CRACIN Case Study Map – K-Net

December 2005

As a foundation for CRACIN's integrative research, case study teams will prepare a "Case Study Map" of their site that details its key characteristics, stakeholders, services and programs etc.. The Case Study Maps will serve to orient study teams to all of the different CRACIN case study sites, as well as to highlight both common and divergent characteristics, circumstances and experiences across them.

The existing "Case History" profiles prepared for the May 2004 Workshop in Montreal can serve as a starting point for the Case Study Maps, (available at: http://www.fis.utoronto.ca/bscw/bscw.cgi/0/622646) although we are looking for something more comprehensive than a simple up-date of these. Case Study teams should aim for a document that is 5-10 pages in length.

Case Study Maps will be shared at the CRACIN Graduate Student Colloquium on Integrative Research in Montreal on December 8/9, 2005. Completed Case Study Maps should be sent electronically to Susan Macdonald (cracin@fis.utoronto.ca) no later than Monday, December 5th so that these can be assembled into a booklet. The Case Study Maps will subsequently be posted on the CRACIN web site and circulated to the CRACIN Core Research Team.

Each Case Study Map should provide details about the following aspects of the case study organization and its activities, with attention being paid not only to providing descriptions of each aspect, but to their interaction as well (for example, how funding agency priorities and imperatives shape the focus and activities of community networking organizations):

Brief Case Study History:

The Kuh-ke-nah Network (K-Net) is a community network that currently comprises 60 First Nations communities across Ontario, and Quebec, Canada. K-Net Services is the telecom and ICT arm of Keewaytinook Okimakanak Tribal Council (the Northern Chiefs), an organization located in northwestern Ontario that brought the original vision of K-Net to life amongst the Tribal Council's six member communities in the mid 1990's.

Currently the telecom infrastructure under K-Net control comprises a C-Band Public Benefit transponder, IP video conferencing and telephony, web and email server space, and a variety of terrestrial and wireless links that effectively connect small, scattered First Nations communities with each other as well as the wider world. In the space of less than a decade, these K-Net communities have gone from a situation in which it was common for there to be but a single public payphone in a settlement, to the point where forty of these communities have broadband service to most households. This level of service exceeds that commonly found in large urban centres such as Toronto.

But K-Net is far more than a provider of basic carriage services. Rather than be a seller of products, it is a facilitator for First Nations organizations and communities. In this capacity it

brokers relationships among various agencies to provide a wide range of public and civic services in remote communities (e.g. telehealth applications, Industry Canada's First Nations SchoolNet, the Keewaytinook Internet High School (KiHS), personal homepages and email addresses, video conferencing and webcasting/archiving of public events).

It thus constitutes a (nearly) full-spectrum, vertically integrated service provider oriented to meeting the social and economic development needs of its primary constituents.
First Nations community ownership and control over local loops means that each community can adapt broadband services to address local challenges and priorities. For some communities, the priority is creating residential telephone access or cable plant for entertainment purposes, for others it is promoting education opportunities and public health online, and for others it is economic development. This aggregation of demand from disparate users creates economies of scale and allows the dynamic reallocation of bandwidth to meet social priorities (Internet high school classes, remote eye examinations, residential connectivity). While a reflection of the technical savvy and political acumen of its initiators, K-Net's achievements also derive from its First Nations roots. This is seen in its decentralized structure, which encourages resource pooling, knowledge sharing, and respect for local autonomy. Together these values support community-driven needs and objectives to shape the network and its applications.

Community Profile:

K-Net primarily serves a "high cost serving area"[1]. Its primary constituents are remote and sparsely populated First Nations communities that inhabit the Sioux Lookout district, an area of northwestern Ontario that spans 385,000 square kilometres. There are 25 First Nations communities in the district, and only one has fulltime road access. When the town of Sioux Lookout is included (pop. 5336), the district's total population reaches approximately 20,000. This gives it a total population density of approximately half a person per square kilometre. Indubitably, distance and isolation have shaped the fabric of this society.

The Sioux Lookout district is part of the Nishnawbe Aski Nation, a political territory that includes 53 First Nations across Northern Ontario.
On the map to the left, the 25 Sioux Lookout district First Nations communities occupy the northwestern portion of Ontario, and include, from the legend: Sandy Lake (an independent band), and communities represented by four tribal councils – the Independent First Nations Alliance, KO/Northern Chiefs, Shibogama, and Windigo. The communities are remote. Some are only accessible by air. For others, a temporary winter road links them to a

southern supply corridor during the months of February and March. Without winter roads it costs from CAD$400 to CAD$1000 to make a one-way trip by chartered aircraft to the nearest town Sioux Lookout (Ont.), or the larger cities of Thunder Bay (Ont.) and Winnipeg (Man.).

