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Title: "Engaging Citizens in Community Wi-Fi: Insights From Three Canadian Case Studies"¹

Municipal and community wi-fis have been expanding in such a manner that even one of its leading innovators, Sasha Meinrath,² cannot reasonably estimate how many there are, where they are and/or how they all operate. There have been widespread municipal and community wi-fi initiatives in the United States and many parts of Europe, but less so in Canada.

Canada has been slow in the uptake and implementation of wi-fi communication services. A partial explanation for this lag is a long-standing government commitment to fair and accessible landline telecommunications as well as the geographical challenges of the Canadian landscape. It is also not clear that Canadians are convinced that wi-fi

¹ This project, Community Wireless Infrastructure Research Project (CWIRP), <http://www.cwirp.org>, has been made possible through a financial contribution from Infrastructure Canada and the Social Sciences and Humanities Research Council. I would also like to thank Tammy Miller for her research assistance on this paper and in particular the preparation of accompanying powerpoint presentation.

² Sasha Meinrath made this comment at the Alternative Telecommunications Policy Conference, Ottawa, Ontario, October 19, 2006.

technologies offer compelling applications, meaning that there has been limited interest in the rollout of these services, particularly in relation to mobile data and internet access.

Our research team, CWIRP, has been studying five unique sites that have developed and deliver wi-fi capabilities to a range of Canadian communities such as publicly accessible, pay for fee, or free wireless networks. These include a municipality, Fredericton E-Zone (<http://www.fred-ezone.com/>), a volunteer-based group in Montreal, Ile Sans Fil (<http://www.ilesansfil.org>), a corporation, Toronto Hydro Telecom (<http://www.thtelecom.ca/one-zone.html>), a community-based wireless internet service provider Wireless Nomad (<http://www.wirelessnomad.com/>) in Toronto, and an Aboriginal Network, K-Net (<http://www.knet.ca/>), in Northern Ontario.

My talk today will focus on three of these case studies, Fredericton E-Zone (Fred E-Zone), Ile Sans Fil (ISF), and K-Net, illustrating how they have attempted to engage citizens and businesses to use their wi-fi networks. In particular, each of these sites view wi-fi as a fundamental service to their communities. However, their conceptualization, technological strategies and servicing of the wi-fi networks are fundamentally different. For the municipally driven service, wi-fi is viewed as part of its economic development and city infrastructure much like sidewalks and sewers. The city is taking responsibility for providing a wi-fi network, but does not guarantee quality of service (QoS). ISF, a community-based volunteer group, is interested in not only providing a wi-fi network, but also in "promoting interaction between users, showing new media art, and providing geographically and community-relevant information." To attend to this, they have developed 'wifidog' and 'HAL' (open source software to manage community hotspots) and are currently working on its functionality to make explicit the social relevance of wi-

fi. Finally, K-Net wants to provide a telecommunications infrastructure to Aboriginal communities in Northern Canada that are mired and imbricated in numerous local, provincial and federal funding bodies in the most challenging physical environment of all our case studies.

These case studies make for an interesting set of policy considerations for a nation that has been viewed as a leader in telecommunications, but lags behind the wireless development and delivery of most industrialized nations. For example, Canada has 51.4 mobile subscribers/100 inhabitants as compared to 82.8/100 for the average of high income countries (and 100.71 for Denmark), mobile subscribers represent 47.6% of total telephone subscribers in Canada, as compared to 61.7% average in high income countries (62.0 in Denmark) (ITU, 2006).

These three different models reveal much about the current climate of and possibilities for wi-fi in Canada, and provide insights for the development of community-based wireless services in other regions.

Wi-Fi Context in Canada:

Canada has closely followed ITU recommendations and regulations regarding spectrum and has even taken the lead in, for example, auctioning off 3G spectrum, before many of Canadian telecommunications companies had committed to or developed 3G applications and markets. Much of the development and implementation on wi-fi networks has been shepherded by community groups and municipalities in Canada. Like most nations, Canada has complied with standardized and unlicensed spectrum, the IEEE 802.11 (a-g).

One of the first community wi-fi networks in Canada was initiated by a small group of largely technicians in the city of Montreal, ISF (I will discuss them in more detail below). This group has been influential in the development of other wi-fi community networks in Canada such as BC Wireless (<http://www.bcwireless.net/>), Ottawa-Gatineau Wireless (<http://wiki.ogwifi.ca/>) and Wireless Toronto (<http://wirelesstoronto.ca/>). All of these groups have consulted with ISF and most have taken up their community portal application wifidog. As well, ISF has been asked by numerous groups to help, guide and even implement wi-fi in other communities in Canada and other countries.

