to be transmitted where relatives in different communities took part in it together (Brooks, 2006)

The opportunities for continuing education have improved due to online capabilities. For example, a Nunavut ISP has indicated that there has been a steady increase by small business owners in pursuing training in business related topics through online courses in

the last several years (Itorcheak, 2006). Also, academic institutions can offer online and modular advanced education programs to staff working in social and health agencies in Aboriginal communities.

Economic development

There are a number of Aboriginal business development barriers that ICT can play a role in reducing. The barriers more amenable to be directly countered by ICT are access to markets and access to skills. However, barriers to financing and capital may also be indirectly impacted by ICT. In today's business environment, access to broadband connectivity is an essential requirement to achieve some degree of level playing field. In essence, a sustainable economy is not feasible anymore without this type of access.

The internet can open businesses to the global economy where original products, such as Aboriginal arts and crafts, tourism opportunities, and virtually any other product or service can be viewed and purchased from afar. A prime example is that of carvers in Nunavut, that have a much better return on their products when they sell them through E-Bay. Nunavut has only 34,000 people, a very small market, while over the internet it widely opens market opportunities while allowing producers to have direct control over their sales. Tourism companies in Nunavut are conducting almost 95% of their business online. In a reserve near Cranbrook, BC, an 82 year old man was selling teepees online to New Zealand, Tansmania, Japan, Israel, etc. He also bought some of his materials, such as canvas material and sewing machine parts, online. Healing centres could more easily promote their activities and even conduct some activities online or by videoconferencing.

Business opportunities are not only related to tradition-based products and services. Service industries such as call centres could be run from remote communities. Contractors can more readily access calls for proposals and submit their proposals. Access to high speed internet coupled with ICT training has a profound effect on the way in which companies do business. ICT in itself can become a business opportunity. The sole Aboriginal-owned telecommunications company in Canada, enTel (operating in British Columbia) is a prime example. Other economic development initiatives such as golf courses, eco-tourism, resorts, wineries (as is the case of the Osoyoos Indian Band in British Columbia), are enhanced by good connectivity.

Training individuals from the community in ICT serves to increase community capacity and job opportunities. Putting infrastructure in place to address the different ICT needs of for example band administration, schools, health centres, ISPs, etc., requires first level technical support, that is particularly suitable as job opportunities for young people with appropriate training. Some initiatives such as Telehealth have created jobs like a Telehealth coordinator, project managers, and technicians. Eventually, ICT support and software development companies can increasingly emerge in Aboriginal communities. As some of the interviewees indicated, after years of national consultation with Aboriginal communities and organizations it has become apparent that broadband and e-services are not just about ICT, but that they are about the social and economic engine of the future.

Health

Telehealth has been made possible by broadband connectivity. It links patients from remote and isolated communities with physicians and specialists located in urban centres. Telehealth reduces the need for people to leave the community for regular doctor's visits, such as prenatal checkups, skin rashes and other health concerns that can be addressed using the new technology. It can significantly reduce costs for certain health services. For example, eliminating the need to fly one patient from an isolated community to an urban centre for a medical examination can save at least $7,000. Also, people in the community who are afraid to fly or would rather not leave the home community would have Telehealth as an alternative. Other applications of Telehealth include tele-psychiatry and tele-radiology.

A Telehealth station is managed by a Community Telehealth Coordinator (CTC). These positions are awarded to members of the community who are given specialized training in the operation and maintenance of the Telehealth station. Case studies have shown the most successful way to implement CTC training is to employ an ICT technician who can facilitate the operation of the Telehealth station to perform the duties of the CTC in the community while a community member job shadows and gradually assumes responsibility for the daily operations of the station (Fiser et al., 2005). "On-going professional development is key to the success of this application" (Walmark et al., 2005). Employing community members in this initiative is also imperative and provides a greater sense of ownership of the program and the physical space which results in more successful outcomes when compared with other health programs operated by people from outside the community (Walmark et al., 2005).

Additionally, internet access enables the community to obtain heath information and the Telehealth professionals can disseminate significant health information to interested members of the community. With increased connectivity there is more opportunity for dissemination and discussion at the community level of health research results, as well as active participation of communities in the research itself. Further, increased connectivity can facilitate to some extent the exchange of knowledge on traditional healing practices.

Cultural continuity

There are a variety of ways in which broadband connectivity can assist in the preservation of culture and language. For example, an online Oji-Cree dictionary has been developed that allows users to search categorically for images, sounds, syllabic script and Roman orthographic text. "The online dictionary provides one way to preserve and utilize this original language in all aspects of local education and service programs" (Beaton et al., 2004). Also, K-Net, in northwestern Ontario has created syllabic computer keyboards in which the layout is in Oji-Cree and Cree in order to involve elders who do not speak English with computers and ICT applications (Fiser et al., 2005). One of the current concerns surrounding Aboriginal culture is that native languages are being lost.

Technology offers one method of preserving traditional language and culture for future generations: digitally recording the traditional stories of elders. A prime example is First Voices, a web-based program available for free that seeks to preserve Aboriginal languages across the world. Similar technology is being used to preserve precious artefacts, as the U'msta Cultural Centre in British Columbia is doing with its mask collection, among other traditional items. The interactive features of online cultural studies enhance their educational impact, particularly among young people.

Certain impacts of ICT are plausibly detrimental to cultural continuity. The effects of pop culture for example may increase its potential, particularly among youth. Nonetheless, this is not a particularly new phenomenon and the main attitude among Aboriginal leadership is that the tide is unavoidable and should consequently be dealt with by seizing it and transforming it into positive opportunities.

Governance

Another possible application of a broadband network is videoconferencing. Videoconferencing provides a two-way feed of video, allowing people in distant locations to be seen and heard during meetings. The cost of bringing people together for meetings is sometimes prohibitively expensive. Videoconferencing reduces the need to travel and allows people who want to participate to remain in their community while still taking part in conference discussions. This can be particularly useful for meetings involving leadership or representatives from different communities. Aboriginal people living in urban settings that want to continue participating in matters of their communities can do so by videoconferencing of assemblies, etc. Some reserves are also considering the possibility of online voting. Further, videoconferencing has international applications. For example, on March 2005 a conference was held in Balmertown, Ontario, that included university and government researchers, graduate students, government funders, policy makers, and First Nations' leadership. While some people did travel to Balmertown, videoconferencing technology joined people at multiple sites across three time zones (Walmark et al., 2005).

Other possibilities refer to collecting and mapping data particularly relevant to land claim and treaty negotiations. GIS has been used to prove the historical connection to a certain territory. Data of this type can also be used for better administration of resources of the land and sea (e.g., to help sustain and rebuild fisheries, for trap-lines, etc.). As quoted in a dissemination material of the Ktunaxa network "we now have more and better information about the territory than the government." During negotiations, ICT allows for more fluid communication by sharing drafts and documents or having online side-meetings in between formal meetings with government.

Services

In communities with increased connectivity, services such as banking and shopping are now done online. For example out of the 25 Nunavut communities there are only three

banks, in Cambridge Bay, Rankin Inlet and Iqaluit. So online banking becomes a particularly relevant service. Online shopping has the potential of reducing costs given the possibility of wider price options. Nonetheless, cost for transportation of goods is always an issue.

Community services can also be enhanced through online capabilities. Illustrative of this is the Ktunaxa Nation in British Columbia where 120 computers from all agencies in the community (school, social services, band administration, health centre, etc) are connected in one information system. This integration of the information from the different agencies has increased efficiencies and level of services.

Socializing and leisure

Many families, particularly in remote communities are using the internet to communicate with other family members in different parts of Canada. Family members that relocated to the cities are better able to keep in touch. In the few cases where videoconferencing is available, gatherings across communities have taken place. With increased videoconferencing capacities this may prove to be a strong socializing tool. Online chatting, "facebook", homepages, blogs, etc., particularly among young people, can become prevalent.

The options for leisure activities dramatically increase. Similar to everywhere else in the world there are a myriad of opportunities ranging from participation in group chat sites, games, news, different forms of entertainment, hobbies, etc. The impact on leisure is, however, often seen as a potential source of concern because it may increase isolation of an individual within a family or community, increase risk behaviours among youth, and addictive behaviours of different kinds.

6.2 Impact of ICT on social capital

The state of ICT in Aboriginal communities, although changing at a rapid pace, is still a relatively new phenomenon in its more recent development. The introduction of the internet and broadband connectivity is the watershed innovation through which we can expect a significant impact of ICT in communities. As was shown in previous sections, this has taken place at a differing pace across Canada. Nonetheless, the digital divide and digital inequality are still very much in existence. This is a matter of social equity and of basic infrastructure that requires increased efforts. If the digital divide is properly addressed, the next five to ten years will see a dramatic increase in connectivity in the majority of Aboriginal communities. We should not forget that impact can be understood as positive and negative. The main issue to consider is if ICT will become a tool for the enhancement of Aboriginal people's lives or a tool for assimilation and suppression.

Empirical evidence that would allow for an assessment of this type is still almost non-existent. Nonetheless, the social capital framework above described enables us to consider the plausibility of the impact of ICT on communities. It can provide us with

guidance in terms of issues to consider in the current implementation of ICT initiatives and in the formulation of areas for evaluation and research. Better evidence is paramount to inform policy decisions at different levels in relation to ICT implementation.

Let us start with the simplest form of the framework to understand the plausible impact of ICT on communities. What are the possible mechanisms through which ICT can impact the relations within communities, between communities, and across communities and formal institutions? Specifically, given that social capital implies some form of investment, how can ICT be a tool in strengthening communities' resources, networks and ethos?

The importance of preserving language cannot be overemphasized. One of the central tenets of colonization was the taking of land and the destruction of language and traditional practices through for example residential schools, the outlawing of potlatches, etc. Aboriginal identity is grounded in land and language. There is sufficient evidence suggesting how their loss has undermined the spirit of many communities leading to tragic consequences. It is thus revealing that some connectivity initiatives have been spearheaded precisely by the aspiration to recover and preserve language and land.

The effort of recording elders and digitalizing previous recordings, of creating a variety of online tools for teaching the language, is an investment in essential symbolic resources. It serves to enrich each community as well as the binds across communities of the same cultural ancestry. The process of collecting and using data about the land and water by Aboriginal organizations or communities, facilitated for instance by GIS mapping capabilities, is both a symbolic and a natural resource type of investment. The return is enhanced capabilities for land claim negotiations, more informed management of the natural resources, and the use of further means to protect the land. The use of ICT is truly only one aspect in this process, but it is a tool that helps to galvanize interest and resources. The Inuit's creation of Unicode font for Inuktitut syllabics enables users to create their own documents and webpages in Inuktitut as well as print out an Inuktitut keyboard layout. This represents an investment in a symbolic resource of major significance.

The creation of community-owned ISPs implies a financial, physical and human investment within the community. This can be seen in a number of First Nations and in Inuit communities. The latter have very appropriately called them "community service providers." Aside from the benefits of increased connectivity community ISPs have the potential to become a source of income and community re-investment. Similarly, the case with enTel (the Aboriginal-owned telecommunications company in BC), has the potential of return in a number of ways, increased economic development, employment, and capacity building within and across First Nations communities among others.

The Music Grid experience suggests the future opportunities offered by high quality connectivity, essentially for videoconferencing, as an investment in human resources through improved education for student groups within the community. This pilot

initiative suggests that the investment is not only related to broadband (however essential) but that it requires training teachers from the community that can deal with the technology, with the learning dynamics of children in this new environment, and with the external instructors. Programs of the type of Music Grid are focused on engagement not on sitting and watching a teacher on the screen. Properly used this media can encourage and promote active thinking and talking. It also allows for classes where small groups of students from one community interact live with students from another community. That the Broadband Visual Communication (BVC) and the Communications Research Centre (CRC) from Industry Canada played a key role in this experimental initiative (among others), suggests the crucial linking investment that the federal government can play in fruitful implementation of ICT in Aboriginal and remote communities. In fact the focus of the research is not merely on the technology itself, but on the value it may have to the user community and on how it should be implemented to match real human behaviour. It is clearly an investment directed at the future. Music Grid and other pilot initiatives are using much more bandwidth than what is normally available through current broadband networks to carry videoconferencing in a useful way. Expanded initiatives of this type can provide Aboriginal communities with the opportunity to implement this technology in a format that will correspond with human and social realities.

Even Telehealth, essentially a linking social capital type of resource, has specific bonding employment spin offs. Telehealth requires positions like Telehealth coordinators, project managers and technicians. As well, it can increase local capabilities for training in health related occupations. In general, better connectivity infrastructure can lead to more technical support positions and job-related training opportunities for young people. The fact that numerous health care providers, particularly specialists, have supported Telehealth speaks of its linking role.

ICT investments in remote communities dramatically increase their bridging and linking opportunities, with potentially major returns in business opportunities, education and health. Simply being able to track and send out more reliable information faster when there are environmental degradations suggests increased bridging and linking capabilities to preserve natural resources.

The First Nations Technology Council (FNTC) of BC clearly demonstrates bridging social capital as it relates to supporting the development of ICT in First Nations' communities. It also provides, together with First Nations political entities, increased linking social capital vis-à-vis the government. With an original mandate to develop a technology plan that would address broadband connectivity, technical support and technical capacity building, it consequently added the mandate of using technology to promote the revitalization of culture and language. One of its most significant achievements is the Fully Integrated Technology (FIT) community model as a strategy to obtain investments. The community technology plan seeks to ensure, among other aspects, that everybody in the community has a computer as well as the tools and education to use it. The idea was that by having a model community the FNTC could increase its leverage when lobbying for resources, showing to government and industry

that investment in technology makes good business sense (see Ktunaxa case description). It also provides an experience from which other communities can build on.

The value of bandwidth is greatest in remote communities, and consequently from a socioeconomic perspective its potential for return is very high. The notion of socially invested resources clarifies this potential. This idea is difficult to grasp from a private for-profit business perspective, i.e., where the return is essentially measured by the profit of the company. However, from a broader perspective of community return, the potential of ICT with high capabilities can directly enhance the development of communities' business opportunities, as well as of their educational and health systems among others. A business case can be made from a narrow perspective or from a broader (and more real) perspective. The notion of social capital, where the bonding, bridging and linking dimensions are considered, can provide guidance towards the development of measures of true returns in the investment, and not simply of narrowly conceived returns. The linking and bridging notion is particularly relevant, in that this type of vision requires the committed joint involvement of Aboriginal organizations, government and the private sector.

The social capital framework also focuses on less tangible aspects of communities. The notion of *ethos* seeks to capture how ICT may impact features such as participation, collective action, norms of reciprocity and trust, within communities, across communities and with institutions. For this analysis it is important to distinguish different ways of utilizing ICT. For instance, videoconferencing can sometimes be used through video cameras in individual's homes. However, a common use is related to group activities such as classes, assemblies, etc. These different modes of utilization need to be considered when seeking to understand the plausibility of the impact of ICT on social relations.

Lets commence with what some have argued are potential negative impacts of ICT. Increased connectivity while facilitating interaction with the medium itself may sacrifice everyday contact with people living nearby. Some authors have examined if virtual communities affect face-to-face communities (Blanchard, 2004), and have argued that because virtual communities are not completely placeless, virtual communities may even help connect people in face-to-face communities around particular topics. Numerous studies across the world have been examining the impact of online capabilities on human and social behaviour. Increased isolation within the family, addictive behaviours and access by children to harmful material, among others issues, have been recorded. Although much of this is not new per se (similar critiques have been made of other media like television, etc.), the concern is that increased connectivity can augment the harm. Particularly to what we are examining, a point could be made that if internet access will glue people to the screens, it may as a consequence decrease their participation in local community activities. Another possibility would be that positive norms of reciprocity may be eroded. Ultimately, the potential for increased individual isolation and decreased trust among community members have been raised as concerns. Some chiefs have mentioned their concern that a sudden increase in ICT capabilities may to some degree

open “Pandora’s box” in their communities and one particular risk is that people may become more insular. The potential for the erosion of certain aspects of bonding social capital should not be minimized, and it highlights the relevance that community technology implementation plans anticipate these potential impacts and strategize accordingly.

The flip side suggests favourable impacts. Online discussion groups, within and across communities is a simple example of participation. These online groups can facilitate people’s involvement in a number of activities that, particularly in remote communities, may not have been possible before. Online discussions can also galvanize involvement and support for collective action initiatives. Videoconferencing and other online capabilities that enable group activities such as classes would in fact be encouraging participation. Even initiatives such as Telehealth, if implemented with a community development model around it, can facilitate participation and collective action in health related activities. For instance, informed debates around particular health issues, determinants of health, input in health research activities and dissemination of results, and more community involvement in health related initiatives can be facilitated with such a model of Telehealth. Telehealth can also play a bridging role across communities. Elder sessions have taken place using videoconferencing equipment, where elders get together for lunch and see and talk with relatives they have not seen for years. Reports suggest that these particular experiences were emotionally very powerful. From a bridging social capital perspective, the increased efficiency of Tribal Council meetings, easier organization of common initiatives across communities, more ongoing communication among communities, etc., may be interpreted as increasing possibilities for collective action, as well as trust and positive norms of reciprocity.

The fact that most communities want to have videoconferencing as a way to connect with relatives and friends in other communities, suggests their awareness of its potential impact on what we are calling bridging social capital. Setting up teleconferencing units increases bridging and linking capabilities. Particularly in northern communities where travel is very expensive, this type of medium enables agency staff from different communities to participate in joint sessions and can improve the interaction with government and private institutions located in urban centres.

Broadband internet capabilities greatly facilitate the collection of very diverse type of information. This can be within community information such as job postings, buy and sell opportunities, community events, health centre, school, and administration information, etc. For example, a common complaint is that job postings are not properly disseminated. If the norm is to post on the band administration’s website, this concern can be dissipated. From a within community perspective, ICT can facilitate (although not ensure) more inclusive and diverse networks. Simultaneously, internet capabilities enhance the possibilities to share and disseminate information, promote businesses, entertainment options, etc. As well, information from other communities, Tribal Councils, Aboriginal organizations, etc., can be more readily distributed. Not to mention general information from any part of the world. As Dale (2005) states, e-dialogues are a

means of making deliberative discourse and dialogue accessible to a wider audience of engaged citizens and policy makers alike, who through shared dialogue and learning on-line form novel electronic communities.

In general, the school is a good focal point for the community. Consequently, if the school has good bandwidth and equipment, community members can concentrate there for a number of activities involving videoconferencing. In some ways this can strengthen the role of the school in the community, which is important particularly in some communities where many parents rarely visit the school. When a community in northern Quebec had their Christmas concert, community members living in Ottawa were invited to join the Christmas concert at the school from the VTC lab by videoconference. One year there were four people from the community in the VTC lab, and there were three people in Montreal, and both were connected with the school. At the school they put the projector up against the wall showing the two additional sites and each site saw the performances. During the performance it was mainly watching but after the concert was finished there was a lot of discussion and people were greeting each other, showing the new babies, etc. Socially it appeared to work very well. This speaks to the maintenance of community networks from a bonding and bridging perspective, as well as increasing participation. The following illustrates another instance of increased participation. Thirty two First Nations in British Columbia are involved in treaty negotiations. A practical way of letting community members know what is going on in treaty discussions is to use the community server or website. Again, this talks of the potential to impact bonding and bridging networks, as well as participation, trust and collective action.

The possibility of maintaining more connections through online capabilities with relatives and friends when community members are studying or working in urban centres can also be considered as an expression of fostering inclusive and flexible networks. Being able to do online banking for example, can be understood from a more inclusive network aspect. This relates to linking social capital.

Online capabilities can make information networks more inclusive for example in relation to information about governments' support to agencies that administer grant and loan programs to help Aboriginal people access capital and market resources. This can counter the information trickling down through word of mouth via sometimes non-inclusive networks. As well, the emergence of an informal social network among technicians working with the Bulletin Board System of K-Net to pool or share knowledge illustrates an impact on inclusive and flexible bridging networks.

6.3 Social capital investments/prerequisites for successful ICT implementation

Among one of the important discussions held at the roundtables was what can be considered a "successful" implementation of ICT in Aboriginal communities. Tentatively it was argued that this means the development of sustainable ICT capabilities that tangibly serve the well-being of the communities. From a social capital perspective, success would be understood as the sustainable implementation that strengthens the

communities themselves. What follows briefly examines two related issues. What conditions seem to facilitate the successful implementation of ICT and what social capital investments should be considered to make this success more likely?

One simple but pervasive issue is that of the cost of computers and of service. Cost both at the investment and service level, and cost at the individual user level. The latter relates to the true possibilities of impoverished families to purchase home computers. For equitable ICT implementation, the lack of access to computers by significant segments of populations may in fact play a negative impact on community social capital. If a community becomes more reliant on ICT capabilities, those without adequate access will in fact become increasingly marginalized from social and information networks, from possibilities of participation, and from opportunities that may enhance their lives such as ongoing education, etc. For Aboriginals in urban settings, where ICT infrastructure may be good, cost may be the most significant limitation to access. There are initiatives that can be implemented to address this issue, and they need to be taken into account in ICT implementation plans. One example is an Australian program "computers for schools and homes" which supplies refurbished computers. In Canada there is a similar program called "computers for schools and libraries" but it is not for households. There are recent developments in hardware that may likely bring to full production computers geared to online capabilities that will cost approximately $450 (e.g., Intel is developing a laptop aimed at schools) or even to $200 (e.g., the One Laptop Per Child nonprofit international initiative) (Markoff, 2006; AP, 2007). A study assessing the digital divide of Indigenous communities in Australia (Daly, 2005) describes the development of community online access centres as another way of bridging this divide.

The other cost related issue is that of investment. Private companies such as MTS and Shaw determine whether or not a business case exists to establish backbone infrastructure in an area. In other words, private businesses usually define whether or not the particular community could provide a revenue base from which the company could recover investment costs and achieve profits. These companies see remote and sparsely populated communities as not worth their investment. Consequently, governments' involvement is absolutely necessary to ensure that infrastructure investment will take place. As an example, the 30 northern communities north of the 53rd parallel in Manitoba were unable to provide private companies with the high population counts and an economic base to project potential profits. The province of Manitoba working with these communities and with funding from both the Manitoba Canada Infrastructure Program and Industry Canada's BRAND and NSI programs, together with matching funds of 50% from the communities, other funding organizations and private entities, enabled the very recent achievement of broadband connectivity. This very well exemplifies the socially invested resources aspect of social capital, particularly from a bridging and linking perspective.

If communities are to risk their limited resources in ICT infrastructure and services when the may be lacking in basic infrastructure such as housing, water, sewage, etc., they must clearly see it as a possibility for socioeconomic development. Understandably, communities that have been burnt with expensive and unsuccessful earlier attempts to

obtain connectivity are reluctant to go down the same road. The regaining of trust through, for instance multi-sectorial ICT plan developments where community leadership has the ultimate say is essential. Bridging social capital, where they learn from how other Aboriginal communities have tackled ICT implementation, is paramount. As an example, for some communities to take that leap to jump from $20 per month dial-up to owning a PoP (point of presence) and then building their own ISP, learning how this was done by over 100 First Nations would be a crucial asset.

Another option is where bridging social capital organizations that look after the interests of a group of First Nations (such as MKO in Manitoba) may help achieve economies of scale. An example could be the price tag of customer premise equipment (CPE) that came down from $1200 to $800 a piece when sold to 30 communities. Nonetheless, there are instances where very small and isolated communities may need to rely more on linking socially invested resources and the solution is to share bandwidth with the RCMP office, the school, etc. Another significant cost issue is the satellite expense for communities that cannot rely on fibre optics or microwave towers connections. For these cases linking infrastructure investments are also necessary.

An alternative approach has been to make arrangements with private telecommunications companies together with some government involvement. Understanding that it is unlikely that there will ever be a large economic base for numerous First Nations communities in British Columbia, the provincial government engineered a deal with TELUS where they now provide connectivity to 119 communities by supplying 10 megabit connections into those communities at a price of either, $150, $300, or $450 per month depending on population size. This creates a business case and then organizations such as the FNTC promote small grants to the communities for last mile solutions that are to be developed at the community level and run by volunteers or by local entrepreneurs.

Again, from a socially invested resources perspective, it is difficult to argue against understanding connectivity as a basic infrastructure issue for socioeconomic development. An aspect of linking social capital refers to social investments at differing institutional levels. As roads are considered infrastructure at any level of government, broadband infrastructure is now a necessary condition for the successful implementation of ICT in Aboriginal communities. Connectivity infrastructure equity matters more than ever. Particularly from a bridging social capital point of view it matters so as not to increase inequities across Aboriginal communities or between Aboriginal communities and others. Granted that urban and rural or remote environments are quite different worlds, especially in how they relate to population density (smaller markets) and cost of extending ICT accessibility (higher costs related to geography). Nonetheless, as has traditionally been the case with postal services, basic social and economic life requires public investment to serve areas that the market by itself will not cover. The role of the CRTC in imposing certain regulations to counter these potential inequities is essential. A recently published United Nations report on the information economy (2006) indicated that although the growth of broadband is largely due to competition and declining prices,

it also depends on the available infrastructure. It further states that when there is a lack of economies of scale,

> "the incentive to expand broadband infrastructure outside urban areas is low. Wireless technology and satellites can help circumvent the cost of infrastructure for sparsely populated, remote or rural areas. Governments have an important role to play in improving access to broadband through infrastructure and policy."

Another key prerequisite and social capital investment relates to capacity building and human resource development, particularly at the community level. From a linking perspective, when government departments such as Industry Canada, Human Resource Development, Indian Affairs, and Health Canada, orchestrate cooperative efforts between departments, it maximizes the possibility of skill development needed for successful ICT implementation at the community level.

Among the investments required for successful ICT implementation is the training of community-based users that is up-to-date and ongoing. The need for digital literacy education for adults has been identified. One of the arguments is that if the digital literacy programs are picked up, if people become interested in them, then we will see more of a hobbyist interest in computers in the communities. A recent study on Aboriginal students and the digital divide (Deane & Sullivan, 2006) explored the role of non-formal learning in the inner-city of Winnipeg. It concluded that Aboriginal students tended to undervalue their general levels of skill and knowledge in information technology. It found that although many students did not have a computer at home, they had learned ICT skills in non-formal situations more than they had in the classroom. This suggests the role of peer social capital, and emphasizes the need to also invest in non-formal settings to bridge the digital divide.

Other necessary approaches are ones such as the Manitoba First Nations SchoolNet youth initiative funded by Industry Canada. In the past year this program gathered 25 youth from across Manitoba in Winnipeg for two weeks for intensive training in technical ICT support, followed by 15 weeks of supervised work experience in the community. It has repeatedly been stated that it is relatively useless to spend money in technical infrastructure without a parallel capacity building program. This includes capacity building that may help communities better identify how ICT can assist them in social, cultural and economic ways. There have already been discussions through workshops linking people across the country to explore what capacity building means for First Nations communities and what could be the appropriate delivery mechanisms. In essence it is recognized that ultimately ICT is about people and that machines and equipment without sufficient individuals providing support are of little use. As well, this needs to happen in cooperative environments with people communicating and working together, rather than through imposition.

Many Aboriginal communities already have individuals with the needed ICT technical capacity. However, there is increased need for more trained people. Individuals with technical skills that are able to fix the connexion with the satellite, to reboot the server, to

service home connections, etc., are essential. Although many are self-taught, investment in formal training programs at various levels is necessary. For instance A or A plus certified individuals is probably the basic technical skills needed for a community. This level of training requires at least 100 hours of class time, and anywhere from three to six months of supervised practice. This illustrates a required level of investment that many communities are still not able to achieve.

For particular ICT initiatives such as the Music Grid example, a necessary condition for its successful implementation is not simply the technical role. In this case capacity building around a new type of role, that of a pedagogical project organization role, appears to be necessary. As yet, school boards do not offer this kind of training nor do job descriptions support teachers in this role. For example in Nunavik there are 14 communities, seven of which now have videoconferencing capabilities in their schools, but only one of them has a pedagogical facilitator. This has severely limited classes using videoconferencing. For schools to successfully implement ICT capabilities, new staff roles and training are required.

Another necessary investment is to provide some basic level of computer literacy to new users. Particularly in remote communities, the proportion of users without any prior computer experience is high. Training programs at this basic level can increase true accessibility for a wider segment of community members.

Community leadership's role in the implementation of ICT is associated with its success. For instance in First Nations, Chief and Council have a basic role in enabling the basic infrastructure to be set up. They can also play a significant role in capacity building. Developing an ICT implementation plan can facilitate this education component and also ensure that the businesses and organizations within the First Nation utilize the infrastructure. Self-government is essential for successful ICT development plans. A solid plan can prevent being taken advantage from vendors and other players in the field. It has been stated that the community has to have control and ownership over this implementation. There have been many problems when the community feels it is outside companies or organizations that are telling them what to do. When community leadership creates a level of organizational capacity that takes ownership of these types of initiatives, the most positive results are seen.

Community "buy-in" is essential for a successful implementation. The notion that it may be a tool for socioeconomic development is usually quickly defined. Elders' opinions are important. Many of the communities with successful implementation have had elders embracing this possibility while at the same time connecting it to the need to preserve traditional identity. ICT appears to be most useful in communities that consider it not as a panacea, but as another tool that under community guidance can increase their capabilities. Conferences of Community Service Providers (CSP) as the ones held in Nunavut enabled local people to share their ideas of what types of services would provide the most benefit for their home community and what types of knowledge would be needed for them to perform their function as a CSP. This type of resource investment

both from a bonding and bridging perspective, essentially involving local people in initial discussions, was seen as one of the key factors in its success.

Bridging social capital opportunities is exemplified in what MKO (a northern First Nations organization of Manitoba) did when it partnered with BCN to learn from them as they were successful applicants to Industry Canada programs. MKO also took the bridging approach of making its ICT initiative a northern Manitoba project, including non-First Nations communities. This had benefits of economies of scale and made telecommunications upgrading less expensive.

Loss of trust by communities that were burnt by initial ICT experiences that were negative (often left with financial losses and failed systems) has increased their reticence to be involved in new ICT initiatives. A slow process of rebuilding trust was essential for them to be part again. Learning from failed experiences is valuable. When FNIHB first piloted Telehealth in the early 1990's in Northern Ontario, it was mainly piloted from a technological perspective. It did not take properly into consideration the perspective of health workers, professionals, and the community. Health care workers were not appreciative of programs just dropping in technology without proper consultation or capacity building for this new health care tool. The lack of physician buy-in crippled the program. The communities were also suspicious that Telehealth was a way of taking doctors and nurses out of the communities. Again, linking social capital, in this case in the form of trust is essential.

What have been called "community champions" play an important role in the successful implementation of ICT. Whether they are health personnel or band leadership, etc., the fact that they provide presentations and demonstrations of leadership to community members, as well as conducting community consultations, appear to make a crucial difference in gaining trust and driving the initiatives.

Budget cuts from the federal government have apparently reduced support for some of the ICT initiatives, consequently decreasing public investment opportunities. Another linking social capital difficulty is that most government backed ICT programs are short term. For these initiatives to prosper there has to be a notion of long term investment. Relations of Aboriginal communities with the private sector or corporations for the implementation of ICT initiatives range from relatively negative (as with TELUS in BC) to relatively positive (as with BC Hydro). The positive linkage with corporations is also essential for success. Finally, universities are players that can have an important role.

6.4 Re-visiting ICT and social capital

The paper has talked about ICT and its potential impact on Aboriginal social capital and of social capital as a potential factor in the successful implementation of ICT in Aboriginal communities. This section will revisit the social capital framework used and integrate the material in a more comprehensive understanding of ICT and Aboriginal social capital.

The case descriptions seemed to support the idea that higher levels of bonding, bridging and linking social capital facilitated the establishment of Aboriginal connectivity networks. As evidenced by most of these cases, this has been (and is) a hard struggle to not only develop but to sustain the networks. They have to-date shown remarkable success in uptake, usage, membership, etc. Community leadership, an aspect of bonding social capital, was one of the key factors in their development. Learning from, and sharing with, other initiatives (bridging) also proved to be very valuable. Access to government programs and relations with corporations were very important. Nonetheless, these linking social capital aspects were (and are) somewhat unstable and present one of the potential barriers for sustainability.

The impact of ICT on Aboriginal communities was also evidenced by the case descriptions and other initiatives examined. For instance, ICT investments in remote communities dramatically increased their bridging and linking opportunities in areas such as business, education, and health. Potential for increased social capital within communities (bonding) and across communities (bridging) was reflected for example in online groups, the use of personal webpages, and efficient tools for self-governance. Consequently, the social capital framework presented in section four should now be postulated as follows to guide us in answering the study questions:

BSC }		{BSC
BrSC} →	ICT→	{BrSC
LSC }		{LSC

BSC=Bonding Social Capital; BrSC=Bridging Social Capital; LSC=Linking Social Capital

The four main questions the study sought to examine were: Why social capital can be a useful notion in assessing the impact of ICT? How can ICT impact community social capital? How can the implementation of ICT be impacted by social capital investments? Does the type of ICT development matter in terms of social capital? The previous sections mostly addressed the first three questions, but what is still lacking is a proper examination of the fourth question. It is the inspection of this latter issue that enables us to understand more holistically the relations between ICT and Aboriginal social capital, including the political aspects (i.e., power relations) inherent to this reality.

One of the most interesting insights from the examination of the ICT initiatives is that despite the *what* of connectivity mattering, it is the *how* of connectivity that can significantly make a difference in terms of community social capital. In other words, the "ownership of the means of production" (in our case the ownership of the networks) clearly relates to increased community social capital at the bonding, bridging and linking levels.

K-Net, Ktunaxa, and Qiniq are powerful examples of Aboriginal organizations taking control over the *what* and the *how*, by responding to the realities of the communities, and in the process strengthening them. K-Net started as a response to the need to maintain contact with the youth that left the communities to further their education, Ktunaxa was

born by the concern of the loss of the traditional language, Qiniq emerged from the vision of a practical initiative to decrease the isolation of the communities. This required strong internal (bonding) investments, well crafted bridging relations among the communities and other Aboriginal organizations, and making use of potential linking investments of government programs. Among the latter, the sometimes contentious, sometimes positive linking relations with private and public corporations played an important role. Aboriginal community networks were developed by local people to meet community needs, and in the process community capacity was created in the development of the business plans and in their actual implementation. The use of technology by individuals and groups and the social learning that takes place in the adoption of a new technology creates social capital. Youth are generally the first to adopt new technologies and in turn teach their parents and elders computer and internet skills. Time spent learning new skills and connecting with people to disseminate new skills may also create social capital. For instance, in Nunavut when the Qiniq network was first launched, CSPs in each community would offer to provide information about computers and the internet and how to use the technology and equipment. This creates connections between people who (even in small communities) may not have known each other, or had a reason to connect prior to the introduction of Qiniq. It would appear that the community networks have more at stake in developing active implementers of the technology, rather than passive consumers of connectivity.

The implementation of connectivity infrastructure by private companies is essentially determined by their business cases. In other words, based on population and revenue expectations the companies predict they can or cannot profit from establishing infrastructure and providing internet services in a community. As well, the private company model assumes minimal community involvement and training. This type of network is planned in such a way that the maintenance personnel come into the community, usually from larger urban centres, to perform maintenance or solve technical problems. However, it is costly to bring technicians to fly-in communities and generally this type of maintenance requires that the community pay for the transportation and accommodations of the technicians. High maintenance and infrastructure costs often results in a network that is non-operational. In many cases, the private company may own infrastructure not far from the community and promote the service while asking the community to pay for the last mile of connectivity. In numerous occasions Aboriginal communities have been sold substandard equipment from a private company that cannot be maintained, which resulted in network connections not being utilized because of the equipment failures. Many private companies are “fly by night” and once the money is gone from the community the company does not return to ensure it is operational. In cases such as these the communities ended up feeling “burnt” by these experiences and reluctant to try other avenues (low linking social capital).