Populations in the communities vary between 100 and 2000 people. District tribal councils and Statistics Canada calculate that 50 per cent of the district's First Nations population is below 20 years of age, and that less than four per cent of the population is 60 years of age or older (Cf. Ramirez 2000, Statistics Canada 2001). Although English is spoken by most of the communities (especially the generations below 30 years of age), their indigenous language is Oji-Cree or Cree. The indigenous languages are primarily oral but a version of syllabic script exists and is taught in many of the communities' elementary schools.

Mission Statement and Goals:

Through the potential of locally controlled telecommunications and Information Communications Technology (ICT), the hope is that First Nations can better face the challenges of life in remote and isolated communities as part of a regionally integrated network society. This potential was recognized by the First Nations leadership as early as 1994, and harnessed for community development by Northern Chiefs and the K-Net Services team. Northern Chiefs strives to accomplish this vision based on a development process that focuses on local revenues, local employment, and locally driven applications.

Organization:

K-Net is managed by K-Net Services, the telecom and ICT branch of Keewaytinook Okimakanak tribal council (an Oji-Cree word meaning Northern Chiefs). The Northern Chiefs maintains offices in Balmertown, Fort Severn, and Thunder Bay. K-Net Services maintains a network headquarters in Sioux Lookout, with staff in Balmertown and Toronto. Maintaining such a distributed organization across these communities would not be feasible without K-Net. The network's circuits are collocated in Toronto at 151 Front St, a carrier hotel/data centre for over 150 international telecommunications companies. Through the carrier hotel, K-Net can negotiate access to Bell Canada, Telus, Allstream, CANARIE, and more. The carrier hotel also connects K-Net to Sunnybrook Hospital's Northern Ontario Rural Tele-Health Network, and the Education Network of Ontario (where it was previously collocated).

The core members of K-Net Services have worked together since the mid-1990s. Informally, they work in two teams. One team comprises a fulltime network manager, network systems analyst, and three network technicians. The network manager currently coordinates network services between the Northern Chiefs, K-Net communities, and other clients (e.g., government services, tribal councils, municipalities, businesses). He worked in a number of First Nations communities in Saskatchewan, Manitoba and Ontario. He has been an auditor and telecommunications engineer prior to joining K-Net Services. As network manager he is responsible for the overall design, implementation, and technical operations of the network.

The Network Systems Analyst designed K-Net's network architecture with the Network Manager. He monitors performance, and supervises upgrades and repairs of the network. He

designed an embedded Linux distribution that K-Net employed to route DirecPC satellite technology during its second growth phase from 1997 to 2002 (peeweelinux.com). Prior to joining K-Net Services he operated a satellite TV installation and repair service out of Sioux Lookout. The Network Systems Analyst is currently training an assistant who will eventually replace him. The assistant, a member of Eagle Lake First Nation, is the newest addition to K-Net Services. He studied computer systems at St Lawrence College in Kingston, and in previous work developed a community cable modem management system. Two technicians, one a member of Flying Post First Nation, and the other a long time resident of Sioux Lookout, operate K-Net's toll free helpdesk. The helpdesk serves all the K-Net communities and supports Ontario schools participating in Industry Canada's First Nations SchoolNet program. It is a line meant to help K-Net users troubleshoot hardware installs, virus protection, network failures, and the like. Alongside helpdesk duties, the technicians operate K-Net's call manager system for VOIP, and support the communities that employ K-Net's videoconferencing facilities. They also provide hardware and software maintenance.

The K-Net Services Coordinator oversees service delivery, special projects, and network applications. He directs the second informal team. He works closely with the Northern Chiefs' other branches in health, education, economic development, public works, justice, finance, and administration to mobilize ICT use policies and network applications for these areas. Prior to joining K-Net, the Services Coordinator worked with Contact North and Wahsa Distance Education Centre, two distance education programs that made inroads to northern Ontario First Nations during the late 1980s and early 1990s. He has cultivated extensive ties with area First Nations, neighbouring tribal councils, federal, provincial, and municipal governments, regional organizations, colleges, universities, and many other partners across Canada and abroad. He directs a team that consists of a Business Manager, a Graphic Designer, and a Multimedia Applications specialist.