Aside from a number of community driven wi-fi networks in Canada, there are other models that have been developing and delivering wi-fi as well from municipally driven to corporately funded³ hotspots. To date, we have been unable to ascertain how many municipalities in Canada have implemented wi-fi networks. For example, we know of one community wi-fi mesh network that was initiated by Bell (telecommunications company), Nortel and the township of Chapleau, Project Chapleau, (<http://www.chapleau.ca/portal/en/connectingchapleau/projectchapleau>) while other municipalities are offering wi-fi services in public libraries.⁴ To date, our case studies, Fredericton E-Zone and Toronto Hydro's One Zone, are the first city roll-outs of

³ In a google search of hotspots in Canada, Wi-FiHotSpotList.com identified 650 hotspots, <http://www.wi-fihotspotlist.com/search.php?street=&city=&state=&zip=&country=CA&network=&proximity=1&submit.x=118&submit.y=11&submit>Show+HotSpots>, November 26, 2006. Please be mindful that these hotspots are registered by users and may not represent the total population of hotspots as a result. For a listing of free hotspots in Canada, with the same caveats, see Wi-Fi-Freespot Directory, <http://www.wififreespot.com/can.html>.

⁴ For a partial listing of Canadian libraries that are wi-fi enabled and municipally funded, see Wi-Fi-Freespot Directory, <http://www.wififreespot.com/can.html>. In this search device, 25 libraries are listed.

municipal wi-fi networks in Canada. Telecom Ottawa does have a small WiFi network in downtown Ottawa, but it is not citywide (see <http://www.telecomottawa.com/wireless/>). Finally, we would argue that the delivery of telecommunication services by the municipal level of government is a significant shift in the provision of telecommunications infrastructure in Canada.⁵ While not in the purview of this paper, it will be interesting to consider the shift from federally mandated and funded telecommunications to municipally based ones. Will this shift play a role in possibly providing more affordable, even free, network access? Can this shift in locale unencumber the telecommunications industry's tight relations with policy makers?⁶

Case Studies:

1) Fredericton E-Zone:

Fredericton is the capital city of the most eastern land region of Canada and an officially bilingual province. It has a population of 47,560 with a median age for men at 37.7 and for women 39.4 with almost 85 per cent of its population over age 15. The overwhelming majority of peoples are Canadian born with only 2,100 immigrating to Fredericton since 1991, average earnings per full year work \$39,214. Employment rates

⁵ See Christian Sandvig, "Disorderly Infrastructure and the Role of Government," forthcoming in *Government Information Quarterly*, 2006, for a discussion of rurally based co-operatives providing telecommunications infrastructure in the early 1900s.

⁶ For example, in the Canadian Federation of Municipalities' submission to the Telecommunications Policy Review Report, they stated that "[t]he CRTC is, institutionally and culturally, so close to the telecommunications industry that it cannot appear to be as neutral an adjudicator as is a judge" (Submission to the Telecommunications Policy Review Panel by the Federation of Canadian Municipalities (FCM), August 2005, p. 12).

are at 63 per cent and the unemployment rate at 7.9 per cent. The predominant employers are "other services" followed by health and education and then business services.⁷

While Fredericton is the capital city of New Brunswick, it is not the largest city in the province. The largest city is St. John, and almost double the size at 70,000, and 100 kilometers away. Interestingly, St. John has not followed the successful wi-fi initiatives of Fredericton. This municipality is pursuing a free public wi-fi internet service called "Freespots". In this wi-fi network, St. John is encouraging property owners, businesses and organizations through "community marketing" to offer freespots and to link these freespots to create and build a larger network (<http://www.freespots.ca>).⁸

Unlike St. John, Fredericton is more reliant on the public sector service as a major employer and in particular is the home of a fairly large eastern university, the University of New Brunswick. The University employs 1400 people and there are over 9,000 students. As they are a capital city, they are a large public sector employee:

Table 1: Province of New Brunswick Public Sector Employees

Public Sector	Number of Employees
Province of New Brunswick	4,123
River Valley Heath Corporation	3,600
NB Power	2,700

⁷ Other services category includes: retrieved from Statistics Canada. 2002. 2001 Community Profiles, Released June 27, 2002, <http://www12.statcan.ca/English/Profil01/CP01/Indedx.cfm?Lang=E>, accessed November 6, 2006.