Even government health care initiatives of ICT in Aboriginal communities were somewhat of a failure when communities and other stakeholders were not involved in their implementation. In the initial attempts to develop Telehealth in the late 1990’s the equipment would be delivered into a community without consideration for training,

maintenance and updating software. Frequently, the equipment would remain locked in a closet in the health unit or school as no one knew how to use it or even how to set up the equipment. In the case where a technician was sent to set up the equipment, relevant training was not provided to community members for continued operation. Further, there was no proper training of health personnel in the community to coordinate its use, and there was no clear buy-in from health professionals in urban hospitals.

Most Aboriginal community networks are partially government subsidized. Community owned networks are run by community people who have an understanding of the values of community members and the issues that can be addressed via the use of technology. The main problem is that the subsidies are mostly project and short-term related, creating a somewhat unstable funding environment. Qiniq was established by a non-profit organization, the Nunavut Broadband Development Corporation, and was based on private but bandwidth subsidized model. In other words, internet service in Nunavut is not tied to Health Canada or other anchor tenants and all 25 communities have residential connectivity readily available. K-Net is based on a services model, which means connectivity is initially provided to anchor tenants such as the health unit, the administration or band office, and the school. Anchor tenants require larger amounts of bandwidth and must pay a higher monthly amount which secures the business case for the network. This model does not initially provide residential broadband access but supplies communities with a model for the creation of a community owned network. Both Qiniq and K-Net also have Community Access Centres (CAPs) for the public use of computers and connectivity. Even in urban environments, where basic connectivity infrastructure is well established, the issue of accessibility related to affordability could be addressed through community initiatives using wireless modalities. The potential to develop urban Aboriginal networks would be strong.

Although the paper has not discussed in detail "all" forms of ICT[3] most of what has been examined is applicable to current or future developments. What seems highly relevant is how ICT community networks are actually developed and implemented may establish a synergy of social capital as advantageous pre-requisite for their success and the success itself as strengthening the community's social capital. This implies the consideration of power relations among Aboriginal communities and organizations, governments, and private and public corporations. Legislation that favours large private or public ICT corporations over community-based profit or non-profit entities, project-based funding sources that leave community networks at the mercy of government bureaucratic whims, public connectivity infrastructure investments particularly lacking for rural and remote areas, are all instances of power relations. In fact, these are particular aspects of the

[3] For instance new generations of user-friendly, handheld wireless devices that provide 'always-on' access to email, phone, real-time payments, and other multimedia services; onboard computers in motor vehicles; high-capacity broadband links that support web services and content-rich and interactive services for entertainment, e-commerce, research, and collaborative work environments; mobile phones and their applications (e.g., SMS text messaging) (Australian Government Department of Communications Information Technology and the Arts, 2005).

broader notion of Aboriginal self-governance. Considerations of ICT and Aboriginal social capital that do not consider these power relations as central to the analysis are missing the point, that strong social capital is not simply about social relations, but it is essentially about agency and self-determination.

7. Lessons learned: Policy and research priority issues

The above approach to understanding ICT and social capital raised a number of issues that require ongoing debate, research, and policy formulation. One of the purposes of the paper was to organize ideas for a discussion of these issues, and the symposium organized by our study (that took place in January 2008) provided a forum for such dialogue. This last section interlaces the main points raised at the symposium with findings from the study, with the intention of highlighting main policy and research priorities in relation to ICT and Aboriginal communities. Further, the study has created a website that is meant to be both a forum for ongoing examination and debate of these issues, and a clearinghouse of resources for the use of Aboriginal communities, Aboriginal organizations, government, and researchers in relation to ICT and social capital. The web link is the following: www.communityICT.ca

A first key issue is that *ICT infrastructure needs to be considered a right*. As basic infrastructure for water and sanitation are a matter of equity, and services such as postal and health care are in essence guaranteed across the vast territory of Canada, current community social and economic development requires solid ICT infrastructure. Rural and remote communities that in many cases are lacking proper bandwidth are precisely the ones with the most to benefit from adequate ICT infrastructure. It became clear with the study and the symposium discussion that the social aspect of connectivity is one of the most powerful motivators to its uptake and use. Aside from its impacts at the social networking level, this motivator enhances the possibility of ICT having a central role in economic and social development for rural and remote communities. It is clear that the lack of proper ICT among Aboriginal communities dramatically hinders any possibility of leveling the playing field in relation to community development and economic opportunities.

Another central issue is that of *social enterprises and social economies*. Central to the successful implementation and positive impact of ICT in Aboriginal communities appears to be community ownership and implementation of the networks. Despite private sector, crown corporations and government having an important role to play, ultimately community control is what can guarantee that the power relations linked to ICT will not derail it to the detriment of community members and organizations. As well, the private business model does not work for social enterprises such as community owned networks. Serious efforts have to be directed to adjust legislation, norms, and funding models to serve these social economies.

The *role of government* is crucial to the above identified issues. As the United Nations report on the information economy (2006) indicates “governments have an important role

to play in improving access to broadband through infrastructure and policy." There are a number of aspects where government at its various levels can play a positive role. Among these are to: move away from pilot project funding to longer term program funding approaches (adequate and reliable funding); reduce duplication and fragmentation of government departments as they relate to ICT development; increase necessary investments in ICT infrastructure at the community level; work closer with communities; assist in securing funding for community networks; establish legislation that at the very least levels the playing field for community enterprises vis-à-vis private corporations; allocate proper bandwidth and related fees in Canada (e.g., Telesat) for community and non-profit initiatives as compared to industry and other corporations.

Among the crucial investments in ICT for Aboriginal communities is that of *human resource capacity building*. These investments are intimately connected to community ownership and management of the networks, to the successful uptake of the technology, and to the enhanced use of the different applications for cultural, social and economic opportunities. More so, ICT is an area where youth capacity building is of particular relevance and prospect.

Addressing the digital divide or digital inequality has significant differences if it relates to *urban or rural-remote settings*. Within urban environments, inequality in access to adequate connectivity relates mostly to the lack of purchasing power of the computers and network connections among urban low income Aboriginals. Programs that address this inequality need to focus on household investments and community access initiatives. In rural and remote Aboriginal communities, aside from the above mentioned issue, is that of community connectivity. These communities are unique and do not mirror the economic, social and cultural circumstances of urban centres. These communities require proper support to develop their own networks so they will reflect their social, cultural and economic realities. ICT development and implementation has to be unanchored from the urban mindset and needs to be simultaneously re-developed from the rural and remote realities.

There is an obvious need for further *research*. One essential area is that of investigating the *how* of implementation and development of ICT in Aboriginal communities. The role of community-owned networks, the power relations among the different players (Aboriginal organizations, private and public corporations, government, etc.) must be more rigorously studied to enhance the understanding of the dynamics at play and to adequately guide future policies, programs and community initiatives. An example would be to research best practices in community ICT development and implementation. Further, the *impact* of connectivity in Aboriginal communities at various levels, social, cultural, economic, requires more in-depth and empirically based studies to assist Aboriginal communities, Aboriginal organizations, and government to better capture the effects of these new realities and better foster successful implementation, positive development, and further investments. This research needs to be future oriented, in that it must rapidly incorporate the study of new technologies, tools, and models, and seek to anticipate future developments.

Finally, it must be emphasized that *ICT is in essence about relationships* at various levels, not merely about technology. Relations at the social and community level, both as a draw for its use and for the social effects it may have. Further, the increased social networking across Aboriginal communities in Canada and abroad facilitated by ICT is of remarkable significance. As well, it is about relations associated with technical knowledge, financial resources, legislation, and ownership. For Aboriginal communities to properly benefit from ICT development they need to have comparable leverage to that of the other actors given the power dynamics at play. As was mentioned before, this in essence is about agency and self-determination.

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9. Appendices

9.1 Information and communication technology in Aboriginal communities in Canada: An environmental scan

Information and communication technology (ICT) serves to link people, communities, businesses and organizations across regions, nationally, and internationally. Connectivity is a term that describes the degree to which a particular region, province or community has linked its citizens and organizations with each other and internationally. The purpose of this section is to describe the state of connectivity in each province and territory in Canada, providing context to the examination of Aboriginal connectivity. The approach taken is to examine the current state of infrastructure, technologies, and the main stakeholders involved. A particular focus is on the role of communities and public/private partnerships in advancing connectivity within Canada. Where the data is available, the amount invested in dollar terms is provided. Connectivity in each province is presented and a final matrix is used to summarize connectivity developments by category. Granted, this is a quickly evolving field, where environmental scans of this type rapidly become outdated.

9.1.1 British Columbia

British Columbia is one of the most connected provinces in Canada, second only to Nova Scotia whose geographical size is an obvious advantage. Access to broadband is available in communities containing 91% of the population (NetWorkBC, 2007). Seventy two percent of provincial homes have internet connections more than half of which are high speed or broadband connections (NetWork BC 2005). In 2005, 90 percent of British Columbians accessing the internet from home did so using a broadband connection (NetWorkBC, 2007).

Bridging the digital divide in British Columbia is an initiative that began in 2001 when members of the provincial government formed the Premier's Technology Council (PTC). Comprised of leading members of the British Columbia technology community and academia, the PTC's mandate is to provide advice to the Premier on all technology-related issues facing British Columbia and its citizens. The Council visited communities and conducted consultations to establish recommendations regarding the best way to bridge the digital divide across British Columbia. The Council identified that out of 366 communities with a public school, library or health facility, 151 communities lacked affordable high speed internet access. Communities without one of these facilities were not selected for broadband connectivity. The council recommended that one way to address the digital divide without drawing on additional funding from the province would be by building on infrastructure currently in place to extend the network. The provincial government created NetWorkBC.

Prior to 2001 access to the internet was available in some rural areas. However, the technology was seldom utilized as a result of the long wait time inherent with dial-up network connections. To enhance the current network, the Shared Provincial Access Network, the council amalgamated the demand of the current network with the demand of the provincial health authorities and Crown corporations to use their collective purchasing power "to motivate telecommunications suppliers to upgrade their networks to provide high speed connectivity to provincial communities" (NetWorkBC, 2005). A contract for supplying these agencies collectively with telecommunications services was awarded to TELUS, giving TELUS a virtual monopoly on telecommunication services provided to the provincial government. It was estimated that the province along with the other agencies included would spend approximately "$245 million for telecommunication services over the next four years" (NetWorkBC, 2005). Under this agreement TELUS would provide these services at a rate similar to, or competitive with, those in British Columbia's urban centres and would not compete with any community supplier or local ISP whose services are being offered as a result of this agreement until 2008 (NetWorkBC, 2005). Generally, a contract of this size would not be awarded to a single company in order to avoid the creation of a monopoly. TELUS is required to provide the services as stated in the agreement until 2008. After that time TELUS is no longer obligated to provide services at a competitive price and can begin to compete with small community suppliers. The project was to be completed by January 1, 2007.

At this time all government agencies in the province were using a network called the Shared Provincial Access Network or SPAN/BC. The network needed to be updated to utilize new technologies and to transfer larger amounts of data between government agencies. Updating this technology to Next Generation Network Services was an inevitable cost the province would have to incur. By coupling this project with the proposed extension of backbone infrastructure across the province the government was able to leverage their spending power to create an overall savings and establish the backbone infrastructure to connect rural, northern and Aboriginal communities.

Unlike federal initiatives, NetWorkBC partnered with TELUS, a private telecommunications company, in this joint initiative. Today, TELUS has provided infrastructure throughout the province in order to provide access to many of the identified communities. However, access in this case does not refer to an internet connection in a home or business, but rather refers to the opportunity to access the backbone infrastructure that can be utilized by individuals with a business plan who intend to offer internet services to residents and commercial businesses in the local communities. In remote locations, where extending fibre was not an option due to the geography of the land, the province partnered with the federal government to provide satellite service to select communities.

NetworkBC also works with First Nations communities in creating solutions for last mile connectivity. Substantial progress has been made in British Columbia since the creation of the Premier's Technology council in 2001. Most communities selected to receive connectivity infrastructure are now working with various organizations to create last mile solutions and community internet service providers.

British Columbia is home to one third of Canada's First Nations communities. The First Nation's communities in British Columbia are for the most part located in remote and isolated regions of the province and tend to be comprised of relatively small, geographically scattered communities that have an average population size between 100 and 300 people. Strategic planning and partnerships on behalf of the provincial government have created an expansive backbone infrastructure throughout the province that utilizes fibre optic, microwave tower, and satellite technology providing rural and remote communities with new opportunities and improved access to government services.

The government of British Columbia aims to bridge the digital divide in the province by ensuring all 366 communities (places that have a library, school, or healthcare facility) have broadband access to the internet is substantially complete. 356 of the province's 366 communities now have access to affordable high speed internet connections. An estimated 85 of the 203 First Nations have broadband access. The government of British Columbia has made a further commitment to bridge the digital divide with all 203 First Nations in British Columbia (NetWorkBC, 2007).

9.1.2 Alberta

The province of Alberta is being credited internationally as the region in Canada which first bridged the digital divide. Alberta's SuperNet, the infrastructure that has the ability to connect 429 communities across the province was completed in July of 2004 and connects 4,200 learning and health facilities and governments' offices (Government of Alberta 2005). SuperNet is a high speed broadband network that includes more than 12,000 kilometres of fibre optic and wireless components and that has enabled people living in rural areas to benefit from the same opportunities enjoyed by those living in urban centres (Bell Canada 2003). Financing was provided by the provincial government

who partnered with Bell West Incorporated, and Manitoba Telecom Solutions (MTS) to build the network. The provincial government also partnered with a local Calgary company Axia NetMedia Corporation which controls customer access to the entire network (Cherry, 2004).

Alberta's SuperNet consists of two networks, the base network that links Alberta's 27 largest cities, which is owned by Bell West Incorporated, and an extended network that provides 'backbone' infrastructure to the remaining 395 communities. The extended network has been completely financed by the provincial government which is facilitated by the Alberta government's budget surpluses. The base network or infrastructure owned and established by Bell is more extensive than a comparable business would have provided had they not partnered with the provincial government (Cherry, 2004).

The role of the Calgary based business Axia NetMedia Corporation as the operations and access manager is to give Internet Service Providers (ISPs) a "single point of contact for connecting to the network at any location. Monthly rates will be the minimum needed to provide enough revenue for continued investment and upgrading" (Cherry, 2004). It is significant that Axia charges a low rate because this allows ISPs in rural areas to charge their customers low rates, even in remote, isolated and sparsely populated communities. In the past these communities found that the high cost of access to the internet was prohibitive. Additionally, providing a role for Axia ensures that access across the province will be universal as Axia is not an ISP and therefore has no need to compete with others or keep anyone off the network, as would be the case if portions of network had been awarded to different ISPs (Cherry, 2004).

The partnership between Axia and the province proved beneficial for all involved. As part of the call for proposals created by the provincial government, Axia was required to provide access to the backbone infrastructure that could be utilized by all schools, libraries, and provincial health facilities. The requirement ensured that backbone infrastructure would be supplied to all Alberta First Nations and Métis communities with these facilities.

Most communities were unable to establish the infrastructure on their own. Once the backbone infrastructure has been supplied communities that can access investment capital can then use the opportunity to engage in economic development. A community member or group could establish a community ISP as a business. Community ISPs are the preferred mode of service delivery in First Nations communities because in many cases the number of people per community is not large enough for established corporations to form the business case needed. A local ISP may create capacity in First Nations and Métis communities. The business may employ local people and prompt them and others to seek out training options. Alberta SuperNet provides the opportunity for the provincial government to provide an increased quality of services to First Nations and Métis communities.

9.1.3 Saskatchewan

The implementation of Saskatchewan's province-wide initiative CommunityNet II, which began in the year 2000, has been met with success. Utilizing a two-way satellite system CommunityNet provides access to infrastructure for rural, remote and First Nations communities across the province. CommunityNet is a broadband, high speed, province wide, telecommunications network that connects more than 800 school and regional colleges, including those on First Nations reserves; 310 health facilities; 162 public libraries; and 256 government offices (Government of Saskatchewan 2004).

To date CommunityNet connects 366 Saskatchewan communities and is currently being extended to connect other communities in the future. CommunityNet provides the backbone that can then be utilized by an ISP to bring internet services to the local community. The main ISP in Saskatchewan is the crown owned SaskTel which has provided Internet services in Saskatchewan since 1996 and connects more than 61% of Saskatchewan residents (Government of Saskatchewan 2005).

Unlike other provinces in Canada, the Saskatchewan government has taken the initiative to provide the infrastructure for CommunityNet and is also the ISP through SaskTel for the delivery of service. According to the CommunityNet website, the services provided to communities may not include residential or local business connectivity. Some communities are connected in the sense that the local school is connected or a Telehealth station has been established.

> While CommunityNet provides the anchor for SaskTel to explore the expansion of high speed commercial offerings to an increasing number of communities, each expansion must be looked at on a case-by-case basis to ensure that the service can remain economically viable (Government of Saskatchewan 2005).

In comparison this initiative does not appear to provide provincial wide connectivity to residential homes and businesses in rural communities as has been the case in some provinces.

In 2004, an Industry Canada grant assisted the province and SaskTel in upgrading all Saskatchewan schools, including 73 First Nations schools, from their one-way digital satellite network to a two-way satellite system. In June of 2005 the provincial government announced that all "schools, libraries, health facilities, and community groups" would be receiving a high bandwidth link to global research networks around the world through SRnet. "SRnet is Saskatchewan's Optical Regional Advanced Research and Education Network" and supports the "exchange of research and educational data traffic between its members and their peer organizations across Canada and around the world" (Government of Saskatchewan 2005: 30). SRnet utilizes CommunityNet infrastructure and is able to support applications such as videoconferencing, but as a network it is not used commercially and is not available to residents or local businesses.

The federal government provided a significant portion of the funding used to connect all First Nation's schools in Saskatchewan to the province's high speed network through the

program First Nation's SchoolNet (Fnsnews 2005). Federal funding through the Broadband for Regional and Northern Development (BRAND) program was awarded to the Meadow Lake Tribal Council in partnership with the Keewatin Career Development Corporation (KCDC) to connect 37 communities in northern Saskatchewan. KCDC has been involved with the federal First Nations SchoolNet projects and has successfully established Community Access Centres where community members have access to computers connected to the internet in 46 northern schools in Saskatchewan, 23 of which are First Nations communities (KCDC 2004).

9.1.4 Manitoba

In Manitoba 85% of the population has internet access. However, almost 85% of the population of Manitoba lives in or near a major urban centre. As of July of 2003 the farthest reaching network in Manitoba was MTS which was available in Winnipeg and extending to Brandon and up to Thompson. MTS is a provincial backbone structure which provides service for the Provincial Data Network (PDN). Manitoba Hydro has developed fibre backbone from Winnipeg to Grand Rapids continuing to Nelson River. Shaw cable and internet services are available in Winnipeg, Selkirk, and Steinbach. Also, Westman Communications provides cable and internet services in Brandon and the surrounding areas. Other much smaller but notable providers include: I-NetLink which is linked to the Westman Fibre network and provides wireless service in Brandon; Group Telecom which is primarily a commercial application and has some fibre infrastructure in Winnipeg; and lastly, Rat River Co-op provides internet service to St.Pierre and area (The Cathedral Group, 2003). Yet according to Industry Canada more than 180 of Manitoba's 220 communities are without broadband service (The Cathedral Group, 2003).

Manitoba's Provincial Data Network (PDN) is an "MTS supplied service that runs on MTS infrastructure" which ranges from low speed analogue access (rural and remote) to high-bandwidth fibre optic digital access in Winnipeg and Brandon (The Cathedral Group, 2003). In 2001 the Provincial Government requested proposals to upgrade infrastructure for the PDN. However, the

> PDN is primarily a tool to serve government and its ever-increasing bandwidth requirements. In some cases the local traffic might in fact face degradation, as government traffic takes up more bandwidth in an already stressed system (The Cathedral Group, 2003)

The Provincial Data Network connects all Regional Health authorities including "approximately 300 retail pharmacies, 85 hospitals, and a number of personal care homes using common MTS infrastructure" (The Cathedral Group, 2003). All libraries (108) in Manitoba are connected by the PDN, which operates on MTS infrastructure. Each of the 108 libraries in Manitoba use local internet solutions (private ISPs) to complete the last mile of connectivity. The library system piggybacks on MTS infrastructure and purchases internet service from a private local ISP. Manitoba does not have a school network, although schools across Manitoba have access to the internet. Most rural school divisions

have dial-up access only. Approximately 24 communities have access to the internet through a one-way satellite service which also relies on a phone line to comprise a system that is "currently over-subscribed and is providing a reduced quality service" (The Cathedral Group, 2003). Manitoba Hydro has a small network that utilizes a portion of MTS infrastructure and provides connectivity to several of its generating facilities.

Manitoba currently has a number of projects underway involving internet connectivity and upgrades. As of 2003, Manitoba had developed 146 Community Access Program (CAP) sites in rural and remote areas. An additional 240 rural or remote sites and 200 urban sites (Winnipeg) will be established in the future. Many CAP sites that have been established recently are located in First Nations communities. "There are currently 600 CAP sites in Manitoba: 61 in northern Manitoba, 338 in rural Manitoba, 201 in Winnipeg, and 18 WEB-4 access sites for assistive technology assistance" (The Cathedral Group, 2003).

Manitoba Hydro has established infrastructure over a significant area of Manitoba. The capacity for the development of internet service is based on the proximity of the site to be serviced to a Manitoba Hydro Point of Presence (PoP). In other words, in order for Manitoba Hydro's infrastructure to be cost effective enough to be utilized by local ISPs, the site in question would need to be located near a PoP. Manitoba Hydro is currently involved in a seven-year upgrade project to increase the capacity of their dark fibre. (The Cathedral Group, 2003).

Winnipeg and Brandon are the two major urban centres in Manitoba. Urban advantages include: plentiful service levels and options in these areas; over 260 public access sites in Winnipeg; ISPs compete with each other, causing services to be less costly and seemingly more efficient. Winnipeg and Brandon can be seen as "knowledge bases" or central points of research and information dissemination. The larger populations in urban centres create a strong business case and consequently funding is more readily available from governments and private companies. Further, larger populations promote competition and motivate private companies to provide services in larger centres. I-NetLink, an ISP in Brandon, has received funding to establish wireless internet connections for households and businesses in six communities outside Brandon (The Cathedral Group, 2003).

Lac Brochet is a First Nation community located approximately 300 km northwest of Thompson that has a high speed satellite system for accessing the internet. The system includes a wireless network connection to the band office, nursing station, local store, school, and 40 residential homes. The community is now receiving the electronic delivery of education, health, cultural, recreational and government Services (The Cathedral Group 2003).

Pukatawagan First Nation is a northern Cree community in Manitoba with approximately 2,800 residents that now has access to the internet via a satellite connection. The local network connects the schools, RCMP station, nursing stations, and band offices.

Financial support for this project was provided by the Federal government (The Cathedral Group, 2003).

BRAND assisted projects exist in at least 13 centres, including Broadband Communications North in Thompson, Community Development Corporation in Ste. Anne, Wheat Belt Community Future Development Corporation in Brandon, and MMF Broadband To All supported by the Manitoba Métis Federation in Winnipeg. (The Cathedral Group, 2003). Additionally, 30 northern communities in Manitoba have been connected to the internet via a wireless network facilitated by Broadband Communications North and was set to be completed and available to community residents and businesses in 2006.

High speed internet connectivity is becoming a reality for First Nation's communities in Manitoba. The development of broadband internet connectivity in northern, rural and Aboriginal communities involves the establishment of backbone infrastructure, developing a business case for a local or community ISP, training and capacity building, leadership, community buy-in and an effective community champion.

Manitoba's 10 most northern communities, beyond Thompson, are connected today by satellite, as the terrain does not facilitate the efficient establishment of backbone infrastructure. These communities were connected as part of the National Satellite Initiative (NSI), a program created by Industry Canada that parallels the Broadband for Rural and Northern Development (BRAND) project.