The Business Manager, controls staff payroll and accounts. She is a status Indian living on an off-reserve community near Sioux Lookout. The Business Manager will take over the network manager's responsibilities when he retires. She has worked in various positions with the Northern Chiefs since the early 1990s. The Multimedia Applications specialist and Graphic Designer are responsible for designing and maintaining K-Net's web applications (e.g., portals, web mail, MyKnet homepages). The Multimedia Applications specialist is a member of Sandy Lake First Nation. He studied computer science at the University of Windsor and began working with K-Net as a summer student in 1995. He administers K-Net's web servers, which are all LAMP based (i.e., Linux, Apache, MySQL, and PHP). He co-designed the original ZED platform for K-Net's Internet High School in 2001. He also conducts "train the trainer" sessions in host communities on database management and web design (e.g., PostNuke CMS, Macromedia Flash, Dreamweaver, Adobe Photoshop). He is K-Net's first teleworker and manages the servers remotely from his home in Sandy Lake. The Graphic Designer is a member of Lac Seul First Nation. A visual artist and photographer, he designed the look and feel of the K-Net portal (www.knet.ca). He also produces videos, web-casts, and publicity materials for the Northern Chiefs and affiliate community services.

ICT Infrastructure:

K-Net Services has worked with satellite and terrestrial networks as well as different technologies such as DOCSIS cable installations, wireless (900 and 2400 megahertz) installations, HDSL and ADSL technologies. K-Net Services also has experience building embedded computers for various applications such as the K-Net router and the K-Net remote access server.

- K-Net is a comprehensive, reliable, secure and scalable network that is operational today providing broadband connectivity between 20 remote First Nations and other major centres across the province as well as across Canada (partner sites in Sydney - Nova Scotia, Wendake - Quebec, Winnipeg and Thompson - Manitoba, La Ronge - Saskatchewan, Vancouver -B.C.);
- A VPN tunnel is in place on the network today providing a connection to the telemedicine network's (NORTH) VPN concentrator which provides access to more than 70 hospitals located across the province and to the Health Science centre in Winnipeg;
- The pricing for the network is shared among all the different network users thus aggregating the bandwidth costs and supporting local community economic development efforts involving the "smart" use of ICTs;
- A fibre optic municipal network in addition to a local wireless loop is in operation in Sioux Lookout connecting the First Nation organizations and service providers to the First Nation communities on the network;
- A wireless broadband loop is in place in Thunder Bay/Fort William and Timmins to connect First Nation organizations and other partners to the network in those centres;
- High speed data, IP telephony and IP videoconferencing services are all being delivered and supported over the present network;
- A multi-point video Accord bridge and a Cisco IP audio Call Manager are now in place to handle multiple sites for both video and audio IP connections;
- C-Band broadband satellite services utilizing Industry Canada's public benefit transponder with a locally supported Network Management System in partnership with the Kativik Regional Government in northern Quebec;
- Experienced and knowledgeable staff is in place supporting the use of the network along with helpdesk services for NORTH Network (with a Service Level Agreement in place) and Industry Canada's First Nations SchoolNet program.

Key Services, Programs & Accomplishments:

K-Net is a platform for the delivery of multiple services, including education, health, and employment.

Among the network applications available to K-Net communities, telehealth consumes the greatest share of community bandwidth. It also pays for over half of the total cost of community bandwidth under the aggregated business model. At the centre of telehealth is the community nursing station. A nursing station is a medical clinic in remote First Nations communities that looks after routine medical examinations, homecare, and public health. The nursing station is an important fixture of service in the communities. It is funded by Health Canada.

Northern Chiefs' telehealth program began in 2002, when its six communities constituted the first clinical First Nations telehealth network in Canada. It has facilitated more than 1500 telehealth sessions from March 2002 to March 2005 (Rowlandson 2005). The K-Net telehealth network's origins date back to 1998, when the Northern Chiefs began an effort to leverage public and private investments for regional upgrades. These upgrades to terrestrial and satellite accessibility made telehealth possible across the Sioux Lookout district. The Northern Chiefs' partners in this endeavour include First Nations communities and tribal councils, Health Canada, Industry Canada FedNor, the Northern Ontario Rural Tele-Health Network (NORTH), the Northern Ontario Heritage Fund, Bell Canada, ADCOM, and CISCO.