⁸ While we digress on this matter, it is important to point out how context plays a role in shaping what kind of wi-fi networks may develop in certain settings. We would venture that the community marketing model deployed by St. John has developed as a result of a larger community having different resources to draw on and how they may also wanted to create a different model from one of its competing cities in the province.

School District 18	2,500
City of Fredericton	1,400
Mactaquac Provincial Park	300
Service Canada	230
Total	14,853

Source: <http://www.teamfredericton.com/Statistics01.asp#labour>.

Hence, the small population and the concentrated size of the city, the significant public sector presence made for a ready group interested in better ways to facilitate communications and their costs amongst and between themselves.

E-Zone has received significant attention from municipal wi-fi advocates, has earned the city an economic innovation award,⁹ and has served as a model for the delivery of wi-fi services by municipalities. Fredericton is one of the first municipalities in Canada to build and implement a wi-fi network. It is a fascinating tale to hear how the good will and hard work of a few civic-minded men and citizens to the place of Fredericton took a cost-saving initiative and parlayed it into a municipal wi-fi network.

E-Zone was a municipal response on how to link the public sector services such as the university, the municipality, the police, hospital and schools to reduce telecommunication costs and improve service levels. In 1999, in an attempt to reduce these costs, three individuals put together a business plan for the city, e-Novations, on how they could build and lay their own fibre network to deliver lower costs and better bandwidth to the municipality.¹⁰

⁹ For example, they were granted the *Canadian Information Productivity Award*, 2004.

¹⁰ Interestingly, the e-Novations group applied for federal funds to develop community internet access through the CAP (Community Access Program) in the late nineties and

e-Novations was incorporated by the City, and went through the CRTC licensing procedure, laid the fibre and connected the major institutions that could afford the high cost of fibre. Most small to medium-sized businesses could not afford fibre, so e-Novations implemented a point-to-point wireless solution based on the fibre network. (<http://www.teamfredericton.com/e-novations-about.asp>)

There is an elaborate story of how these individuals had to gain the support of municipal politicians and were taken to court by the largest telecommunications carrier in the province. However, they persevered and created a municipal network sharing the costs across public services. The wi-fi network was not originally part of their telecommunications' infrastructure plan.

E-Zone was a peripheral communications service they realized that they could provide easily using their existing fibre. They are not interested in being an internet service provider. From their perspective, being an ISP requires a commitment to a certain level of service. What they have done is make wi-fi available and citizens can acquire the various equipment and skills to tap into the service. They utilize a range of technologies for this network and have worked fairly closely with Cisco who has supplied them with antennae and other equipment. However, E-Zone is not afraid to return solutions that do not work for them and to hail the ones that do. Some of the E-Zone staff were particularly proud of a CISCO video that featured their town's wireless network.¹¹

Fredericton E-Zone represents one of Canada's wi-fi success stories. Out of nowhere, although the individuals involved in the development of E-Zone will tell you

were unsuccessful in their application. To date, the creators of e-Novations and E-Zone suggest that as a result of not receiving this funding they sought out other opportunities that have now provided them with both infrastructure, autonomy and local accountability in ways CAP funding would not have delivered. Smart Community application - is this the same as CAP?

¹¹ Available at *Videos*, <http://www.teamfredericton.com/videos01.asp>.

there was considerable labour and politicking that went into its deployment, Fredericton established itself as the first municipality in Canada to offer wi-fi to its residents. In E-Zone's promotional literature the emphasis is on how wi-fi networks can lead to economic development and encourage industry to come to their city. However, the city has neither developed ways to measure the relationship between the network and economic success nor have they provided training for businesses on how to capitalize on what network access can do for them.

The innovators and players behind E-Zone view their wi-fi network as public infrastructure akin to the sidewalks. They have significantly reduced the telecommunication costs of their city, they have brought national and international attention to it, and they have generously shared their process to countless municipalities (See Appendix I for technical details about E-Zone).