Over the past five years the province of Manitoba has been working with funding from federal government programs to establish high speed internet connectivity by establishing infrastructure in 30 communities located north of the 53rd parallel, 22 west central communities, and 40 communities in the Parkland area. In other areas, specifically in the south or in locations with a population larger than a typical northern community, private businesses establish infrastructure at their own cost. Companies such as MTS and Shaw determine whether or not a business case exists to establish backbone infrastructure in an area. The 30 northern communities north of 53rd parallel are unable to provide private companies with the high population counts and economic base to project potential profits. The province of Manitoba is working with these communities and funding from both the provincial and federal governments via the Manitoba Canada Infrastructure program and Industry Canada's BRAND and NSI programs. Although substantial funding has been supplied by both these sources, matching funds of 50% of the total project cost must be acquired through the communities, other funding organizations, or private organizations in order to receive the federal funding (Montreuil, 2006).

The BRAND program provides funding for the establishment of the backbone infrastructure, but generally does not supply funding for the last mile of internet connectivity. BRAND allows for 10 units of Customer Premise Equipment (CPE) in each community that has been awarded funding. Prime locations such as the nursing station, band office, family social services centre, RCMP detachment, day care, or school may be

chosen for internet connectivity. Once the infrastructure is in place in the community and the 10 CPE's have been utilized the opportunity exists to establish a local or community ISP. The ISP would offer internet services to residential homes and businesses (if they are not already connected). The NSI provides high speed internet through a satellite signal to rural, northern and Aboriginal communities in areas where the establishment of a backbone infrastructure is impossible (Government of Canada, 2002).

Once the infrastructure is in place bandwidth is offered to the communities at a considerable discount. By providing the bandwidth through the established infrastructure at a reduced rate, the possibility of developing a community owned ISP becomes viable. Further, the reduced cost would allow the community ISP to provide service to community members at an affordable rate. Community members have the responsibility of taking the initiative to establish and operate a local ISP. The province's mandate is to support the building of backbone infrastructure and provide educational sessions regarding the benefits of broadband and various ICT applications (Montreuil, 2006).

The Manitoba First Nations SchoolNet is another program taking place within the province that has been very successful in bringing connectivity and computers to First Nations schools. Prior to the introduction of this program approximately half of the First Nations schools in Manitoba had internet connectivity. The schools that were connected to the internet had a dial-up connection and no technical support, rendering any educational applications and even basic usage inadequate. One of the objectives of the First Nations SchoolNet program was to upgrade the internet connections provided to the schools by utilizing a bi-directional satellite signal. Today, this has been accomplished and many First Nations schools have been further upgraded to high speed connectivity.

Broadband Communications North

Broadband Communications North (BCN) was one of the successful applicants to Industry Canada's BRAND program and was created to function as a community champion for the establishment and implementation of broadband connectivity in northern Manitoba. 'Community Champion' is a term created by Industry Canada to refer to a person or entity that promotes the benefits of broadband connectivity to community members and addresses the issues and concerns of the community as a whole. BCN was set up as an entity to fill this position for a number of communities and to be the community champion sponsoring organization.

BCN was successful in securing $2.7 million dollars from the BRAND program and $2.8 million from the Manitoba Rural Infrastructure Fund (MRIF). Additionally, "as a result of a partnership involving INAC, First Nations Inuit and Health Branch (FNIHB) and the Keewatin Economic Development strategy, 10 northern Manitoba communities" will be receiving equipment used for broadband connectivity, a contribution of approximately $1.2 million (Manitoba Keewatinook Ininew Okimowin, 2005). BCN has been responsible for securing the funding and overseeing the operations of the establishment of high speed internet connectivity in communities in northern Manitoba.

The infrastructure being built in 30 northern communities was expected to be completed at the end of 2006. The type of technology (satellite, microwave tower, or fibre optic) a community establishes may depend on the geographical terrain. This requires training enough people from the communities to maintain, upgrade, and repair the local equipment. In Manitoba, various training strategies have taken place. One program, the Manitoba First Nations SchoolNet youth initiative, brought youth from northern communities to Winnipeg for educational sessions that taught basic computer and ICT skills as well as digital literacy and life and job skills. Once the skills training portion of this program was completed the students went back to their communities and received work placement in organizations and businesses in the community. This placement enables the students to provide technical support for their community and gain valuable work experience for a term of 14 to 15 weeks. The students were also encouraged to hold workshops for community or family members to share the ICT skills they had developed (Stevenson, 2006).

Churchill, Manitoba: The beginning and end of a community network

Churchill is an isolated community in Manitoba located on the southwest shores of the Hudson Bay and has a population of approximately 1,100 people. Individuals in Churchill began seeking internet connectivity in the mid 1990's. As a result of community efforts and financial assistance from the federal government's Community Access Program (CAP), a dial-up connection was obtained in 1997 and a community ISP was created called the Churchill Community Net or CCNet. In addition to federal money, which did not cover all the costs of internet access, CCNet received funding from the Town of Churchill, the Churchill Northern Studies Centre, and the Churchill Development Corporation. With this assistance the necessary equipment was purchased and a connection was established through an Ontario satellite company called Global Wireless Satellite Networks. CCNet was able to offer internet connections to community residents and businesses ranging from $35 to $60 per month. CCNet was operated in a manner similar to a non-profit organization and was managed by community members who volunteered their evenings and weekends. One of the goals of the business plan was to obtain 35 to 50 dial-up service subscribers in order to repay the initial business loan. By March of 1998, "CCNet has easily surpassed the goals set out in the business plan as it had attracted over 130 members who signed up for Internet service" (Cameron, et al., 2005).

After experiencing great economic, social, and cultural success with internet connectivity in the late 1990's, a demand arose in the new millennium for upgraded equipment and technology to keep pace with the rapidly changing world of ICT. Concurrently, the government's Provincial Data Network (PDN) was to be upgraded to increase access to bandwidth for hospitals and provincial government buildings. One of the benefits of providing access to a broadband network was to improve hospital services such as Telehealth, oncology outpatient, and to create a Drug Program Information Network. Seemingly, the residents of Churchill had not benefited from the PDN prior to this time.

"Manitoba Telecom Service Inc. (MTS) was awarded the contract for upgrading and expanding the capacity of the Provincial Data Network" (Cameron et al., 2005).

In 2002, through a partnership between CCNet and Global Wireless Satellite Networks, new equipment was obtained and a broadband internet connection characterized by increased downloading speed was established. However, the transformation from dial-up to broadband connectivity was met with many problems. The high speed connection required an increased level of maintenance in terms of time and skill which placed great strain on the volunteers operating CCNet. There was also a financial strain on CCNet that occurred because a computer technician had to be flown to Churchill to perform portions of the equipment maintenance. At the same time service interruptions caused by technical difficulties experienced by the Global Wireless Satellite Networks company inconvenienced customers. Around the time MTS began offering dial-up service in Churchill at a lower monthly cost than CCNet was able to offer for the high quality connection. Consequently, customers perceived the less expensive dial-up connection as a more reliable connection (Cameron et al., 2005).

CCNet acquired two major customers as a result of the partnership formed between CCNet and Global Wireless Satellite Networks. The make up of the partnership was as follows; Global Wireless Satellite Networks satellite signal was utilized as the connection to internet which was provided by CCNet as the ISP. On April 10, 2004 the equipment that provided the satellite connection to the internet crashed causing the two major customers, the province of Manitoba and the Regional Health Authority (RHA), to loose service for weeks. Following this event the province and the RHA decided to switch to MTS for internet service. The cost of repairing the satellite was high and CCNet made the decision to move from satellite connectivity to MTS's fibre optic link.

Throughout 2004 the community of Churchill was equipped with two sets of infrastructure to provide internet connectivity. CCNet was offering broadband high speed internet using and paying for MTS infrastructure. MTS developed a secondary infrastructure apart from the infrastructure CCNet was utilizing, in order to provide a secure internet connection for the province of Manitoba and the RHA. CCNet was not awarded this contract initially because it could not offer a secure network connection. MTS, at this time, was providing the province and the RHA with broadband high speed internet service while offering dial-up internet service to community members and small businesses. CCNet continued to loose customers to MTS and for a variety of factors was forced to cease operations in June 2005. Consequently, the only service available to residents of Churchill today is dial-up. "The Hudson's Bay Port Authority, the Churchill Northern Research Centre and the Town of Churchill have, at great expense, had MTS install private cable lines to deliver high speed service because broadband internet service was critical to their day to day operations" (Cameron et al., 2005)

Churchill was not eligible for funding from either the BRAND or the NSI. In order for a community to be eligible for this funding the backbone infrastructure needed to establish broadband capacity internet services must not be available. Although MTS is not offering

high speed intent services to the community the infrastructure is in place to serve the province of Manitoba and the Regional Health Authority.

9.1.5 Ontario

Ontario's SMART community program is called SmartCapital for the regional municipality of Ottawa-Carleton and is sponsored by the Ottawa Centre for Research and Innovation. The program focuses mainly on the development of advanced online applications. This already connected region plans to apply on-line technologies to municipal government services, create virtual work spaces for community groups, student associations and other special interest groups, develop advanced applications for education, use videoconferencing for professional development seminars and provide comprehensive applications for entrepreneurs to launch new business initiatives (Government of Canada, 2000).

SmartCapital will also develop a program called SmartLab which will utilize a high speed fibre optic network to connect advanced research labs. The SmartCapital initiative will also establish the SmartCapital Portal which is to be a "gateway to all public on-line services in the community" (Government of Canada, 2000: 11). The portal will enable citizens to access government services from education, health care, business, tourism, and community agencies.

A partnership between Storm Internet, an ISP, and Telesat Canada, a company that leads its industry in satellite operations and systems management, have teamed up to bring broadband connectivity to the rural municipality of North Stormont in Eastern Ontario. North Stormont is located 40 minutes outside Ottawa and will soon benefit from Storm Internets "last-mile terrestrial wireless service" (Storm Internet, 2003).

Ontario's Research and Innovation Optical Network (ORION) is an initiative by the Minister of Energy Science and Technology that was established in 2000. "The two major components of the project were network backbone and connectivity and collaborative research projects" (Baker, 2001). ORION invests in network infrastructure and aims to establish a province-wide, high speed, fibre optic, advanced research network that would connect 43 post-secondary institutions and 50 research institutes and organizations across Ontario.

One of Ontario's main initiatives for the establishment of broadband in rural, northern, and First Nations communities is the Connect Ontario: Broadband Regional Access (COBRA) program. Announced in 2003 the COBRA program consists of $55 million in partnership funding over a three year period (Communications Today, 2003). The participating communities must establish a business case and provide 50% of the capital costs of their broadband project which can be funded through federal level Canadian government programs or through private or public partnerships.

During the mid 1990's a First Nations organization in northwestern Ontario called the Keewaytinook Okimakanak Tribal Council created and implemented K-Net (the Kuh-ke-nah Network) in seven First Nations communities. Today this network serves 60 Aboriginal communities across Ontario and Quebec. K-Net is a broadband network and is the oldest and largest Aboriginal Network in Canada.

Another initiative taking place in Ontario is the expansion of the northeastern Ontario Communication Network (NEOnet). NEOnet is an information and communication technology development organization that was established in 1999 "to facilitate private and public sector partnership that will result in better telecommunications infrastructure and ICT-related services in the region" and to promote "the development and innovative application of technology, especially as it pertains to economic, culture and social development of northeastern Ontario (NEOnet, 2006)." NEOnet has recently completed a project in which three First Nations communities were connected. Chapleau Cree First Nation, Brunswick First Nation, and Chapleau Ojibwe First Nation have been connected since July of 2006 (NEOnet, 2006). Residents and businesses in this area have access to the high speed wireless network. The Federal Government's FedNor program provided partial funding of $513,600 for this project which involves Bell Canada Enterprises, Nortel, and the Township of Chapleau. An Information Technology Coordinator was hired for the project and held train-the-trainer sessions in the communities in order to develop the local skill base (Nortel, 2006).

