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Going Wi-Fi in Canada: Municipal and community initiatives

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While in the United States, debates over who should provide wireless internet access (Wi-Fi) have pitted municipalities and community groups against telecom corporations[1] [2], in Canada, the provision of Wi-Fi services has not yet reached such acrimony. Due to the widespread deployment of cable in Canada, most major Canadian cities have broadband access; Statistics Canada data for 2003 indicates that 86% of Canadians have access to broadband services, although certainly a lesser portion actually subscribes.[3] As in American cities, Canadian cities have seen many private Wi-Fi ventures whose objectives are to provide wireless connectivity in commercial establishments, but there have also been several notable municipal ventures like the Fred eZone in Fredericton, New Brunswick.

Urban community Wi-Fi in Canada is at a nascent stage; active non-profit groups include the BC Wireless Network Society in the province of British Columbia and Île Sans Fil ("Wireless Island") in Montreal, as well as a newly-formed group called, "WirelessToronto," and several smaller projects in Charlottetown, Hamilton, and Winnipeg. These groups support, through dedicated volunteers, the development or deployment of Wi-Fi services in community spaces throughout their regions. In some

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cases, the groups also develop and refine software intended to help local communities create and display art and local content over Wi-Fi networks. Community Wi-Fi, therefore, has the potential to support communities economically, socially, and culturally. This potential has encouraged comparisons between community Wi-Fi groups and other forms of community networking. While there are certainly some similarities between community Wi-Fi groups and other community ICT ventures in Canada, there are also clear differences.

This paper first presents a brief discussion of various WiFi networking models and the current state of Canadian spectrum policy. Some contextual information about Canadian community networks in Canada is given, with a brief overview of Canadian ICT initiatives, policies, and programs. The paper then explores how Wi-Fi development and innovation is occurring within urban Canadian communities, both as part of municipal government projects and as part of grassroots community technology initiatives, with a focused discussion of Montreal's Île Sans Fil, a community wireless network. The paper concludes with a reflection on the relationships between community Wi-Fi and other forms of community networking, as well as the potential policy challenges raised by community wireless Internet development.

Methods

The case study portion of this paper is the result of a year-long participatory research project with the wireless community group Île Sans Fil, as part of the Canadian Research Alliance for Community Innovation and Networking (CRACIN) research project on community networking.[4] Participatory research methods are widely used in

the study of community or grassroots networking projects (see [5] for a review of approaches and [6] and [7] for examples in practice). These methods explicitly involve community members in the design and interpretation of research. Research results are intended to benefit community members as well as academics. In this project, one of the authors worked closely with the members of ISF to design and conduct surveys of their users, some of which were deployed by student interns. She was also granted access to the group's user logs. These quantitative methods were augmented by qualitative methods, including interviews with members of ISF's board of directors, attendance at twice-monthly public meetings, and monitoring of online public mailing lists. Research results were communicated to ISF board members to assist in strategic planning.

Networking wireless technologies

Wireless Internet technologies are increasingly being adopted by community and municipal groups as inexpensive ways to extend broadband Internet to citizens. Wireless systems either use licensed parts of the radio spectrum or they transmit signals over the license exempt portions of the radio spectrum at 2.4 GHz**.** A large number of devices, including garage door openers and commercial wireless equipment, operate using this portion of spectrum. High-powered transmission using licensed radio spectrum is often called "fixed wireless" because signal transmitters are fixed in place. These systems operate on spectrum that is licensed for a particular use and often require specialized receivers for users. Open wireless, which operates on license-exempt radio spectrum, has a much lower signal strength than fixed wireless, and as the license-exempt band fills up, transmission speeds can diminish. However, open wireless has become increasingly

popular as a last-mile solution for homes and neighborhoods because there is no license fee for the radio spectrum and because all commercial systems use the same standard for wireless transmission, so devices are easily interoperable. While there are numerous potential technical configurations for wireless Internet projects, municipal and community projects tend to organize their networks in one of three ways: as a series of independent or linked hotspots, as a hub-and-spoke system, or as a dynamic mesh. The choice to use one type of networking model over another depends upon the technical, social, and economic capacity in any particular local area.

Networking Models

1. Hotspots (also called access points): These are points at which broadband Internet signals are broadcast wirelessly to the immediate geographical area. Coverage normally extends about three hundred meters from the source signal, although more coverage is possible using exterior antennae. Community Wi-Fi groups Île Sans Fil and WirelessToronto use hotspots to provide a simple way for local businesses and organizations to share bandwidth, and as methods of displaying local art and encouraging the development of local community content production.

2. Hub-and-spoke systems: In isolated areas, a single high-powered antenna can broadcast a signal from, for example, a hill to the homes of the valley below. Hub-and-spoke systems are often used in fixed wireless installations where wireless is used to disseminate a signal in areas where fiber-optic cable cannot be laid due to geographic or economic limitations. The municipal Fredericton Fred eZone is a collection of hubs and spokes connected to high-powered backhaul bandwidth. These

systems function best when the community has the ability to purchase and distribute adequate bandwidth.

3. Dynamic mesh: Interconnected nodes in a neighborhood share bandwidth drawn from a high-capacity backbone in this type of configuration. Each of the nodes can communicate with the Internet as well as with each of the other nodes, providing the possibility for creating robust local area networks. Deploying mesh networks necessitates a certain number of individuals or organizations that are willing to share their Internet backbone. When mesh networks function well, communication between nodes is as important as communication with the Internet. The most robust and flexible software for developing community mesh networks has been produced by CUWin, the Champaign-Urbana community wireless network (http://www.cuwireless.net/). BCWireless has experimented with mesh networks, although they do not have a stable provider for their Internet backbone, which means that their systems primarily connect nodes to one another, as opposed to connecting many people to the Internet.

In Canada, most community wireless projects concentrate on creating wireless hotspots, while municipal projects use hub-and-spoke systems and sometimes (although rarely) mesh systems. It remains to be seen exactly how wireless mesh networks will be deployed, although they have so far been successfully adopted in US municipalities and in the developing world.[8] [9]

Canadian wireless policy

Canada's spectrum policy is established by the Ministry of Industry under the Radiocommunication Act and the Department of Industry Act. