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# Keewaytinook Mobile in Fort Severn First Nation

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*Abstract: Fort Severn First Nation is a remote fly-in Cree community on Hudson Bay. About 400 people live in the community, and their lifestyle reflects a deep respect for and connection to the land. In November 2009, Fort Severn and its tribal council, Keewaytinook Okimakanak, established Keewaytinook Mobile (KM) service in the community. KM, an innovative community-owned and managed GSM cellular and data service, is an example of self-determination applied to telecommunications. It is also the result of a number of strategic partnerships that came together to address local needs and priorities. This paper includes a review of the history of Keewaytinook Mobile and its implementation in Fort Severn First Nation, and a study of how and why community members are using or not using the service. The analysis is based on interviews with 42 community members conducted in March 2010 and a follow-up discussion with community members in November 2010. The paper discusses the challenges, opportunities and ways forward for KM in Fort Severn.*

## 1 Introduction

Fort Severn First Nation, a small remote community in Northern Ontario, introduced the Keewaytinook Mobile (KM) service in late 2009. This paper highlights the leadership shown by Fort Severn and its tribal council Keewaytinook Okimakanak in developing and implementing the KM cell phone service. It describes the cultural context of the Fort Severn community and how and why the community members are using KM. Finally, it puts forward some possibilities for the future.

The authors use a community informatics approach, understanding that the KM infrastructure, technology and service are potential tools for social benefit. Community informatics theory (Gurstein,

2003) suggests that the introduction of KM into Fort Severn offers the community more capacity for independence and social, cultural or economic development.

The use of mobile communications technologies is widespread in most regions of the world; an estimated five billion mobile phones were in use in 2010. Over the past decade, the global growth of mobile and wireless services has sparked considerable interest in how they can contribute to development. For example, Lam et al., (2010) found that the link between mobile phone use and economic growth is not limited to high-income countries but is also evident in lower-income countries. Similarly, Kauffman et al. (2009) found that wide diffusion and innovative uses of digital wireless phones are important sources of a country's economic growth and social development.

Economic sustainability is a need for Fort Severn, as it is for any First Nations community in Canada. The researchers are interested in how mobile technologies can stimulate economic and community development in Fort Severn and other First Nations. However the focus of the current study is more basic. Understanding how and why community members are using or not using the KM service and mobile technologies more generally is an important first step to understanding how KM can in future contribute to development in Fort Severn.

KM can be situated within the larger national mobilization by First Nations to build digital infrastructure and services to meet community needs. As outlined in McMahon et al., (2010) and O'Donnell et al. (2010), over the past two decades, First Nations across Canada have been actively building a network of telecommunications services for their communities, and a number of these services are community-owned and operated. A new telecommunications service such as KM in a remote northern community like Fort Severn is an example of self-determination applied to telecommunications.

This study is to our knowledge the first one in Canada or internationally to explore how mobile communications can address the needs of remote indigenous communities like Fort Severn. One previous study in an Australian Aboriginal community (Dyson and Brady, 2009) found that community members were actively using mobile phones soon after their introduction in the community, at a much higher rate of adoption than other information and communication technologies. However that community, in a rural area serviced by a commercial wireless provider, cannot be directly compared to Fort Severn, which is extremely remote and has a different cultural context. Another recent study analyzing the potential impact of mobile technologies on learning opportunities of indigenous children in Latin America (Kim et al, 2008) assumed a large population base; again, in the Fort Severn case, the small size of the population makes such comparisons difficult.

Fort Severn is a unique coastal environment heavily involved in and dependant on traditional land-based activities such as trapping, fishing and hunting. The study demonstrates that the specific remote and land-based context of this small community has led to specific requirements for the Keewaytinook Mobile service. The extent to which KM can meet these community requirements will determine the future of KM in Fort Severn.

## 2 History and Overview of Keewaytinook Mobile (KM)

The history of Keewaytinook Mobile (KM) begins with the leadership of the KO tribal council, K-Net, and the First Nations communities that own and operate local KM services. The Keewaytinook Okimakanak (KO) Tribal Council (Northern Chiefs) serves six First Nations in northwestern Ontario, and the IT division of KO is the Kuhkenah Network (K-Net) (www.knet.ca).

KO/K-Net has a long history of developing telecommunications services for and with KO communities and also other communities in northwestern Ontario and into Manitoba and Quebec. This development occurs in the face of extreme challenges on many levels – including geographical and technical challenges, federal policy inaction, and social and organizational restraints (Fiser and Clement, 2009; McMahon et al., 2010; O'Donnell et al., 2009a, 2009b, 2010).

K-Net helps to sustain distinctive and minority cultures, plan and act to meet community needs, mobilize communities, encourage and support individual and community use of ICT, and foster and encourage community-based use of ICT for social interaction (Beaton, Fiddler & Rowlandson, 2004; Carpenter, 2010; Fiser & Clement, 2009; O'Donnell et. al, 2009 and 2010). Its new KM service is rooted in the same community development ethos.

K-Net remains a national leader in broadband communication services for remote and rural First Nations, and Keewaytinook Mobile is a further extension of its existing service portfolio. From its office in Sioux Lookout, Ontario, K-Net provides web, Internet, satellite and videoconferencing services, and infrastructure to rural and remote communities in northern Ontario – and now cellular services as well.

The history of Keewaytinook Mobile can be traced to the mid-2000s, when several KO First Nations, including Fort Severn, were discussing with KO/K-Net the possibility of developing a cell phone service in their communities. At that time, none of the First Nations communities in the region had a cell phone service. There is no regulation in Canada forcing commercial telecommunication companies to provide services in any particular area of the country. They need to have a business case (a proven return on investment) to develop services in rural and remote areas; in general they are not willing to expand into remote northern communities without significant public support (McMahon, 2010; O'Donnell, 2010).

Building a new cell phone service in a remote northern community is a large infrastructure project requiring public and private partners. KO began actively looking for opportunities. In March 2007, the Northern Ontario Heritage Fund Corporation (NOHFC) announced its interest in piloting a cellular development project in two remote First Nations. The NOHFC offers funding programs to promote job creation and economic development in the North. Following the announcement, KO issued a request for proposals to develop a pilot project. Major hurdles identified in the request for proposals included the remoteness of the communities, a limited population base, lack of access roads, and limited telecom and transport facilities.