According to the Aboriginal Portal of Canada's website there are 137 First Nations communities in Ontario; 68 communities have a high speed internet connection, 51 communities have a dial-up or 56k connection, one community has no access to the internet, and 13 communities are reported as having a type of connection that is not characterized by any of the above categories. The site also reports that four First Nations communities have upgraded from a dial-up connection to a high speed connection sometime before 2007 (Government of Canada, 2006a).

9.1.6 Quebec

This section first discusses the successes of the First Nations Education Council in Quebec in utilizing broadband connectivity to support educational initiatives, followed by the experiences of the Inuit in northern Quebec with broadband connectivity and videoconferencing.

The First Nations Education Council (FNEC) in Quebec has established connectivity and provides videoconferencing services to 29 First Nations schools in Quebec through initiatives with Indian and Northern Affairs Canada and Industry Canada's First Nations SchoolNet program. The videoconferencing program began in 1999 and has had significant positive impacts on member communities. The objectives of the videoconferencing network were to; "reduce travel costs, enable distance learning, promote language and culture through special projects and reduce the effects of geographical isolation" (Bastien, 2006).

The use of videoconferencing as an educational tool addresses many issues faced by First Nations schools. Videoconferencing can provide distance education programs, address the shortage of teachers in First Nations schools, provide training programs for youth and adult learners, and facilitate band meetings. Online programs offered by FNEC include: New Paths for Education, Parental Involvement, Professional Development, Special Education Services. FNEC also offers online programs for youth that include: Youth Employment, Career Promotion and Awareness, and Science and Technology. Additionally, FNEC administers a language program that is funded by Heritage Canada (Bastien, 2007).

FNEC has maintained a website since 2005 that houses a variety of tools for community members, students, schools, and administrators. The site provides a videoconferencing reservation form, updates for students enrolled in training programs, a kids section that allows young children to play games that improve dexterity and math skills, a search engine, a help desk section for community technicians, and a section that provides instructions for hosting a successful videoconferencing session (Lalancette, 2006).

FNEC has partnered with the University of Montreal via distance education enabled by videoconferencing to provide training for teachers in the use ICT in the classroom. The teachers received master's diplomas in the pedagogical integration of ICTs from the Education Faculty at University of Montreal (Laine, 2006b). FNEC has also developed software for school age children and games that "allow children to discover computers and develop motor skills, [and] at the same time viewing Aboriginal cultural images". The software is also intended to "facilitate the pedagogical integration of ICT" for children and is available to students in classrooms and early learning centres and online (Laine, 2006a). One of the online courses offered to students for school credit, via videoconference, is "Introduction to the History of First Nations". All courses offered through videoconferencing are offered free to FNEC members.

FNEC has also: partnered with the program Computers For Schools, resulting in a computer-to-student ratio of 1:6 in 2006; assisted in providing employment to 13 students in the 2005-2006 school year through their relationship with First Nations SchoolNet; provided ICT training for youth, students, teachers, and technicians through the use of SMART board technology; provided funding to create mobile laboratories which provide wireless access, printers, servers, and internet access to students within their own classroom and have created distance training for teachers and e-learning applications for early learners. Each school enabled with connectivity and videoconferencing technology also acts as a hotspot for faculty and students.

In northern Quebec, the large-scale broadband e-learning program called Music Grid was scheduled to end in 2004. The goal of this program was to provide research materials that could improve broadband networks, satellite communications, e-learning and music programs (Government of Canada 2003a). Kangiqsualujjuaq, Nunavik, formerly known as George River in northern Quebec, was one of the communities that hosted the Music Grid program and continued the program with school board funding at the end of the

research period. The Music Grid program activities focused on using videoconferencing to carry out classroom activities. A research council officer of the National Research Council (NRC) Institute for Information Technology worked closely with the Inuit community throughout the implementation of this project (Brooks, 2006).

The school in Kangiqsualujjuaq was provided with more bandwidth than was originally available in the community and access to videoconferencing equipment to assist the students in learning to play violin via videoconference with a teacher from the University of Ottawa. The students involved in the program were Inuit children approximately five years of age who participated in the violin classes for three years (Brooks, 2006). The videoconferencing system displays the Inuit classroom in Kangiqsualujjuaq and the music teacher and her class in Ottawa. Videoconferencing enabled the Inuit children to see and hear the music teacher and music notes in real time. Also, a translator in the classroom in Kangiqsualujjuaq would relay the teacher's instructions because some of the Inuit children spoke only Inuktitut. The children in Kangiqsualujjuaq were able to perform for the class in Ottawa on various occasions (Brooks, 2006). The program was so successful in Kangiqsualujjuaq, that the community and school decided to make funding for the program a priority after the research period was completed.

9.1.7 Atlantic Canada

The Atlantic Canada First Nations Help Desk offers a localized approach to the dissemination of ICTs in First Nations communities. The Help Desk delivers the SchoolNet program which provides connectivity and videoconferencing services to 33 First Nations schools and communities in Atlantic Canada. There are three sites in Newfoundland, 10 sites in New Brunswick, 18 sites in Nova Scotia, and two sites in Prince Edward Island. The Help Desk works with "federal and provincial governments, the private sector and Aboriginal groups to pool resources, cut duplication and costs, and offer faster service" (Government of Canada, 2006).

The Atlantic Canada First Nations Help Desk is funded by Industry Canada, the Atlantic Policy Congress of First Nations Chiefs, Mi'kmaw Kina'matnewey, the Aboriginal Youth Initiative, and the Centre for Excellence (Government of Canada, 2003). The Department of Canadian Heritage reported that, in 2003, there was a large amount of community support for this project. In one month the Help Desk website received over 109,000 hits, and noted that individuals saw the Help Desk as supporting various organizations with programs such as language initiatives by distributing and promoting materials (Government of Canada, 2003).

A variety of resources can be accessed through the Atlantic Canada First Nations Help Desk, including: six different online language programs (as there are a variety of Aboriginal languages throughout this region), online information about culture, history, and spirituality, traditional Native American technology and art, educational information, the Mi'kmaq Portraits Collection which is a database of portraits and illustrations of the Mi'kmaq of Atlantic Canada, the First Nations Information Project (a site that groups

information regarding Aboriginal economic development, community planning, self government and education into one comprehensive resource), and an online training program for youth.

In early 2004, the Help Desk provided 30 community schools with four, three-day digital video workshops for both educators and students. Each school that participated received a computer and video camera and today the students that participated in the workshops have created their own video productions.

In New Brunswick, a grade 10 class project was facilitated by connectivity when they were able to correspond with a Canadian author residing in Japan through blogging. The class was able to study his work and ask the author questions. The project was undertaken in preparation for the class to begin short story writing. The blog site, created for the project also provides a tool for displaying and sharing the students' work (Martin, 2007).

Eel Ground school in New Brunswick hosted a videoconference session for their students with children's author Robert Munsch. Rural and remote schools have previously not been able to provide this type of activity to their students. The students at this school are learning to use ICT's, build websites, research on the internet, produce educational videos and have also started an online music program. The school was recognized in 2005 by INAC for its use of leading edge technology in education (Government of Canada, 2005). The students of Eel Ground have created new media projects that have won international awards and that have been purchased by Health Canada and the Provincial Fire Department.

The Help Desk has also launched a variety of language initiatives through their website which include components such as; a vocabulary list and pronunciation guide, traditional songs that can be played online, talking books, online poster that promotes culturally relevant learning, an online dictionary, online prayer, and has created online language lessons for students. Kevin Burton of the Atlantic Canada First Nations Help Desk stresses the importance of increasing technological capabilities further to facilitate an increased variety of course offerings in all communities.

Currently in Nova Scotia, a grassroots organization has partnered with CANARIE, which is a Canadian non-profit advanced internet development corporation, supported by its members, project partners and the federal government. The partnership will bring advanced networking to municipalities, universities, schools and hospitals through the Annapolis Valley. The project will establish the backbone infrastructure that facilitates internet access in rural municipalities and assist in providing business opportunities. (Lawes, 2006). According to the government of Nova Scotia's website, high speed internet access will soon be available in every school, library and community college in the province (over 600 sites). Further, Statistics Canada data shows that in 1996 Nova Scotia was the most connected province in Canada with a total of 1,203 communities with internet access.

One of the three First Nations communities in Newfoundland and Labrador, Mushuau Innu First Nation, will be upgrading from dial-up to high speed as of 2007 (Government of Canada, 2006a). Mushuau Innu First Nation uses the internet for the sale of local crafts and art. A high speed connection will allow customers to reliably email retailers in the community to order merchandise (Mushuau Innu First Nation, 2006).

The announcement was made in February of 2004 that the Prince Edward Island and New Brunswick CANARIE research grid had been completed and now links research facilities to the CA*4net that has been established in different areas across Canada. The research grid is designed to increase bandwidth to the research, industry, and academic communities in New Brunswick and Prince Edward Island, so they can collaborate and participate in research and innovation projects regionally, nationally, and globally (CAnet-News, 2004).

Prince Edward Island is home to 67 Community Access Program (CAP) sites including 22 Schools, 18 Community sites, 10 Library sites, five Access PEI sites, six Canada Post sites, and six Family Resource sites (CAnet-News, 2004). There are two First Nations communities in Prince Edward Island and according to the Aboriginal Canada Portal both communities have high speed internet connections (Government of Canada, 2006a). In Nova Scotia there are 13 First Nations communities. According to the Aboriginal Canada Portal nine of these communities have high speed internet and four have a dial-up connection or 56K internet connection.

9.1.8 Yukon

The Yukon Telecommunications Study (2003) states that the "Yukon is well served in terms of the minimum basic telecom infrastructure" (Lemay-Yates Associates Inc., 2003). However, this comparison is made with the CRTC's basic service objective of a present network which provides for an individual line service, including the "capability to connect via low-speed data transmission to the Internet at local rates". Due to the remoteness of this geographical area the monthly expense is greater when compared with the rest of Canada; approximately $160 per month in the Yukon as compared with approximately $60 - $80 per month on average in Canada. The result is that both residents and businesses typically pay about double for internet connectivity. The Yukon connectivity report designates the higher number of active line connections to businesses greater reliance on communications due to the region's remoteness (Lemay-Yates Associates Inc., 2003). Additionally, in the late 1990's Yukon led the country in consumer internet connectivity (internet use from home). In 1998, home internet use in the Yukon was 32.9% as compared with 24.8% for Canada as a whole, and in 1999 the respective figures were 40.7% and 33.1%. However, as of 2003, the Yukon fell behind Canada's 50% average (Lemay-Yates Associates Inc., 2003).

Business connectivity in the Yukon in the late 1990's was similar to Canada as a whole for some sectors such as information and culture, retail, and finance. While in other sectors, including wholesale, construction, and mining, business connectivity lagged

severely. Yukon businesses became similar to businesses in Canada as a whole in 2003 with regard to connectivity when approximately three quarters of businesses in the Yukon were using the internet (Lemay-Yates Associates Inc., 2003).

The Yukon Telecommunications Study indicated that, in 2003, high speed connectivity covered most of the Yukon. However, the amount of bandwidth available to customers was not enough to allow for higher-end applications or was prohibitively expensive. Additionally, bandwidth connectivity in and out of the Yukon was also identified as a problem. Currently in the Yukon there is only one provider of backbone infrastructure which may be the cause of the continually higher cost of internet services throughout the region.

9.1.9 Northwest Territories

In November of 2005, the government of Canada signed an agreement with Falcon Communications GP Limited to provide broadband service to 31 Northwest Territories communities that were without service. Financing for the project was provided by the National Satellite Initiative (NSI) from which the government of Canada will be contributing $9.72 million. The goal of the NSI is to provide affordable internet connections to people in the North and in remote or isolated areas of Canada. Falcon Communications will be contributing $22.7 million to the project for the purchase of satellite capacity. Falcon Communications has partnered with SSI Micro to design and build the network and will eventually own and operate the network. SSI Micro has contributed $4.7 million to the project. "The funding will help to bring broadband access to more than 43,000 residents, 14,000 households, 2,531 institutions and 2,100 businesses in the Northwest Territories" (Government of Canada, 2005a). The network will connect the communities to each other and to the internet through a satellite connection.