To render telehealth operable K-Net maintains a VPN tunnel to the NORTH Network. NORTH provides remote community access to more than 70 hospitals located across Ontario, and to the Health Science Centre in Winnipeg, Manitoba.
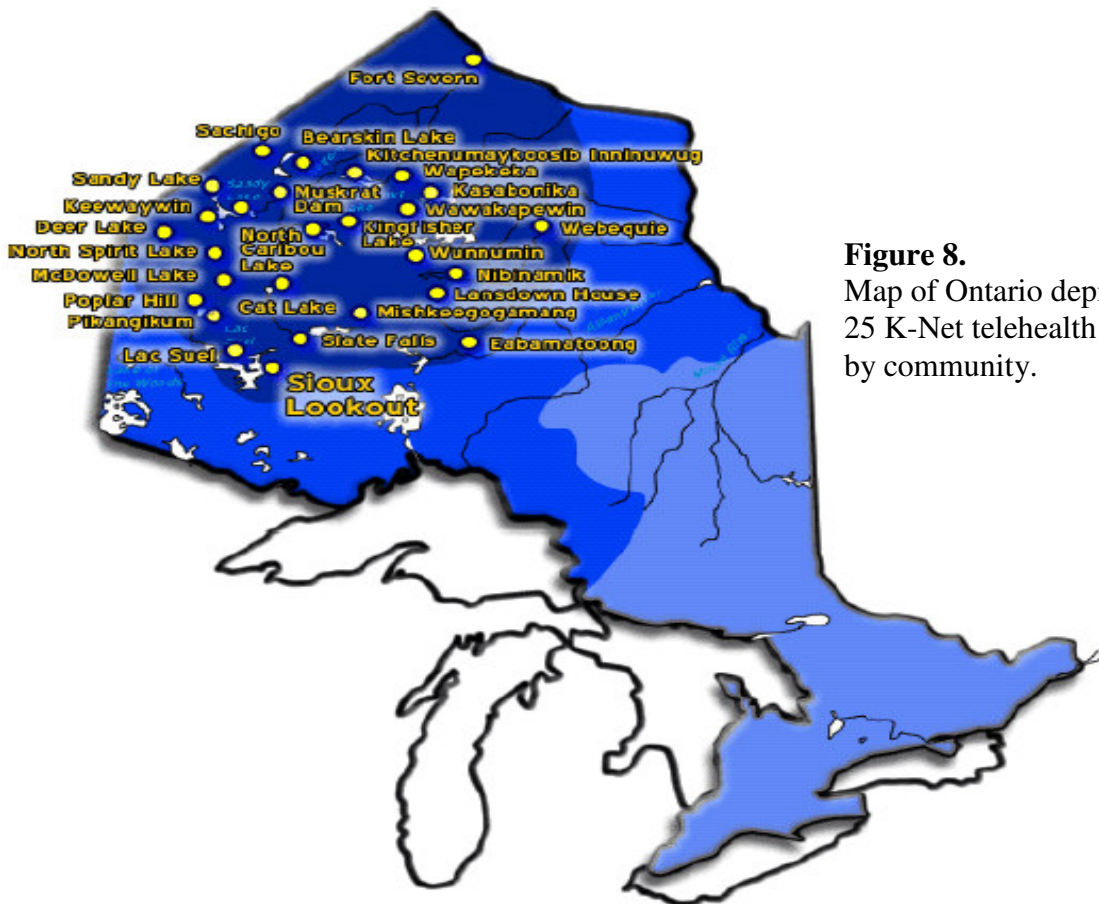
Figure 8. Map of Ontario depicting 25 K-Net telehealth sites by community.

Currently 25 K-Net communities have nursing stations that support telehealth applications, including all the First Nations communities of the Sioux Lookout district. These applications involve a standard set of equipment purchased for the communities by Northern Chiefs in partnership with allied tribal councils, Health Canada and Industry Canada FedNor, who have collectively invested over CAD$13M. The equipment is purchased from ADCOM (now owned by Telus) at a "best price" bulk rate. Each nursing station involved employs a Polycom videoconferencing unit and an ADCOM iDOC telemedicine workstation (featuring Polycom components). The Polycom unit is employed for general meetings and training

sessions across the telehealth network. It also facilitates therapy sessions for telepsychiatry and special needs education programs. The iDOC telemedicine workstation comes with a basic Polycom videoconferencing unit and peripherals such as an otoscope, a stethoscope, and a patient view camera.

Figure 3. From left to right: Otoscope, Stethoscope, 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 patient's skin rash or wound up to 50 times, and transmit the footage in real time or captured as a still image. K-Net can allocate enough bandwidth to support two consults at a time within a single nursing station.