The successful bidder was Lyon Wireless Inc., based in Thunder Bay, Ontario. Their solution was an IP-based soft switch GSM mobile wireless network. The company was then contracted for the design, engineering, licensing, approvals, acquisition, and installation and testing of the network facilities. Lyon Wireless was also the pilot project manager.

KO worked with Indian and Northern Affairs Canada (INAC) and NOHFC to secure the required funding, and with the KO Chiefs to ensure community support for the project. The two KO communities selected for the pilot project were Keewaywin First Nation and North Caribou Lake First Nation, the first terrestrially-served and the second satellite-served.

By January 2008, the first towers and telco buildings were purchased and cellular equipment ordered from the supplier, Lemko. The Lemko architecture located in Fort Severn includes a Node1® GSM Base Station unit that is located at the cell tower. The Node2® unit that serves as the cellular hub and gateway is located at Dryden Municipal Telephone System (DMTS), the cellular network partner's central office. Together, the two Node units deliver a low cost, full-functionality cellular system. In Fort Severn the Node1 GSM Base Station is configured with 48 channel capacity, supports the local network subscriber database and services and the Node2 unit supports complete cellular call processing, network management, billing, gateway, and subscriber services.

The architecture is supported by a 200-foot tower in Fort Severn to provide a potential 30 kilometre area coverage and range of services to support the outdoor lifestyle and short-distance travel. The LAN equipment is connected to the Fort Severn/K-Net services C-Band satellite service POP (Point-of-Presence) in the community – in some communities this is a cable connection and in others a wireless connection to the local POP. The local cell traffic is managed on the Node1 BTS and the management data is then shared with the Node2 network management system. In Sioux Lookout, the community's IP traffic is routed to the Node1 in Dryden where the mobile switching centre was established in partnership with KO/K-Net and the DMTS office, with an IP-based soft-switch to manage remote sites and allow roaming to occur on partner networks.

In February 2008, the hiring process was established for KM Community Liaison which is based in Keewaywin First Nation and the Community Technician positions based in each partner First Nation. By March, the towers had been shipped and delivered into Keewaywin and North Caribou Lake. By August, the Keewaywin Telco building and tower was set up. Meetings and training to support the new Keewaytinook Mobile service were ongoing.

In mid-2008, an agreement was signed between KO/K-Net and a major wireless provider. The company holds an Industry Canada license for cellular spectrum service across Canada but at that point did not provide cell service in any remote and most rural First Nations communities across northwestern Ontario. The agreement between the company and K-Net allowed K-Net to apply to Industry Canada for a subordinate license to the company's license. This allowed Keewaytinook Mobile service to offer cell phone services using the widely available commercial wireless spectrum.

The Dryden Municipal Telephone System (DMTS) is a full service, municipality-owned telephone company with a coverage area extending along the highway network across northwestern Ontario. Early in the development of KM, Lyon Wireless learned that DMTS was planning to use the same cellular solution to develop their mobile services for their customers. The KO/K-Net team met with DMTS management to develop a strategy to work together to build their two cellular networks. DMTS now provides the Node2 network, gateway and billing services for KM. The KM prepaid mobile wireless service works on the KM community network and the wider DMTS / KM extended service calling area as result of a the KM-DMTS agreement. As DMTS expands its service area in Northern Ontario, KM

subscribers will benefit from the expanded service area, and as more First Nations communities sign on to KM, the coverage will continue to grow between First Nations.

The basic business model for KM is for clients to purchase pre-paid KM phone cards, in $10 or $20 or $50 amounts. DMTS provides the cards at a wholesale rate to KM, so KM makes a percentage of revenue on every card sold that is collected into a common KM fund. The First Nation partner keeps the majority of the revenue to cover their local operating costs. Calls on the KM network for KM prepaid services are presently priced at $0.05 per airtime minute for local calls within the home community or outside the community within the KM and DMTS networks. North American long distance KM customer within the KM network is charged the $0.05 airtime charge plus $0.10 per minute for the long distance call. Customers can pay $2.50 for unlimited SMS texting and voice-mail services, if these services are desired. There is presently no cost for data services as this service still needs to be developed. GSM compatible phones, supporting both data and text, are priced at about $135 each.

People visiting the community with their GSM phones are able to roam on the KM network because of its partnership with DMTS. KM has a roaming agreement with DMTS. DMTS has roaming agreements with most of the major telcos. Therefore most GSM phones from other providers work in Fort Severn. KM customers who need to travel outside of the KM-DMTS network region need to either purchase a pre-paid service from the local provider or purchase a post-paid cell plan to be able to roam in other parts of the country.

The Keewaytinook Mobile website went live in July 2008 (http://mobile.knet.ca). On its website, Keewaytinook Mobile describes itself as “the new First Nation owned telecom group delivering GSM cellular and data services in remote and rural communities across Northern Ontario.” The service offers voice calls, voice mail, text, data and call forward. Users do not need to sign contracts and there are no credit checks.

The KM model is for participating First Nations communities to own and operate Local Cellular Service Providers (LCSP) in coordination with KO/K-Net and other users of the community cellular network. The service could be considered a substitute for land-line service. The LCSPs administer local sales of the pre-paid cards and phones and support technical maintenance. The KO/K-Net team recommends technical infrastructure designs and assists with seeking capital funding.

The KM community partners have identified a number of economic and social benefits to joining the network, including to: develop and sustain essential telecommunications services; improve local connectivity solutions and broadband applications; and increase telecommunications access to community users and provide services to community visitors. The community-based LCSPs respond to the unique needs and business philosophy of each community.

In a press released issued in July 2009, KO noted that with the success of the KM pilot project in two First Nations, “the chiefs of Keewaytinook Okimakanak moved quickly to invest in the development of mobile services in the other four KO First Nations including Deer Lake, Fort Severn, North Spirit Lake and Poplar Hill. Mobile IP applications will support the next generation of communication technologies and services to address the needs of First Nations across the north.”

Following on from the pilot project, by February 2009, telco buildings were shipped to the remaining four KO First Nations, with a tower also shipped to both Deer Lake First Nation and Fort Severn First Nation. The cell tower was erected in Fort Severn in August 2009.