The government of Canada provided additional funding for this project through the Broadband for Rural and Northern Development (BRAND) Pilot Project. The funding provided assists each of the 31 communities in creating a business plan and building satellite receiving stations. BRAND "was created to help provide high speed internet access to northern, rural, and First Nations communities" (Government of Canada, 2005a). The project consisted of constructing satellite infrastructure and developing training plans for Community ISPs.

The broadband network in the Northwest Territories is called Airware and is set up to offer internet as well as other services such as Voice over Internet Protocol (VoIP) and videoconferencing technology. Airware utilizes satellite and wireless technology and is able to provide services to both residential and commercial users. Today Airware is available in all communities in the Northwest Territories.

In January of 2006, Canada's Research & Education Network, CANARIE, announced the availability of their network, CA*net, in the Yukon and the Northwest Territories. CANARIE's CA*net in partnership with NothwesTel, Yukon College, Aurora College,

and the governments of Yukon and the Northwest Territories provides a national education and research link enhancing services to Yukon College in Whitehorse and its 13 campuses, 26 schools and several government departments. The new network enables schools to participate in two-way videoconferencing (CANARIE, 2005). In 2003 the Northwest Territories had a population of 41,389 people of which half are Aboriginal.

Although internet services are now offered in all NWT communities, further investment is required to realize the potential benefits offered by broadband connectivity. A symposium called Connecting the Northwest Territories was held February 6th and 7th, 2007 to attract local residents interested in becoming CSP's and to develop an ICT Strategic plan. The initial federal broadband project did not successfully integrate the technologies into communities in a manner that was relevant to local people. The objective of the symposium was to develop "an investment plan for promoting ICT applications in the NWT", also known as an ICT Strategic Plan (Government of Canada, 2007). The group, called Connect NWT, is focused on promoting community development through ICT opportunities.

9.1.10 Nunavut

In 2005, the Nunavut's Broadband Development Corporation announced the completion of their new network's (Qiniq) backbone infrastructure in 25 Inuit communities. Financing was obtained from Industry Canada and the Department of Indian and Northern Affairs Canada (INAC). Other financial support was provided by SSI Micro in the form of equipment already installed in Nunavut communities. As well, in kind support was provided by various Nunavut based organizations. Each of the 25 communities now has a local Community Service Provider (CSP) that operates the local ISP. The technology utilized is broadband high speed rather than dial-up and can be accessed up to 25 kilometres outside of each of the 25 Inuit communities. Qiniq is a network that gets it name from an Inuktitut word that means "to search". The Qiniq logo design and the subscriber and marketing material were both developed in Nunavut (Smith, 2005).

The president of the Qiniq network reports that after just one year of operation, one out of every four households in Nunavut is connected to the internet via the Qiniq network (Smith, 2006). The Qiniq network provides videoconferencing services between two locations and will soon provide multi-point videoconferencing services, building security services, and Voice over Internet Protocol telephone services. Smith also states that after only one year the business has achieved the market penetration needed to ensure the company's success (Smith, 2006).

9.1.11 First Nations Connectivity in Canada

The Aboriginal Canada Portal (www.aboriginalcanada.gc.ca) has reported on the connectivity status of all First Nation's communities in Canada. A survey was administered in 2005 and representatives from each community were given the following

options to characterize the type of internet connectivity available to residential customers in their community: cable, satellite, dial-up without incurring long distance charges, dial-up while incurring long distance charges, other and no access (Government of Canada, 2006a). Dial-up refers to an internet connection accessed via a phone line. No communities reported a dial-up connection for which long distance charges were incurred.

The following chart represents the responses given by community representatives for all First Nations in Canada. The second row, beneath the row that identifies the province or territory represents the total number of First Nation communities in each region. The first column, on the left, represents the type of connectivity. Broadband PoP or BB PoP refers to a Broadband Point of Presence which denotes that the community has access to broadband infrastructure (though the access may or may not be utilized) and that the source of that connectivity is within the community. High Speed (HS) refers to a connectivity characterized by its ability to download quickly, support multi-media applications, and facilitate immediate access to information. A dial-in no charge (DINC) connection refers to a 56K internet connection that is characterized by slow download speeds and is characterized as being generally unreliable. A reply of “No Access” would be given when there is no internet connectivity in the community. The reply “Other” would be given when a community’s connectivity situation is not characterized by any of the previous categories.

Table 1
First Nations Connectivity in Canada

	YT	NWT	PEI	NB	NS	NL	QC	ON	MB	SK	AB	BC
	15	26	2	15	13	3	39	137	62	69	45	197*
Broadband PoP	0	0	0	0	0	0	0	0	0	0	21	2
High Speed	14	11	2	15	9	1	23	68	15	20	22	101
Dial in No Charge	0	0	0	0	4	1	11	51	25	32	2	53
No Access	0	0	0	0	0	0	0	1	2	2	0	7
Other	1	0	0	0	0	0	0	13	0	0	0	1
DINC – BB Pop(2007)	0	0	0	0	0	0	0	0	0	0	0	23
No Access – BB Pop (2007)	0	0	0	0	0	0	0	0	0	0	0	1
DINC – HS (2007)	0	11	0	0	0	1	5	4	18	15	0	8
No Access – HS (2007)	0	4	0	0	0	0	0	0	1	0	0	1
Other – HS (2007)	0	0	0	0	0	0	0	0	1	0	0	0

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9.3 Interviews list

1) Ashmede Asgarali: September 5, 2006. (Northern Broadband Corporation)
2) Samantha Stevenson: September 5, 2006. (Manitoba First Nations SchoolNet Youth Initiative)
3) Mike Ducharme: September 5, 2006.
4) Dan Pellerin: September 5, 2006. (K-Net Network Manager)
5) Brian Beaton: September 6, 2006. (K-Net Services)
6) Maurice Montreuil: September 8, 2006. (Manitoba Broadband)
7) Ernie Dal Grande: October 5, 2006. (First Nations and Inuit Health Branch)
8) Don Maki: October 11, 2006. (Traditional Knowledge and Language Director)
9) Sue Hanley: October 13, 2006. (First Nations Technology Council)
10) Bill McIver: October 16, 2006. (Research Officer, National Research Council of Canada)
11) Martin Brooks: October 16, 2006. (Research Officer, National Research Council of Canada)
12) John Webb: October 19, 2006. (Network BC)
13) Peter Czerny: October 24, 2006. (Industry Canada, Broadband Program)
14) Ken Henry: October 24, 2006. (Manitoba Keewatinook Ininew Okimowin)
15) Adamee Itorcheak: November 9, 2006. (Nunanet, President)

9.4 Roundtables list

Iqaluit, Nunavut – Inuit - March 2007
Sioux Lookout, Ontario – First Nation - April 2007
Cranbrook, British Columbia – First Nation – April 2007
Edmonton, Alberta – Métis – June 2007
Winnipeg, Manitoba – Urban – June 2007

9.5 Symposium participants

The following is the participant list of the symposium held in Winnipeg at the Faculty of Human Ecology, University of Manitoba, on January 25, 2008. Two of the 23 participants were present through video-link.

1) Penny Carpenter, K-Net (Ontario)
2) Darrell Ohokannoak, Qiniq, Nunavut Broadband Development Corporation (Nunavut)
3) Yvonne Pratt, University of Calgary (Alberta)
4) Susan Barthel, Métis Settlement General Council (Alberta)
5) Don Maki, Ktunaxa Nation Network (British Columbia)
6) Pauline Eugene, Ktunaxa Nation Network (British Columbia)
7) Marcia Nickerson, Crossing Boundaries (Ontario)

8) Richard Jock, Assembly of First Nations (Ontario)
9) Justin Richards, Manitoba Métis Federation (Manitoba)
10) Ashmede Asgarali, Keewatin Tribal Council, FN SchoolNet (Manitoba)
11) Melody Meyers, Industry Canada, (Manitoba)
12) Crystal Chercoe, Innovative Technologies (Manitoba)
13) Lora Sanderson, Assembly of Manitoba Chiefs (Manitoba)
14) Mabel Horton, Assembly of Manitoba Chiefs (Manitoba)
15) Lisa Clarke, Assembly of Manitoba Chiefs (Manitoba)
16) Tracy Booth, University of Manitoba (Manitoba)
17) Dan Pellerin, First Nations SchoolNet (Manitoba)
18) Brian Beaton, K-Net (Ontario)
19) Sue Hanley, First Nations Technology Council (British Columbia)
20) John O'Neil, Simon Fraser University (British Columbia)
21) Jason Brown, The University of Western Ontario (Ontario)
22) Heather Henley, The University of Manitoba (Manitoba)
23) Javier Mignone, The University of Manitoba (Manitoba)

9.6 Technical terminology and acronyms

Access Point: An access point is one or more wireless radios that allow any user with a wireless computing device to log-on and access the internet.

Backbone: The primary connectivity mechanism of a hierarchical distributed system. All systems which have connectivity to an intermediate system on the backbone are assured of connectivity to each other. This does not prevent systems from setting up private arrangements with each other to bypass the backbone for reasons of cost, performance, or security.

Bandwidth: Bandwidth refers to how fast data flow through the path that it travels to the computer. It is usually measured in kilobits, megabits or gigabits per second.

Broadband: Broadband comes from the words "broad bandwidth" and is used to describe a high-capacity, two-way link between an end user and access network suppliers capable of supporting full-motion, interactive video applications.

LAN: Local Area Network. A data network intended to serve an area of only a few square kilometres or less. Because the network is known to cover only a small area, optimizations can be made in the network signal protocols that permit data rates up to 1000mb/s.

MAN: Metropolitan Area Network. A data network designed for a town or city. In terms of geographic breadth, MANs are larger than local-area networks (LANs), but smaller than wide-area networks (WANs). MANs are usually characterized by very high-speed connections using fibre optical cable or other digital media.

Mbps: Stands for Megabits per second, or millions of bits per second. This is a measurement of how much data can be transmitted through a connection. For example, 6.0 Mbps is 200 times faster than a 28.8 Kbps analogue modem.

Network: A computer network is a data communications system which interconnects computer systems at various different sites. A network may be composed of any combination of LANs or WANs.

Satellite: Refers to the type of broadband connection where information is sent from and arrives at a computer through satellite dishes.

Wireless: Refers to the type of broadband connection where information is sent from and arrives at a computer through transmission towers.

Intranet: Web technology in conjunction with a LAN to enable staff to share information, access databases and exchange documents and files. For many businesses, an intranet is an important step in streamlining and integrating internal businesses and processes.

Dark Fibre: A fibre-optic strand with no optical transmission equipment. Customers add their own equipment and build their own network, retaining complete control over all aspects of it.

Last Mile Connectivity: Refers to ground that the local provider will cover between the high speed connection at the door to the community and the user's homes and businesses.

Latency: Time taken to deliver a packet from the source to the receiver. Includes propagation delay (the time taken for the electrical or optical signals to travel the distance between the two points) and processing delay. Due to the distance to a satellite and back (over 34,000km each way), the latency when communicating via a satellite connection is at least 270 milliseconds, making interactive services difficult, compared to a delay of about 10 milliseconds across Europe via fibre.

Local Loop: Originally, the pair of wires (loop) between the subscriber (to a telephone system) and the local telephone exchange (switch or office). Now used as a generic term to describe the connection between the last switch/routing point and the subscriber, no matter what technology is used to deliver the service, nor what service (voice, data etc.) is delivered.

Optical Fibre: A method of guiding light over long distances with very little reduction on strength (attenuation or loss). A central core of high-refractive index material - usually very pure glass - is covered with a cladding of lower refractive index material. Modern fibres have losses in the order of 0.25 dB/km, so 1 km of fibre has less loss than a pair of ordinary spectacles or reading glasses.

Packet: A block of data. The terms packet, frame, and datagram are often used interchangeably.

PoP: Point of Presence (or Access Node). A site where customers can connect into the backbone network.

VoIP: Voice over IP. The ability to carry Packetised voice over an IP-based Internet with POTS-like functionality, reliability and voice quality.

WAN: Wide Area Network. As distinct from Local Area Network. A WAN connects multiple LANs together. Typically an ISP or service provider provides the WAN into which a company will connect their LANs from each site.