The latest statistics on usage collected by the Northern Chief's telehealth team indicate a busy schedule for the telehealth network. From April to May 2005 there were 399 telehealth related events over the network: That breaks down to 171 clinical consults, 24 telepsychiatry sessions, 55 meetings, 73 education sessions (for staff), 5 family visits, 13 demos, 64 training practices, 18 tests, 60 cancellations, 4 spontaneous sessions, and 143 other events including consultations. The nursing stations also host lunchtime sessions for elders with the Polycom videoconferencing unit. Because many community elders seldom have the means to leave their reserve, the sessions enable them to see how old friends and relations are doing outside.

The Northern Chiefs and regional health partners have developed a number of therapeutic contexts for telehealth. In 2005, Nodin Family Services began to deploy an Art Therapy program over telehealth, to help young children open up and talk about difficult subjects such as physical and sexual abuse (Rowlandson 2005: 18). In partnership with the George Jeffrey Children's Treatment Centre, Northern Chiefs have proposed a model to deliver speech and language therapy over telehealth. These types of programs are seen as critical social needs in the Sioux Lookout district (Minthorn-Biggs 2004).

Nursing stations have also converted the traditional chemical process for developing X-rays into a digitization process. Now X-rays can be sent directly to a distant hospital in Sioux Lookout or Thunder Bay for a specialist to assess, instead of having to be processed on film and flown down. The VPN tunnelling K-Net provides ensures the secured transmission of confidential medical data.

To achieve this evolution in healthcare, Health Canada pays CAD$1,600 per month for bandwidth and support in each of the 25 K-Net telehealth communities. That is more than half of the cost of aggregated user bandwidth per community (i.e., approximately CAD$2,700). Cost

analyses conducted by Northern Chiefs, Health Canada, and their regional healthcare providers estimated that without telehealth applications Health Canada pays an average cost of CAD$1,000 per patient. This fee per patient is mostly taken up by Medevac costs between Sioux Lookout and the remote communities (Walmark 2005).

The health costs escalate the farther out one goes. For example, digital X-ray services in Fort Severn (the most northerly community in Ontario) have improved both emergency and regular health care. In one documented case (Walmark 2005: 19) a patient with a bad fracture was diagnosed and referred to the nearest specialist on duty, 800km away in Winnipeg – before the Medevac had reached him in Fort Severn. In the days of film X-ray, the patient would have been flown to Sioux Lookout, which is a four-hour trip by Medevac. The X-ray would have been taken and read in Sioux lookout, then the patient would have been referred to the Winnipeg specialist and the Medevac would have been called back to take him to Winnipeg. The digital X-ray unit resulted in the patient receiving care from the specialist four hours earlier than would have previously been the case and saved four hours of flight time for the Medevac (i.e., a cost of approximately CAD$4,000).

In 2005, K-Net Services commissioned the Keewaytinook Okimakanak Research Institute (KORI) to study the comparative costs of calls over the public switched telephone network versus K-Net VOIP. KORI's preliminary analysis found that use of K-Net (and related tools such as email, videoconference, and VOIP) by administrative offices in Northern Chiefs communities, between 2003 and 2005, demonstrated a 40 per cent cost savings in long distance charges (Seibel 2005). When calling outside their communities over the public switched telephone network, Northern Chiefs First Nations pay long distance rates from CAD$0.06 to CAD$0.08 a minute. They also incur average monthly service charges of around CAD$350 a month. Through their MAN, and improved VOIP systems, substantial savings are incurred (see **Figure 2**).

Figure 2.
Long Distance rates for Poplar Hill community from 02/2004 to 02/2005. Poplar Hill pays CAD$0.08/minute and a monthly service fee of CAD$350. Graph visualizes impact of MAN tools (email, V/C, and VOIP). Figure courtesy of KORI
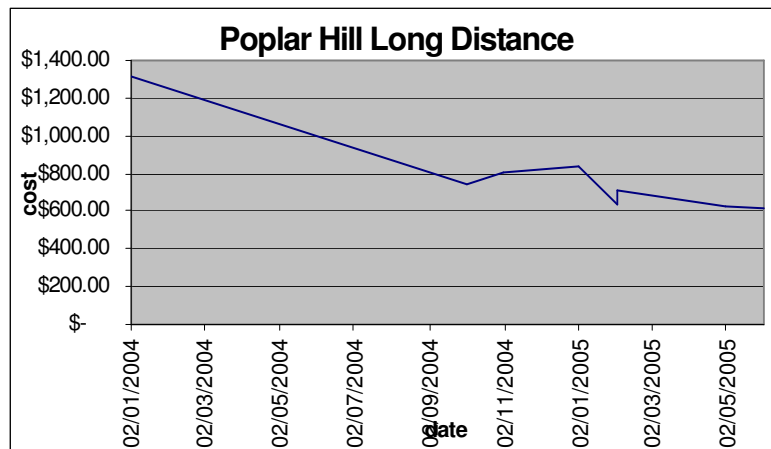
K-Net Services introduced videoconferencing units in 2001 through its participation in Industry Canada's SMART demonstration project. Later funding from Industry Canada's First Nations SchoolNet program and FedNor enabled K-Net Services to distribute units to schools and nursing stations across the Nishnawbe Aski Nation. They are publicly available in community band offices, health units, and schools. As a regional management organization for Industry Canada's First Nations SchoolNet program, K-Net Services has distributed over 200