## 3 Profile of Fort Severn First Nation

The Washaho Cree Nation at Fort Severn, the most northerly Arctic coastal community in Ontario, is located on the Severn River, nine kilometers from where it drains into Hudson Bay. The current population is approximately 650 status indigenous people, of whom about 400 live on-reserve. The language in the community is Cree. English is spoken by the school-educated people.

Fort Severn First Nation government consists of an elected Chief and Band Council. There is an elected councilor for every hundred community members. Fort Severn is a member of the Keewaytinook Okimakanak Tribal Council and the Nishnawbe-Aski Nation (Treaty #9 area).

Hunting, trapping and being on the land are central to community life. Almost every household depends on trapping to supplement household income. Trappers from the community travel as far as 200 kilometers from Fort Severn and some traplines go past the Manitoba border. The area is very rich in wildlife, including black bears, polar bears, moose, caribou, wolves, foxes, lynx, fishers, martens, otters, beavers, rabbits and minks. Many different kinds of birds inhabit the area, as do many different species of fish. There is also the beluga whale and seal. Local vegetation used for food includes many kinds of berries.

Winter usually sets in the middle of October. Winter temperatures vary and cold snaps down to -40 C and lower for several days are common. The river freezes in late October and usually breaks up in mid-May. During a short period in the winter, the community is accessible via winter roads from other First Nations communities located several hours' drive in different directions. Year-round, there is a daily flight to and from Sioux Lookout. Once a year, in September, barge services bring in supplies for the Northern Store and band businesses or members who order gas or vehicles from Moosonee, Ontario.

It is worth noting that compared to most Canadian communities, even most First Nations communities, Fort Severn is very isolated and expensive to visit. The flying distance from Toronto to Fort Severn is 1,495 kilometres. A return flight from Toronto and other Canadian cities to Sioux Lookout costs more than $1,000, and the follow-on return flight to Fort Severn can cost the same, making the total airfare cost about $2,000.

There are approximately 90 residences in Fort Severn, with most homes located on one of the several roads in the community. Even though most of the houses are not very close together, the community is quite small; it would take less than an hour to walk up and down every road and past every building. The small physical size of the community could be an important factor in understanding why residents may choose not to use a cell phone to communicate with each other.

On average, six people live in every residence, more than twice the national Canadian average. Single persons usually live with their parents, due to the housing shortage. Every household has a snow machine or a truck or four-wheeler, essential vehicles for travelling outside the community for hauling water, harvesting firewood, and for trapping and hunting.

Other than residential housing, the other buildings include the band office, health centre, school, post office, e-Centre, teacher residence, radio station, Wahsa distance education centre, youth centre, band garages, several warehouses and trailers, carpentry shop, and a water treatment plant. The community has a nine-room hotel, the Niska Inn, primarily used by visitors. There is only one store in the community, the Northern Store, originally known as the Hudson's Bay Company.

Transient workers include nursing staff, teachers, police officers, and the Northern Store manager. The community has a very high unemployment rate, estimated at more than 70%. Full-time employment - other than the local government, band council staff, and health and education staff – includes airport personnel, Ontario Hydro, Bell Canada, and Northern Store clerks. Seasonal employment consists of hunting, fishing, trapping, guiding, and housing and winter road construction.

According to community records, more than 90% of community households own televisions, telephones and radios and have internet service. In 1991, a cable TV system was installed that now has 50 channels plus a community channel for local messaging. There is also a local radio station with spoken Cree programming, and regular English radio broadcasts from Wawatay radio in Northern Ontario. All the community organizations and services are networked via the local cable network that was upgraded in 2000 when their C-Band data satellite network was established. In 1998 a wireless data network was installed to service the Keewaytinook Internet High School, the band office and the health centre. This original wireless network was established in partnership with Industry Canada's FedNor and First Nations SchoolNet programs but was later upgraded to the local cable network.

## 4 Study Methodology

The Keewaytinook Mobile service in Fort Severn was switched on in November 2009. Almost four months later, in March 2010, the researchers undertook a study of KM in Fort Severn, as part of the larger VideoCom project. VideoCom is a collaborative research project exploring how remote and rural First Nations communities are using information and communication technologies. The project has been ongoing since July 2006 and has produced many publications and outreach events.

VideoCom (http://videocom.firstnation.ca) is a partnership between three First Nations organizations and two research organizations that spans the Atlantic, Quebec, and Ontario regions (O'Donnell et al., 2009). The research protocols are developed in collaboration with the project partners and reviewed by the research ethics boards at the University of New Brunswick and the National Research Council.

This current study was conducted with the support of Keewaytinook Okimakanak (KO), our partner in Ontario. KO staff provided expertise, feedback and support throughout the various stages of this study, including the design of the questionnaire and measures, helping foster connections with the communities, recruitment, and other activities.

In October 2009, in collaboration with KO, the VideoCom lead researcher sent a letter to the Chiefs of 33 First Nations in the Sioux Lookout Zone in northwestern Ontario, inviting them to participate in the VideoCom initiative and host a community visit. Two First Nations, including Fort Severn, accepted the invitation. The Chief of Fort Severn appointed a community liaison to work with the researchers to organize the visits.

The research team was welcomed into Fort Severn First Nation in March 2010. To recruit interview participants, researchers employed the following methods: circulating posters prior to our visit; visiting community centers (e-Centre, health center, Band office) to meet community members and invite them to participate; advertising the study at a parallel outreach event (community video festival); and placing an advertisement on the community television channel. Finally, the "snowball approach" was effective.

In total, 42 Fort Severn Nations community members participated in this study. All were over 18 years old; however specific age information was not collected. Participants reported holding a variety of roles and positions within the communities, including health workers, teachers, family members and caregivers (e.g., mothers), elders, leaders, band council staff, community workers, part-time workers, hunters, technology support workers, and others. Our sample included 20 women and 22 men. The researchers believe the participants represent a wide spectrum of the Fort Severn population.

The structured interview guide had 12 sections about the use of technology, including one section on mobile technologies. Specifically, participants were asked if they had a cell phone, whether or not they used a cell phone and how often they used it for different activities (talking, texting, internet, and so on) on a 5-point scale (never, yearly, monthly, weekly, daily). Finally, they were asked why they did or did not use the Keewaytinook Mobile service and what their perceptions and experiences were with the service. In addition, the KM service representative in the community was interviewed separately to discuss issues arising with the service.