2) Ile Sans Fil, ISF:

Montreal is the second largest city in Canada. It is a culturally rich and bilingual province with the highest number of cultural producers in the country.¹² According to the last census, it has a population of over 7 million with a median age for men at 37.8 and for women 39.8 with 82 per cent of its population over age 15. The majority of peoples are Canadian born and over 450,000 people have immigrated to Quebec since 1991, with average earnings per full year work \$39,217. French is the main language most often used in paid work place. Employment rates are at 59 per cent and the unemployment rate at 8.2 per cent. The predominant employers are manufacturing and construction industries followed by other services and health and education.¹³

¹² Findings released by Hill Strategies study, *Resources on the Arts*, found that Montreal has the highest average earnings of artists as a percentage of average local labour force earnings and the second highest population of artists after the city of Toronto, http://www.hillstrategies.com/resources_details.php?resUID=1000160.

¹³ Data retrieved from Statistics Canada. 2002. 2001 Community Profiles, Released June 27, 2002, <http://www12.statcan.ca/English/Profil01/CP01/Indedx.cfm?Lang=E>, accessed November 6, 2006.

Montreal's cultural richness has played a role in the development of ISF's community wi-fi network as well as its long history of engagement with sustainability issues and national independence. European colonial cultures, especially France, have also contributed to the architecture, design and Catholic heritage that influence the city. In particular, the high number of artists and self-employed individuals has partially sustained a strong public, café culture. ISF implemented its first free hotspot in July 2003 at Café Laika -- centrally located in what is considered to be a funky and hip neighbourhood, the Plateau. The Café serves as a beacon site and is one of ISF's most frequented and long standing free hotspots.

While E-Zone advocates were municipal employees, ISF is a group made up of almost 60 active volunteers, with more than 500 additional volunteers keeping up with the project through their mailing list.¹⁴ As a non-profit group, they are committed to providing free public wireless internet access in public spaces in Montreal. They describe themselves as "computer hackers (the geeky-but-cool kind), system administrators, "hands-on" academics, web designers, idealists, engineers and more" (<http://www.ilesansfil.org/tiki-index.php?page=ImpliquezVous>). To date, they have implemented over 120 free hotspots and have registered 28,000 users. As one of its founders commented:

[I]t's more the importance of having decentralizing players offering access; offering it wirelessly, not getting stopped by regulations or other non-business obstacles. (Benoit Gregoire, interview, June 7, 2006).

¹⁴ Members of individuals contributing to ISF mailing lists, Board of Administration, 9; Board of Administration Archive, 1; Communications, 22; Discussions, 88; Mesh, 54; NagiosAlerts, 3; General Volunteers: 183; and WifiDog, 191. Mailing List totals: 551.

Who offers wi-fi and how it is offered has been critical to ISF, particularly with a commitment to open source software and politics. In late 2005, there was some discussion that various levels of government and telecommunication companies might be interested in developing a city-wide municipal network in Montreal. As a result of this talk, ISF made a concerted effort to increase their number of hotspots. They felt that this increased presence could play a role in opening up discussions about public and free networks. To date, neither government nor telecommunication company owned wi-fi networks have materialized.

However, what makes this organization unique in the larger international context of community wi-fi networks, has been a commitment to make their network not only seamless and transparent, for example through use of open source software, but as a site for community.

We believe that technology can be used to bring people together and foster a sense of community. In pursuit of that goal, Ile Sans Fil uses its free public access points to promote interaction between users, show new media art, and provide geographically- and community-relevant information.
<http://www.ilesansfil.org/tiki-index.php?bl=y>

ISF founding members have been committed to free public wireless and initially privileged the technical delivery of wi-fi..

[Our] main goal to start off with ... was free public wireless, free wireless in public spaces, and using the technology to create and support local community... (Michael Lenczner, interview, June 7, 2006.)

However, they soon realized that the maxim, "Build it and they will come," did not work and that their own political agendas, were not evident to those who used their services. It is important to acknowledge that there is a wide frame of engaging with wi-fi in this group. The point that I would like to make is that as other community wireless groups

were fledging such as London Wireless and NYC Wireless, ISF wanted to take up their place and context more specifically.

To do this, they have developed an application called 'Wifidog' (replacing 'NoCat') and have made meaningful contact with cultural producers in Montreal to provide content for community portals. Wifidog is both a "a gateway per hotspot running a client process and a Web-based central server." As a captive portal all users are required to login and are taken to an ISF webpage (or redirected to portal page where site is located). This application allows hotspots to create and manage their own location-specific content. They have also extended features allowing users to upload and download text, images, and sound through HAL.¹⁵ They also have a user profile section allowing users to see who is on-line, where they may be located and information (disclosed solely by the user) about particular users currently on-line.¹⁶ Finally, ISF has also collaborated with the artists working with the Mobile Digital Commons Network (MDCN) and other local artists to display their work.¹⁷

Overall, ISF has been a tremendous success in the development and deployment of community wifi. They have set new standards for user integration through their social software applications and have been generous in transferring their skills and knowledge to other community wifi groups around the world. The challenge now is how to assess

¹⁵ Hubs des Artistes Locaux, HAL, <http://www.ilesansfil.org/tiki-index.php?page=HAL&bl=y> and <http://www.halproject.net/>

¹⁶ To date, this application has been taken up in four continents and by over 30 groups.