videoconferencing units amongst 60 First Nations communities in Ontario, Quebec, and Manitoba. K-Net Services also maintains a multipoint video Accord bridge, an ISDN/PRI gateway and a Cisco IP audio Call Manager to handle IP multipoint conferencing connections. It also maintains a Macromedia Breeze server to facilitate multipoint web-casts and simultaneous chat sessions for conferences and e-learning applications.

Target groups and users:

Each participating First Nation owns and manages the Municipal Area Network (MAN) that renders K-Net operable in its community. This arrangement is maintained by the band office[1], the local First Nations government. Moreover, the Northern Chiefs requires that participating communities support the training and employment of local network technicians to cover repairs, upgrades, and general maintenance of the MAN. Per community, this requirement commonly translates to the positions of a Network Services Manager, one fulltime technician, and additional part-time workers who are familiar with standard operating procedures and are hired as needed. Due to their small populations (e.g., between 100 and 2000) some communities share technicians. Northern Chiefs' K-Net Services provides regular training sessions, and consults with community technicians on an as needed basis via listserv-s, email, videoconferencing, and VOIP.

K-Net's decentred relationship with community technicians evolved incrementally. Initially K-Net Services staff installed equipment, and invited the assistance of any local First Nations members who were interested in learning more to provide technical support. The Network Manager recalls that participating communities had at least one or two members who asked questions and dedicated responsibility to maintaining technical knowledge about the local loop, at the local level.

High turnover rates among band members proved (and continues to prove) a challenge for informal knowledge transfer to the communities. K-Net Services produced online manuals, FAQs, and news bulletins to maintain a knowledge base. The communities also initiated their own remedy for brain drain. As the Network Manager recalls, during K-Net's mid-1990s expansion from dialup to DirecPC/MSAT technology, community technicians started to answer each other's technical queries over K-Net's Bulletin Board System. Individuals were using the BBS to pool their knowledge about the network on their own initiative. This inspired an online dialogue between K-Net Services staff and community members, as staff stepped into the online forums to correct misunderstandings and elaborate details about the technologies. It also bolstered K-Net Services' confidence to intensify its decentred approach to development. With each follow up visit K-Net staff offloaded more of the regular technical duties to community technicians until community members could handle MAN maintenance confidently on their own. Today K-Net Services maintains various listserv-s and webpages to propagate and archive the knowledge pooled amongst community technicians and K-Net Services staff.

---

[1] A band office is composed of an elected Chief and Council, and hired administrative staff. Chief and Council are elected every two years. They devise community policy, represent the community's interests, and manage the community's relations with neighbours, tribal councils, and external governments (e.g., Indian and Northern Affairs Canada).

Besides its recruitment and support of community technicians, K-Net Services also enrolls local "community champions" (Ramirez 2000). Champions do more than represent community interests. They help develop network applications and maintain local accountability for the Northern Chiefs. They are responsible for articulating the fit between a community's perceived needs and the perceived benefits of a particular technology. Champions may be concerned citizens, social service professionals, or members of local government. They believe passionately about a concern, have extensive contacts in their communities, and want the proper tools to help achieve their respective missions. The tools the champions help conceive may not necessarily be ICT based, at least not right away. They could be a way of organizing human resources to address a social need, one that in later stages could be augmented by ICT for rapid regional deployment or to cut the costs of travel. Through Northern Chiefs and K-Net Services, champions have an outlet to build upon the talents and capacities already in their communities. They are given resources to "think big" and work with other champions from the district.

Before embarking on a new project or infrastructure upgrade, communities (largely through their champions) are encouraged to deliberate why they believe a certain technology would benefit their social needs. Plans and visions are openly discussed through town hall meetings and call in sessions over community radio. Moreover, once K-Net Services proceeds with a project, the community champions become enrolled in the development process, from the initial needs assessment to follow up evaluations. They rally community members for town hall meetings, they go door to door to explain project proposals, they create buzz through local media (e.g., community radio, newspapers), they lobby local members of parliament for recognition and support, and they continue the process of enrolment by identifying potential partners in the community.