The interviews, following the 12 sections of the guide, lasted between 20 minutes and one hour. Participants were given a $20 honorarium. All 42 interview audio recordings were transcribed and the transcripts imported into a qualitative analysis software program – NVivo. The transcript sections related to mobile technologies were coded thematically for reasons for using a cell phone and reasons for not using one. Typically, when performing a thematic analysis, subthemes and data are only reported if more than one individual has raised the same issue, so as to avoid "n of 1" issues. However, since this is new and exploratory research, all of the concerns of community members were identified, even if the point was only raised by one participant. During the paper drafting, the transcripts were reviewed again to identify quotations to illustrate the findings.

Following the analysis of the interview data, the research team returned to Fort Severn for a visit in November 2010. As part of the visit, there was an informal discussion with community members about Keewaytinook Mobile to discuss the initial findings of the study in March. At this meeting, community members explained to the researchers that several of the concerns raised earlier in the year had since been mostly resolved. These will be discussed in the research findings.

During the November visit, the outline of this research paper was discussed and revised with the community author (Kakekaspan), who also supplied information about the community for the paper. The paper outline was then developed and revised again in communication with KO and the co-authors. K-Net supplied background documents about KM that were essential for reconstructing the history of the service. One author, (Mak) a university student, participated in the November visit to Fort Severn to establish the DiabeTEXTs service; he contributed the section about future applications of the KM service.

## 5 Study Findings

### 5.1 Cell Phone Ownership and Sharing

The research found that in March 2010, almost four months after the KM service was switched on in Fort Severn, about 50 community members had purchased KM phones and were buying pre-paid phone cards. However we also found that the number of subscribers to the KM service is not a reliable indicator of how many community members are using it, or even how many are using cell phones.

In the interviews, 45% of respondents said they owned a cell phone, but only 32% said they used the KM service in Fort Severn. In effect, some community members owned a cell phone but did not use it in Fort Severn; they had SIM cards from other cell service providers and used their cell on trips to Thunder Bay, Sioux Lookout or Winnipeg, cities they visited on a regular basis.

In addition, 41% of respondents said they did not own a cell phone but rather used one that they borrowed. A further 14% said they did not own or use a cell phone. The respondents who said they did not use the KM service in Fort Severn were asked why not. For 42% of respondents, the main reason was the perceived or actual cost and another 33% believed they did not need a cell phone. The remaining 25% had other reasons or did not respond. The cost barrier is discussed in a future section of this paper.

The high rate of borrowing cell phones to use (41% of respondents) was an unexpected finding of the study. Here are some of the brief responses from community members along these lines: "*I was planning on buying one, but I usually just borrow my brother's cell phone just to text some friends."* (Interview-20); "*I use my Mom's"* (Interview 33 and 37); *"I use my boyfriend's cell phone, every day*" (Interview 40); "*My cousin's"* (Interview 34); "*My girlfriend's"* (Interview 32).

Clearly, in Fort Severn First Nation, sharing cell phones is a very common activity. The wider study found evidence of a general culture of sharing technology in the community – for example, home computers and laptops were widely shared among households. Underlying the sharing culture is the high unemployment rate and correspondingly low household income across the community, suggesting that for many households, technology purchases would be a considerable expense. As well, the small number of regular Fort Severn residents – about 400 – means that everybody knows each other in the community, which undoubtedly would encourage sharing.

### 5.2 Frequency of Cell Phone Use

The interview participants reported how often they were using cell phones for various tasks. As a baseline, 100% said they used an ordinary phone to have a conversation at least daily or weekly. Chart 1, below, illustrates that 59% of respondents were using cell phones regularly (daily or weekly). In response to the question: How often do you use a cell phone anywhere? – 14% said never; 7% yearly; 19% monthly; 39% weekly; and 20% daily.

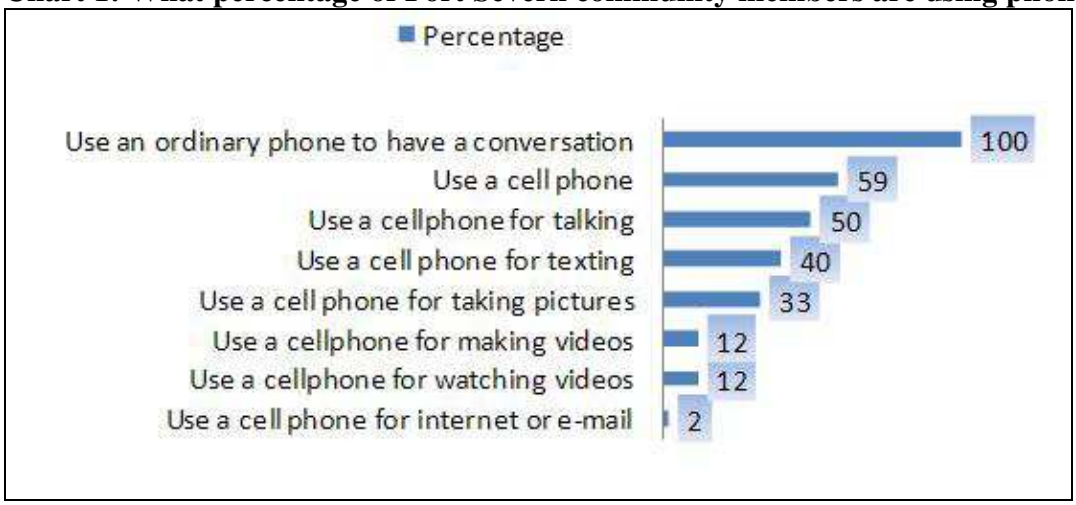
Chart 1 illustrates that voice conversations are the most frequent reason for using a cell phone, with 50% of respondents doing so regularly. However only 13% used it daily for conversations. The Chart also indicates that 40% of respondents used a cell phone for texting on a regular basis. In this case, 20% were

doing so daily. In Fort Severn, therefore, community members using a cell phone every day were texting every day and were texting more often than having voice conversations.

Almost all respondents (92%) never used a cell phone for email or to access the internet. At the time of the study, the KM service in Fort Severn did not offer email or internet access. The 2% that did use their phone for the internet were not KM customers but rather used another service when they were visiting an urban centre.