¹⁷ See Alison Powell, "Île Sans Fil as a Digital Formation," LABCMO, École des Medias, University du Quebec a Montreal, July 20, 2006 and the "Last Mile? or Local Innovation? Canadian Perspectives on Community Wireless Networking as Civic Participation," Presented at TPRC annual conference, September 2006, Washington , DC, <http://www.tprc.org/TPRC06/Sat410Sess06.htm#MuniWireless>.

their social software applications. Do they make users more aware of community wifi issues and community issues more generally?

3) Keewaytinook Okimakanak, K-Net:

K-Net is one of the first aboriginal networks created, developed and maintained mostly by First Nations' peoples.

An initiative of Keewaytinook Okimakanak (KO), a non-profit tribal council in northwestern Ontario, K-Net is an aboriginally-owned and managed community network established in 1994 to provide broadband services and ICT applications (telehealth, education, economic development, and community e-centres) to communities of the Nishnawbe Aski First Nations. K-Net uses satellite broadband, video conferencing, IP telephony, online forums, e-mail, and other web-based communication tools to link First Nations communities and their service organisations. KO was named as Industry Canada's Aboriginal Smart Communities demonstration project in 2000. (<http://www.cwirp.ca/partners.php>)

[It is] a regional network of more than 60 aboriginal communities and related points of presence, clustered around northern Ontario and Quebec. K-Net primarily serves a “high cost serving area”¹⁸. 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 challenges of its geography have also made it a rigorous test case for telecommunications. K-Net is the most recent, and possibly the most significant test. It poses the option of a locally owned regional public telecommunications system, and through its extensive employment of broadband applications, the promise of a First Nations network society. (Fiser, Clement, and Walmark, 2005, p. 1)

K-Net also serves as the Regional Management Organization for First Nations School-Net programs across Ontario, and operates telemedicine services in 24 communities. K-

¹⁸ The Canadian Radio-television and Telecommunications Commission (1998) defines a “high cost serving area” as an area where the telephone company's monthly costs to provide basic telephone service are greater than the associated revenues that the telephone company receives for providing the service

Net servers host over 20,000 web pages and 30,000 e-mail accounts, and receive over 100 million hits per month.

Of the three case studies to be profiled in this paper, K-Net services the most rural and most challenging physical landscape. The deployment of their wi-fi network has been much more difficult as they try to attend to the climate, user uptake, technical training and sustainability. Moreover, these particular Nations have been very successful in seeking out and managing a number of provincial and federal grants to build and develop their network (See Appendix II). However, the grants have also dictated what priority they need to give to certain broadband and wi-fi activities and deliverables. K-Net has had to be strategic in terms of delivering on grant promises and how to best serve their wide-ranging communities.

In particular, we will focus on the deployment of a wifi network in one of their regional communities, Lac Seul. Children are schooled there until grade eight, they are then sent to an Aboriginal school with boarding facilities that were once a residential school for the larger community. It is a 90 minute drive from the closest town with a population of 5,000 and then a boat ride. In the wintertime when the ice is thick enough they use skidoos to access the main road to town.

On our first visit to the Lac Seul region, we were taken to a wireless community network that connects three First Nations communities, Frenchman's Head (population 425), Kejick Bay (population 426), and Whitefish Bay (population 98). The network consists of Smart Bridges Wi-fi radios for public wireless access and Aperto licensed spectrum radios for broadband QoS applications such as telehealth and videoconferencing, and for backhaul into the community. On the day we arrived, the wi-

fi tower was down and the community had been without service for over a week related to a recent thunderstorm. This was the second time the wi-fi may have been down as a consequence of thunderstorms. As a result of various agreements between a telecommunications company, a start up mobile company in town and the Lac Seul Band Council, there were several misunderstandings about who owned the equipment and who was supposed to service it. As the receiving dish was on a telecommunications tower, only network technicians from certified "tower crews" were allowed to replace the broken receiver. There can be a significant wait for these trained climbers and they are brought in from either Winnipeg (almost 800 km.) or Thunder Bay (over 400 km.).