Partnerships are crucial for sustainable community networks. K-Net Services believes that local organizations and service agencies in the communities should contribute to the ongoing operation and maintenance of the local network, thus splitting the costs amongst an aggregated user base so network services can be affordable for as many consumers as possible. In 2003, K-Net's aggregated business model was formalized into regional policy by the Nishnawbe Aski Nation of 53 northern Ontario First Nations, by order of Chiefs in Assembly Resolution 03/49: *Support for the Development of the NAN Broadband Regional Network for First Nations* (NAN 2003). The NAN resolution directs federal and provincial programs and services along with other regional agencies to work cooperatively with and utilize local First Nations community networks. It also directs NAN's Executive Council (i.e., the elected Chiefs of northern Ontario) to lobby all levels of government for alternate service delivery models based on broadband.

Financial & other resources:

Data released by the Northern Chiefs in 2003 and 2005 presented the following costs scheme for terrestrial network services (Cf. Ramirez et al. 2003; Rowlandson 2005). The figures are subject to change with fluctuations in the market, but what is quoted below presents as close an account as can be obtained. Each community on K-Net's terrestrial network owes the Northern Chiefs approximately CAD$2,675 per month for bandwidth. From this amount, K-Net Services pays Bell Canada, the incumbent telco, a monthly fee per community of CAD$2,075 for bandwidth. The balance of CAD$600 consists of CAD$300/month for T1 Internet access (1.544Mbps),

which K-Net purchases in bulk, CAD$200 for the shared portion of a Toronto linkup, and CAD$100 for service support.

The monthly community fee of CAD$2,675 is made affordable by aggregate demand. To become eligible for service each community must devise a scheme to harness the purchasing power of a variety of customers. This condition defines K-Net's business aggregator model. Primary customers include the band office, school, constabulary (Nishnawbe Aski Police Services), nursing station, local businesses, and special online services such as the Northern Chiefs' Keewaytinook Internet High School (subsidized by Indian and Northern Affairs Canada). Together, these various institutions, companies, and residents deal with K-Net Services through the auspices of the community band office. There are certain exceptions. The nursing station is an "anchor tenant" whose consumption of bandwidth exceeds half of the total bandwidth allocated for community usage. As a result, Health Canada deals directly with K-Net Services to purchase bandwidth. Currently, community schools are also an exception, as K-Net Services subsidizes their bandwidth consumption with funds from Industry Canada's First Nations SchoolNet program. The subsequent regional network of community aggregates allows K-Net Services to negotiate bulk rates from Bell Canada and other suppliers, such as Cisco, and ADCOM (a Canadian supplier of videoconferencing and telemedicine products).

The scheme for the 13 northwestern Ontario satellite served communities is based on an arrangement made between the Northern Chiefs, Industry Canada, and Telesat under the C-Band Public Benefits Transponder Agreement (Walmark 2005). It too exemplifies an aggregated business model. In 2002, Industry Canada agreed to have Northern Chiefs administer satellite services to remote communities, via transponder space that Telesat Canada had donated to Industry Canada's National Satellite Initiative for the purposes of public benefit. Telesat donated 12.5 MHz of transponder space to K-Net. K-Net Services chose not to rigidly divide the public benefit bandwidth amongst communities as no community would then have had the 880 Kbps required to support videoconference based applications such as telehealth. They chose to employ Time Division Multiplexing (TDMA) technology, an older protocol common in terrestrial networks, to pool the public benefit resource and supply sufficient bandwidth for applications at the times required. While Internet and email might slow down in order that one community had the necessary bandwidth to do video conferencing or a telehealth consult, no individual community was ever completely cut off from the network.

By November 2002, the northwestern Ontario First Nations of Fort Severn, Slate Falls, Fort Hope, Webequie, and Kasabonika, and the Inuit community of Kuujjuaq, Quebec were sharing the 12.5mhz service. By May 2004, the northernwestern Ontario First Nations of Cat Lake, Weagamow and Sachigo Lake had joined the network. Eight Ontario and one Quebec sites were now sharing 12.5 MHz – nominally 1.4 MHz each. Shortly after, K-Net installed a DVB carrier to increase the output of the public benefit. Two 3.25 MHz TDMA carriers delivered up to 2 Mbps each of two-way traffic. The 5.9 MHz DVB carrier delivered between 6 and 7 Mbps. The nine communities therefore shared approximately 11 Mbps of bandwidth within this configuration. Neskantaga First Nation joined the public benefit network in August 2004. Several more First Nations joined in 2005. Muskrat Dam, Ontario and Obedjiwan Quebec came online in spring 2005, followed by Martin Falls, Peawanuk and Attawapiskat in the summer. The cost of service is based on a price comparable to the cost of terrestrial service to

remote communities. Currently each satellite served community pays CAD$2,700 for T1 capacity. As in the terrestrial network arrangement this fee is split amongst an aggregate consumer base. Moreover, Health Canada is an anchor tenant, and First Nations SchoolNet subsidizes school connectivity.