Taking pictures with the cell phone was a regular activity, with 11% doing it daily and 22% weekly. Making videos with the cell phone was less popular, with only 6% doing it daily and another 6% weekly. The fact that users were not able to exchange the photos or videos, because the email was not functional, could partly explain why more cell phone users were not making photos and videos.

**Chart 1: What percentage of Fort Severn community members are using phones daily or weekly?**




### 5.3 Reasons for Using A Cell Phone in Fort Severn

The study found several common reasons for using cell phones in the community. The most common cited by interview participants was safety and security while outside the community. As mentioned earlier, being out on the land is central to the lives of Fort Severn residents; if they do not go out on the land themselves, a family member will do it for them, to trap, fish, hunt or harvest firewood.

Land-based activities, especially when carried out far from the community, present potential challenges and dangers, such as running out of fuel or having a vehicle break down far from home, running into inclement weather and becoming dangerously cold, or having an accident. There is no emergency (911) service in Fort Severn but the cell phone can obviously be used to call someone for help. Satellite phones have been available for many years for this purpose, but they are very expensive and so not widely used. The many quotes below from respondents illustrate the safety and security value of the KM cellphones:

> *"A cell phone in Fort Severn's a big deal, you know. I'm not sure what the range is, but when I first heard there was going to be a cell phone tower here, it would be good for the hunters, so if*

*anyone in the range if they're out there stranded or if they need help, they would just call because satellite phones are really expensive to get."* (Interview 31)

*"It could save people's lives. It reaches 40 miles, I think. So whenever something breaks down, you can just make a phone call instead of staying out in the cold."* (Interview 55) *"Like when I get stranded or something, stranded in the bush instead of walking home."* (Interview 21) *"Like I usually go out hunting and all that close by, especially in the Spring time. Safety issue."* (Interview 29)

*"People go outside, like go out to hunt, do their traditional stuff, hunting, fishing. Whenever they may be in trouble, they can just phone for help if they're not too far away. They phone their relative to pick them up. My Ski-doo is breaking down, whatever reason."* (Interview 30)

*"I mainly use it for emergencies when I'm on the land, camping and hunting."* (Interview 36)
*"It's good for sticky situations when you're out there, if you run out of gas, so it's good for that."* (Interview 44)

*"The cell phone service helps for safety too because when somebody goes out in the bush and if they're stuck or if their Ski-doo breaks down, they'll be able to call in. Because sometimes before, when there was no cell phones, they would just usually walk home and they would take a long walk, like over three hours walking."* (Interview 20)

*"In terms of safety when you're out on the land. If you have a cell phone just around here, maybe if you get into situation .. A cell phone is a ... You can just call home or if you're snowmobile breaks down or something or it you get stuck or something, you know, you can just call somebody to pick you up or come and help you out."* (Interview 45)

Another common reason cited in the interviews was the ease of reaching people without having to go around the community trying to track them down. Similarly, the phone owners did not have to worry about missing calls. This was especially important for community members with jobs that required them to be reached easily. Along these lines, having a cell phone was good for travelling outside the community to another community or urban location; with the cell they were easily accessible.

*"The only thing I like about it is that my boss can contact me wherever I am, eh. That's probably about it."* (Interview 39)

*"I'm noticing like a lot of people that hold important positions in the community, like the administration, Chief and council, the nurses, the technicians ... Most of them have cell phones and now you can reach them anytime, anywhere. There will be no more missed calls or messages or anything like that."* (Interview 45)

*"I think it would make a big difference with my work, and even as a mom. Like when I'm out in the community, I need to call somewhere, like even in Fort Severn… It sounds very convenient to have one. So I think I'll try and get one after."* (Interview 19)
*"I was planning to buy one sometime – a cell phone… Because I miss a lot of calls at home, long distance calls."* (Interview 31)

A number of participants saw cell phones as having an advantage over land lines. For community members without a home phone or who had difficulty paying the monthly phone bill for their home phone, the KM phone and service is practical and less worry. For some types of calls, the KM service was less expensive than using a home land line. In addition, some respondents liked the pre-paid phone cards.

> *"You don't have to worry about monthly bills and how much your kids are using it. You can keep track."* (Interview 44)

> *"A lot of people are buying them [cell phones] because … some homes don't have a direct phone line, so they just use cell phones because it's cheaper instead of paying monthly and all that, they just have a $20 gift card, and that's the way they contact each other."* (Interview 20)

Another practical advantage of a cell phone compared to a land line is that they be used outside and are not limited by a phone cord.

> *"What I like is that you don't have to stay in one spot. Like, if you want to go outside and go for a walk, you would just keep talking and all that or keep texting and so it's easier to walk around with the cell phone instead of just staying at home and staying in one spot. You can just go for walks [with it] or if you're out going for rides and all that."* (Interview 19)

Some interview participants said their reason for using cell phones was that they were fun: for taking pictures and texting, and the novelty of talking on the phone and connecting with others in a different way. Some participants said cell phones were popular and so being part of the trend was a reason for using them. Finally, other reasons for using cell phones cited by respondents were the possibility of accessing new applications and services, such as mobile learning and mobile health, and wanting to contribute to the community economic impact by supporting a KM, a local business.

### 5.4 Reasons for Not Using A Cell Phone in Fort Severn

A common reason cited by people for not using a cell phone at all or not using their cell more often was the cost. As mentioned above, more than 40% of people interviewed who did not use the KM service said either that it was too expensive or that they could not afford it. This finding contrasted with the earlier finding that other participants used the KM service because they believed it was less expensive than using a land line. Many of these reasons indicate that it will take time to demonstrate the correct information for all the customers.

The finding about the cost of the KM service requires some discussion. A number of respondents were clearly misinformed or had incorrect information about the cost of the service. For example, some people said that the $20 phone cards last only a couple of hours, but at $0.05 per minute for local calls, the card would last for almost seven hours, or more than two hours for long distance calls. Some respondents believed that making a local call to another KM subscriber in Fort Severn was charged at long-distance rates, which is incorrect.
Others said that KM was expensive. In fact, the local call pricing is equal to or lower than the pay-as-you-go rates offered by the mainstream companies elsewhere in Canada (Rogers, Bell, Aliant, Fido,

Telus, Virgin Mobile), and the North American long distance rates are lower than all the competitors (GeckoBeach.com site, consulted January 2011). As the service matures and is able to demonstrate its dependability and operational model this attitude and information will likely change. For example, as illustrated in one of the quotes above from the interviews, there is already evidence that some KM cell phone users are now cancelling their local land-line service to replace it with the KM service.