It may be that the communities have problems finding and keeping technical staff as a result of these kinds of situations and perceived lack of support. As well, the computer technician the Band had hired to maintain and service the broadband and wi-fi network argued that he was not being paid enough to manage the internet services for these communities and resigned from his position.

On the one hand, K-Net has been tremendously successful in the development and provision of broadband network services by and for Aboriginal peoples. To date, there have been few other Aboriginal communities that have attempted to build their own infrastructure. From our preliminary review and as relayed in Appendix II, millions of dollars have been raised and spent to develop and maintain this telecommunications infrastructure. On the other hand, when they tried to spin out a smaller wi-fi network, they encountered a number of challenges. These included unpredictable climate conditions, a mixed infrastructure of stakeholders and technologies, and limited technical support.

Conclusion:

We hope that these three case studies illustrate a range of diffusion and adoption of wi-fi in Canadian communities. Each of these sites has mobilized a range of different players to supply and service wi-fi access to communities. These models do not fall outside some of the typologies that are being developed to characterize and understand wi-fi networks,¹⁹ but we would like some Canadian content and practices to be taken into account in the development of these typologies, particularly to consider how marginalized peoples have developed wi-fi networks to facilitate digital communications.

Municipal Model (E-Zone):

E-Zone is a fascinating story about three individuals who saw an opportunity to provide telecommunications cost at a lower rate than an incumbent telecommunications company. What makes their situation unique is that they own and manage the network. Fredericton is not reliant on other levels of government funding and/or telecommunications companies providing them with legitimate autonomy on how to pursue and use their network. The wi-fi network was a "no brainer" for them. Given the buildings that the city owned, it was straightforward to put up antennae and enable the network. While E-Zone has a FAQ page on how to set up a network and is working hard

¹⁹ See Bar, F., & Galperin, H. (2005). "Geeks, Cowboys and Bureaucrats: Deploying Broadband, the Wireless Way," *A Sociedade em Rede e a Economia do Conhecimento: Portugal numa Perspectiva Global*. Lisbon, Portugal; Bar, F., & Park, N. (2006). "Municipal Wi-Fi Networks: The Goals, Practices, and Policy Implications of the U.S. Case," *Communications and Strategies*, 6(1), 107-125; Gillett, S. E. (2006).z' Municipal Wireless Broadband: Hype or Harbinger?" *Southern California Law Review*, 79, 561-594; and Shamp, S. A. (2004). "Wi-Fi Clouds and Zones: A Survey of Municipal Wireless Initiatives," Mobile Media Consortium, University of Georgia.

to provide coverage to the whole of the city, they view the network largely as infrastructure. Moreover, they have not considered other ways their network could facilitate more civic and user engagement in the city.

Volunteer Model (ISF):

In particular, ISF has been very influential in the community wireless wi-fi initiatives in providing technical information, consulting work and applications that have been fairly straight-forward to adapt to different sites. Moreover, ISF's commitment to provide applications such as "wifidog" and "HAL" has been designed specifically to enable community representation on portal sites. These applications are an attempt to bring meaning to virtual community and link them back to the place where users live and work. However, they are a volunteer organization. Numerous requests for assistance setting up community wi-fi networks, building and maintaining their own network and developing user/community applications have been very demanding for this organization. Presently, ISF is trying to reflect on and consider more long-term implications of their technical and community work.

Hybrid Model (K-Net):

K-Net builds on other autonomous media practices of First Nations' communities such as Aboriginal Peoples Television Network (APTN) and First Nations Broadcasting radio. This particular region has deftly managed numerous funding agencies and project-driven grants to provide broadband networks to support telehealth and videoconferencing capabilities. The rural landscape and its wilderness have presented significant physical challenges to wi-fi networks that do not present remedies as easily as urban spaces. As

well, they do not have the same population of amateur and professional computer scientists and engineers to support, maintain and champion wi-fi initiatives.