Skills/capacities:

- Since 1995 K-Net Services has undertaken skills training for Community Computer Technicians and Network operators
- Through Industry Canada's First Nations SchoolNet programme K-Net Services has organized youth employment/training projects and science camps.
- KO Telehealth recruits and trains Community Telehealth Coordinators

Funders & External stakeholders:

A point-by-point analysis of the funding sources behind K-Net is beyond the scope of this map. As with K-Net's aggregated business model (see above), capital costs have been similarly split amongst a consortium of partners. Initial investments, beginning in 1994, were undertaken by regional stakeholders compacted within the Sioux Lookout Aboriginal Area Management Board (SLAAMB). SLAAMB's core contributions over five years (1994 – 1999) seeded the fundamental knowledge and technology transfer required to embed K-Net in the communities. It supported K-Net's early BBS development, Community Computer Technician training, and Network Technician Training. Behind each SLAAMB contribution were Band Council Resolutions directing investment and interest from the communities to K-Net.

K-Net's transformation into a WAN in the late 1990s depended on federal, provincial, and corporate funding partnerships. For the terrestrial network the biggest capital costs were covered by Bell Canada in 2000 and 2001, during the North of Red Lake and North of Pickle Lake digital infrastructure projects. Bell Canada's contribution to these projects is valued at approximately CAD$15M. Industry Canada FedNor, Human Resources Development Canada, the Northern Ontario Heritage Fund, Indian and Northern Affairs Canada, the Sioux Lookout Aboriginal Area Management Board, and district First Nations also made contributions valuing over CAD$10M. For the satellite network it is estimated that a total over CAD$13M was required to cover capital costs. This total reflects investments made by Telesat and three programs under Industry Canada. The value of Telesat's transponder space over 15 years is approximately CAD$8M. The first K-Net satellite community, Fort Severn, had benefited from CAD$1.8M in SMART funding in 2001. During the expansion of the satellite network from 2002 to 2005, Industry Canada FedNor contributed approximately CAD$5.1M to cover capital costs, at per community investments ranging from CAD$200K to CAD$500K. These costs included establishing earth stations and network management systems in Sioux Lookout. Industry Canada's Broadband for Rural and Northern Development program contributed CAD$380K to supplement capital costs for two communities.

Clearly Northern Chiefs could not scale up without the partnerships federal and provincial governments, and the local incumbent Bell Canada. Beyond K-Net's phase two growth (from 1998 onwards) Northern Chiefs would have been hard pressed to construct

prototype applications without the external support of Bell Canada, Industry Canada FedNor, First Nations SchoolNet, the Northern Ontario Heritage Fund, Health Canada, and others.

Broader community:

There are currently thirty-eight thousand K-Net email account holders. These statistics are impressive given that the Sioux Lookout district's total population is approximately 20,000. K-Net Services estimates an almost total penetration of K-Net mail in the district. Registration is free, and access is web-based. There are over 18,000 individuals and groups hosting sites on My K-Net. Currently, the most popular site designs are based on the Open Source Post Nuke content management system (CMS). Users can add modules that expand sites into chat rooms, auctions, media players, and photo-galleries. Although K-Net Services specifies a 5M storage limit for homepage users, to date it has not enforced the rule. As a result, most homepages feature a soundtrack, video clips, and dynamic scripts. Because news travels fast over the Internet, in 2004 K-Net Services began to restrict new homepage accounts to First Nations and members of northern communities.

Policy/regulatory/legal:

> K-Net Services and KO Tribal Council enact projects on the basis of Band Council resolutions. This means that they present endorsements by individual First Nations bands as part of their strategy to procure funds from federal and provincial programmes. The strategy presents K-Net as a consortium of local First Nations interests.
> K-Net Services is a Regional Management Organization for Industry Canada's First Nations SchoolNet programme. It enacts FNS policy (e.g., distributes programme dollars and implements projects) for participating First Nations schools across Ontario. K-Net Services has discretion to shape projects according to its own internally derived mandates (e.g., youth employment, ICT support for schools).