What the "too expensive" reason most likely means is that either the person did not think a cell phone was worth it – i.e., they did not personally see the value of spending money on a cell phone – or else they simply could not afford the additional expense. Many of our interview respondents were unemployed and clearly did not have much money to spare; some said they could not afford to pay their regular home phone bills; for these people, any cell phone service would be seen as too expensive, even the KM service which was more affordable than other services. Here are some of the comments:

> *"I think it's just a waste of extra money, I guess."* (Interview 28) *"I don't have the money. Basically I just use the phone at home."* (Interview 33) *"I can't afford it."* (Interview 34) *"No money to get a cell phone."* (Interview 37) *"I just haven't had the money to pay for [a cell phone]."* (Interview 46)

As mentioned earlier, in some cases, Fort Severn residents have cell phone agreements with other companies that they use primarily in an urban centre such as Thunder Bay. In these cases, some people were concerned about the potential costs of the roaming charges of using the KM network in Fort Severn. In other cases, they believed the KM network was not cost-effective because it did not cover the city where they visited on a regular basis without incurring roaming charges. As users become more comfortable with switching SIM cards and working with pre-paid services from other providers serving other regions, even these positions will likely change over time. Here are some of the interview respondents discussing the perceived cost:

> *"I use it just for texting. Like I'm worried what the roaming charges are going to be, so I made a call on it a few weeks ago, and I'm waiting until my bill to come in just to see."* (Interview 16) *"I hardly use it now, because I'm going to switch over to another plan later on… because K-Net doesn't cover all the area… I can't use it in Winnipeg."* (Interview 18)

> *"I can use it as far as Sioux and Dryden. That's about it, I think. Then it has no signal in Thunder Bay. I thought it did, but it didn't. So I got to get a whole new cell phone for that."* (Interview 27) *"I have my own service provider, in Thunder Bay, so I don't really need a cell phone here."* (Interview 43)

Another common reason for not using the KM service was the limit of the local service range, given the distances travelled from the community for regular outdoor activities. At the time of the March interviews, almost four months after the service was introduced, there was widespread confusion among interview participants about how far the range of the KM service extended. Some people interviewed mentioned two kilometres and others 10 kilometres or more. As mentioned earlier, trappers sometimes travel 200 kilometres from the community, and trips out further than 30 kilometres seemed to be common.

The week of the return research visit in November, a booster was being installed on the cell tower to improve the local service range. The range of the KM services is meant to be 30 kilometres from the tower, and this is a physical limitation of the cell phone service. Here are some of the comments by community members:

> *"Like I said, it [the range] doesn't go very far. So that was the only reason I bought it, I thought it would go far. And I was going to give it to my husband, when he goes out hunting, if he needs something, you know."* (Interview-13)

> *"It's not that useful having a cell phone around [here] unless you're going out hunting or further away from the community. And on top of that, the cell phone tower has like… a 20-mile radius or something like that that… that's not helpful. One thing that is helpful is like if you have those satellite phones, which is like super-duper expensive to buy from the Northern [Store]."* (Interview 41)

Another reason for not using the KM service often cited by interview respondents was dropped calls, poor or no signal, and the network going down. However these technical problems identified in the March 2010 interviews seemed to be largely resolved by the time of the researchers' return visit eight months later: during the community discussion in November the researchers asked if anyone was still having these problems and nobody said they were. A follow-up discussion with the community technician confirmed that these earlier problems had been addressed.

Finally, some other reasons were mentioned by several respondents. These included: the lack of internet and email access; the potential dangers of driving vehicles while texting; fears that cell phones can cause cancer; and concerns that a cell phone could be stolen.

For those with no interest in having cell phones or hooking up to the KM service, several reasons were given. A few people noted that they already had a cell phone plan in another location (Thunder Bay, Winnipeg) and they did not need a cell phone in Fort Severn. Some people were simply not interested in talking on the phone or did not like the idea of people being able to reach them all the time (*"it's annoying"*). Finally several people believed that cell phones were unnecessary in the small community. Here are some of the comments:

> *"I guess [KM would be useful] for the hunters, if they're going far away. Other than that, I don't know, I don't really see the benefits of it."* (Interview 13) *"If it had a long range like to the Rapids, then maybe I would use it, but for a community like Fort Severn, if I want to talk to someone, I just go over to their house. It's just a small community."* (Interview 26) *"I can't keep buying calling cards. And the community's too small. I can usually find them too."* (Interview 50)

> *"I've already got a land phone. If anybody wants me, they can find me. I don't go anywhere, so what would I need a cell phone for?"* (Interview 42) *"I'm not one to gab on the phone. It's just the way I am. I don't see no point in them* [cell phones]." (Interview 47)

## 6 New and Future Mobile Applications - DiabeTEXTs

The introduction of the KM service in Fort Severn opens up new possibilities for applications that could improve communications and services in many different areas. One of these is health applications. The KO tribal council - as well as Fort Severn and many First Nations communities - is actively seeking new ways to use technologies to improve health and wellness in the communities (Williams, 2010; Gibson et al., 2009).

In late 2010, an innovative health application using mobile technology was introduced in Fort Severn. The community, like many First Nations communities across Canada – has a high rate of diabetes. The new application – DiabeTEXTs – is using mobile technology as part of a range of strategies to address this situation.

Living with diabetes makes great educational demands on a family – for children, parental support and involvement play a central role in management of the disease (Wangberg et al, 2006). In order to lessen this burden and improve patient self-care, the potential in using mobile phones for supporting and educating diabetes patients is increasingly being recognized (Ferrer-Roca et al., 2004; Franklin et al., 2006; Wangberg). However, this proposed service has not yet been explored in a Canadian First Nations community context, which would be especially important, given that First Nations people in Canada experience a disproportionate burden of type 2 diabetes mellitus (Dyck et al., 2010).

The DiabeTEXTs Project is a new initiative by KO Health and K-Net to use cellular technology to provide diabetes education and information to interested community members through SMS texting and other electronic media. Information such as reminders for blood-glucose testing, recommendations for healthy living habits, carbohydrate counting, and community diabetes events can be sent to patients, caregivers, and even teachers.