At this point in our research, we can make some preliminary observations. In all of these models, one of the key factors that has not been made central to their networks has been sustainability and user integration. Each of these sites has had a small group of individuals serving as "champions" of public wi-fi networks. It has been quite astounding to see the incredible good will, time, energy that this small handful of individuals have put into play to develop and maintain these networks. One of their challenges will now be to mentor other individuals to keep this work going as well as diversify the group of people doing it. While the current population of largely men makes sense in terms of the demographics of who studies computer science and engineering in Canada,²⁰ their commitment to transferring these skills, particularly ISF, can play a role in changing the power dynamics and also what kind of content and how we may want to use these networks.²¹

Finally, in terms of the current policy context, a recent Telecommunications Policy Review Panel awaits parliamentary review and implementation. The recommendations of this Report state quite clearly that markets should determine development of telecommunications and that federal governments should be committed to facilitating rural access to telecommunications.²² Moreover, there was little discussion on wi-fi and unlicensed spectrum.

Canada is enjoying what Sandvig (2006) refers to as "disorderly" infrastructure. Just as other telecommunications have been introduced over the years, they have gone through various phases of development, implementation, commodification and regulation. Many of these telecommunications have not followed the same path. For

²⁰ See Vashti Galpin, "Women in Computing Around the World," *CM SIGCSE Bulletin*, 34(2), 94-100, 2002 and for up-to-date Canadian data, see "Women in Computing in Canada," <http://www.cs.ubc.ca/labs/swift/cwic/statistics.html>.

²¹ For example, see some of the exciting work being done by Studio XX in Montreal, <http://www.studioxx.org>.

²² See Telecommunications Policy Review Panel, published March 22, 2006, <http://www.telecomreview.ca/epic/internet/intprp-gecrt.nsf/en/Home>.

example, we continue to have spectrum for community radio. Are there lessons to be learned from community radio? Are there lessons to be learned by the struggles of community Internet networks? Is the shift from federal to municipal level of government a way to leverage public wi-fi networks? Over the course of this research, we look forward to exploring these questions, but in the meantime, these case studies have given us much to ponder, celebrate and reflect on with respect to wi-fi and engaging citizens in digital contexts.

Appendix I: Technical Notes, E-Zone Wi-Fi Network

This is the fibre network:

All sites are connected to a core layer 2/3, *CISCO 3750* switch, which assures preferred routing at full 100 Megs within the Community Network. All site switches are automatically updated using RIP protocol. The fiber network is managed and lit using single mode single-fiber transceivers. The use of this new technology, which transmits and receives data on a single strand of fiber on separate light frequencies, has doubled e-Novations fiber count capacity. Single-mode fiber is used throughout the network because of its longer distance qualities. So far, the fiber network extends over a 22 km ring. All fiber is connected to the head-end on a *Metrobility* chassis platform. This allows for remote management and troubleshooting of fiber optic transceivers and signal quality throughout the network.

Point to Multi Point Wireless Network:

A high capacity wireless network was required to extend the fiber optic network's coverage area. *Motorola Canopy* was selected because of its superior capabilities, ease of implementation and affordable cost. Seven tower sites were constructed to host the *Motorola Canopy* access points thus extending the Community Network's broadband footprint throughout the entire City. All sites are synchronized using a unique approach. Broadcast and receive cycles are synchronized using G.P.S.

Tower sites are built or located on existing City properties or on partner sites. As an example; a 100-foot water tower was used to install an omni directional set of Canopy access points. Canopy backhaul at the water tower is consolidated by the use of a *CISCO 2940* series switch and re-broadcasts Ethernet over the fiber optic network to the head-end network switch. Seeking out a qualified Motorola dealer versed in both radio and networking was identified as a critical success factor in the deployment and maintenance of the wireless network. *Eastern Wireless*, a local Motorola dealer was selected to supply, install and maintain the network. In return, *Eastern Wireless* is invited to use the over capacity to offer ISP services to the community. *BrunNet*, another local ISP, also re-sells the City's network to small business and to homes. In this way, e-Novations as wholesale ISP to the community.

From: <http://www.fred-ezone.com/documents/BroadBand%20Wireless%20Article.pdf>

Appendix II: K-Net Case Study Map prepared by Adam Fiser, updated November 26, 2006.

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, capital costs have been similarly split amongst a consortium of partners. Initial investments (phase 1), 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 (phase 2) 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, Industry Canada's SMART development project, 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.

**Industry Canada FedNor is K-Net's largest contributor, adding approximately \$20M in total to a range of K-Net related projects including the K-Net's WAN expansion in the late 90s, KO Telehealth's expansion to 25 communities in the Sioux Lookout district, and the expansion of the National Satellite Initiative. (Total investments made over a period of approximately eight years).