Diabetes workers are provided a cell phone and software to send mass texts to a large number of recipients from their computer. They can also answer patient questions on SMS text directly from the computer as well. This provides the important advantage of mobility – patients simply need to be within a working cellular zone and communicate with their diabetes worker or ask a question to a nurse.

At the end of each week, community workers submit an online report on the DiabeTEXTs main page about how they have been using the cell phones, what types of messages they have been sending, as well as feedback about the project (Keewaytinook Okimakanak, 2010).

In November 2010, Fort Severn was the first KO community to set up the DiabeTEXTs cell phone and software on the Diabetes Worker's computer. The community diabetes worker was provided with a Nokia cell phone, software, USB cable, and instructions on use. Other potential community applications of cellular technology were recognized during this training session, such as community event messaging, anonymous tips for crime prevention, and alcohol and drug abuse support.

Today, the DiabeTEXTs initiative is present in the five KO communities of Fort Severn, Deer Lake, Keewaywin, North Spirit Lake, and Poplar Hill (Keewaytinook Okimakanak, 2010). This project is also the winner of the 2010 AGFA Healthcare Innovation Competition, and was well received by executives from RIM, AGFA, and Canada Health Infoway (AGFA HealthCare , 2010).

DiabeTEXTs is a good example of an m-health application for Keewaytinook Mobile. Other methods of health care delivery through m-health are now being more actively explored as community workers become more familiar with the hardware and software.

## 7 Conclusions and Next Steps

Keewaytinook Mobile (KM) exists in Fort Severn First Nation because of the leadership shown by KO/K-Net and Fort Severn in developing telecommunication services to meet the community's needs. These organizations worked together with government partners and private sector service providers to design and implement the service despite considerable technical and financial challenges.

KM is community-based, and Fort Severn manages and operates the KM service locally, working with KO/K-Net and other communities on the KM network to ensure that the service benefits the communities. From this perspective, KM in Fort Severn is an example of self-determination applied to telecommunications. KM is also an example of a community informatics approach to technology development because KO/K-Net and Fort Severn see the KM service as a tool for increasing the community's capacity for social, cultural and economic activities.

Keewaytinook Mobile can potentially contribute to economic development in several ways. KM is a community-owned service, with profits from the service staying in the community. Before KM was introduced in Fort Severn, the only option for phone service was land lines leased to Bell Canada. As community members make the switch from their existing Bell service to the new KM service, their spending on phone service will stay in the community and may even create local employment. KM can potentially support local business and traditional economic development by allowing more timely communications and fewer missed calls. KM could also contribute to economic development in Fort Severn is through community use of future services and applications that build on the mobile infrastructure.

The innovative and award-winning DiabeTEXTs service that uses the Fort Severn cell phone service is the first in what may be many future mobile applications to deliver services to community residents. Interesting mobile applications for health and wellness, education and learning, community organizing, entertainment and other activities have already been developed in Canada and elsewhere. Many of these could be introduced so they can be adapted for use in Fort Severn and other remote First Nations communities. Fort Severn could even become a site for piloting and developing innovative new mobile services to meet community needs.

The cultural context of Fort Severn First Nation is key to understanding how community members use KM and to determining its future success in the community. Fort Severn is small and remote. This is a close-knit community, and a culture of sharing technology had been established that extended to the KM service when it was introduced. More than 40% of the community residents taking part in the study did not own a cell phone themselves but rather they borrowed or shared one with family and friends.

Although the business model for KM – based on the sale of pre-paid phone cards – was not originally designed specifically to support a culture of sharing the cell phones, in practice the model does just that. The pre-paid phone cards clearly facilitate sharing cell phones in the community because the phones

themselves are not locked into plans owned by a particular person; anyone can buy a phone card, as long as they have the money to pay for it.

At the same time, the low family income in the community – with more than 70% unemployment – means that for many Fort Severn residents, KM is perceived as expensive or unaffordable. On the other hand, some residents have found that KM works out to be less expensive than a land line telephone. There were widespread misunderstandings among Fort Severn community members about the costs of the KM service and its relative affordability. This too may be linked to the specific cultural context of Fort Severn, because clearly (mis)information about KM was being shared widely among residents, along with sharing the phones.

One way for KM to address ongoing misinformation about the service would be to consider an ongoing awareness campaign about KM in Fort Severn. The campaign could use the widely-viewed community TV channel to share facts about KM, such as how long a phone card will last, its relative cost compared to a land line telephone, roaming charges, and so on. Sharing the facts about the real costs of KM would help residents make informed decisions about using or not using the service.

A dominant cultural feature of Fort Severn is that the resident families engage in land-based activities for sustenance and for their livelihoods. For many residents, the KM service ensures a sense of safety and security when traveling for short trips outside the community because in case of emergencies the cell phone means that help will be available.

However Fort Severn community members regularly travel outside the 30 kilometre range of the KM service for trapping, hunting, fishing and other outdoor activities. The limited range of the service area was a common complaint and a disincentive to use the KM service for many people who regularly travel further out from the community.

Finding innovative ways to address this challenge – to somehow extend the limited KM service range so that KM offers some measure of security and safety to community members traveling outside the range – will not be an easy task. There are physical limits to the wireless signals, and building additional cell towers in more remote locations far from community roads and existing infrastructure is not a viable option. As alternative power sources and the financial resources become available to create new cell sites on the winter road to the neighbouring communities, KO/K-Net plans to address this range issue.

It would be interesting to engage Fort Severn community members in an exercise to explore possibilities that have not yet been attempted. For example one of the community members interviewed was a hunter/trapper who suggested that a series of beacons could be set up along the winter road using satellite phones that could be accessed by a KM phone:

> *"[Our] traditional area is on the south side of the winter road. And we have to go like 120 miles to reach it. I think it's about 11 hours to sleep over before we get to our area. And we have basically ... all we have is just our Ski-doo and good luck, whatever. Because if something breaks down, and I usually tell my parents I'll be home like maybe 12 days' time, if I'm not home within 12 days, then that means something is broken, or something like that. And if there was a phone there like a beacon, they have beacons installed along the winter road from all the way to*

*Winnipeg, and you could call from anywhere. Like I could call my home or to [another] reserve, whichever is closest."* (Interview 26)

Whether or not his suggestion is practical or even physically possible, it is an indication that at least some community members are interested in exploring how the limits of the KM service can be extended to meet the needs of the hunters and trappers in the community. This kind of initiative could be a catalyst for interesting innovation in the future.

In the first months after the introduction of KM in Fort Severn, when the interviews were conducted, there were many complaints about technical issues such as dropped calls and service disruptions. These seemed to have been resolved by the time of the second research visit, almost a year after the KM service had been operating in the community. This points to the need to continue to keep the technical quality of the service at a satisfactory level to keep the customers happy.

A significant challenge for KM is providing high speed data services for Fort Severn cell phones. As discussed earlier, the KM cell phones in Fort Severn support only limited internet access and this capability is clearly desired by its users. In 2008, KM purchased 2G-level (EDGE) service from its supplier Lemko, which was the best available software and equipment at that time. The understanding was that is could support DSL-type speeds required for internet connections. With limited satellite bandwidth available to support all the community internet users, this mobile data service is still not being promoted. Now with 4G equipment and services becoming available, to make this work will require an extensive and expensive overlay of antennas and hub equipment with the original community mobile equipment that will cost close to $150K. It will also require a lot more satellite bandwidth than what is available today to make it work properly. In a recent communication, a KM manager said "it would be great to deliver this service but it has to be paid for somehow."

Overall, this research has underlined that the future success of Keewaytinook Mobile in Fort Severn will depend on the extent to which it continues to be reliable, affordable and meeting local expectations for standards of service, and address the safety and security concerns of residents who depend on it when traveling outside the community. KM in Fort Severn is ultimately an example of a community using and shaping a technology to meet its unique context and needs.

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**References**

AGFA HealthCare . (2010, November 29) Agfa HealthCare Institute Recognizes McMaster Student for Innovation in eHealth. Retrieved December 24, 2010, from AGFA HealthCare: http://www.agfahealthcare.com/global/en/main/news_events/news/archive/he20101129_student.jsp

Beaton, B., Fiddler, J., & Rowlandson, J. (2004) Living Smart in Two Worlds: Maintaining and Protecting First Nation Culture for Future Generations. In M. Moll & L.R. Shade (eds.), Seeking Convergence in Policy and Practice: Communications in the Public Interest (Volume 2) Ottawa: Canadian Centre for Policy Alternatives: 283-297.

Carpenter, P. (2010) The Kuhkenah Network (K-Net). In White, J.P., Peters, J., Beavon, D., Dinsdale, P. (eds). Aboriginal Policy Research VI: Learning, Technology and Traditions. Toronto: Thompson Educational Publishing: 119-127.

Dyck, R., Osgood, N., Hsiang, T., Gao, A., & Stang, M. R. (2010) Epidemiology of diabetes mellitus among First Nations and. Canadian Medical Journal , 249-256.

Dyson, L. E., Brady, F. (2009) Mobile Phone Adoption and Use in Lockhart River Aboriginal Community, icmb, pp.170-175, 2009 Eighth International Conference on Mobile Business.

Ferrer-Roca, O., Cadenas, A., Diaz-Cardama, A., & Pulido, P. (2004) Mobile phone text messaging in the management of diabetes. Journal of Telemedicine Telecare , 282-5.

Fiser, A., & Clement, A. (2009) K-Net and Canadian Aboriginal communities. IEEE Technology and Society Magazine, 28 (2): 23-33.

Franklin, V., Waller, A., Pagliarit, C., & Greene, S. A. (2006) A Randomized controlled trial of Sweet Talk, a text messaging system to support young people with diabetes. Diabetic Medicine , 1332-1338.

Gibson, K., Kakepetum-Schultz, T., Coulson, H., O'Donnell, S. (2009) Telemental Health with Remote and Rural First Nations: Advantages, Disadvantages, and Ways Forward. National Aboriginal Health Organisation (NAHO) Conference. Ottawa, November 24-27.

Gurstein, M. (2003) Effective Use: A Community Informatics Strategy Beyond the Digital Divide, First Monday, December.

Kauffman, R.J., Techatassanasoontorn, A. Understanding early diffusion of digital wireless phones. Telecommunications Policy, 33 (8), 432-450.

Keewaytinook Okimakanak. (2010, October). DiabeTEXTs homepage . Retrieved December 24, 2010, from DiabeTEXTs: www.diabetexts.knet.ca

Kim, P., Miranda, T., Olaciregui, C. (2008) Pocket School: Exploring mobile technology as a sustainable literacy education option for underserved indigenous children in Latin America. International Journal of Educational Development, 28 (4), 435-445.

Lam, P-L., Shiu, A. (2010) Economic growth, telecommunications development and productivity growth of the telecommunications sector: Evidence around the world. Telecommunications Policy, 34 (4), 185-199.

McMahon, R., O'Donnell, S., Smith, R., Woodman Simmonds, J., Walmark, B. (2010) Putting the 'last-mile' first: Re-framing broadband development in First Nations and Inuit communities.Vancouver: Centre for Policy Research on Science and Technology (CPROST), Simon Fraser University, December. URL: http://www.sfu.ca/cprost/tacs.html

O'Donnell, S., Perley, S., Walmark, B., Burton, K., Beaton, B., Sark, A. (2009a) Community-based broadband organizations and video communications in remote and rural First Nations in Canada. In Stillman, L., Johanson, G., and French, R (eds) Communities in Action. Newcastle upon Tyne, UK: Cambridge Scholars Publishing. 107-119.

O'Donnell, S., Perley, S., Simms, D., and Hancock, B-R. (2009b) Video Communication Roadblocks Facing Remote Indigenous Communities. *IEEE Technology & Society Magazine*, 28 (2), Summer,16-22.

O'Donnell, S., Milliken, M., Chong, C., Walmark, B. (2010) Information and Communication Technologies (ICT) and Remote and Rural First Nations Communities: An Overview. Canadian Communication Association Conference, Montreal, June.

Wangberg, S. C., Arsand, E., & Andersson, N. (2006) Diabetes Education via Mobile Text Messanging. Norwegian Center for Telemedicine , 55-56.

Williams, D. (2010) Telehealth/Telemedicine Services in Remote First Nations in Northern Ontario. In White, J.P., Peters, J., Beavon, D., Dinsdale, P. (eds). Aboriginal Policy Research VI: Learning, Technology and Traditions. Toronto: Thompson Educational Publishing: 159-168.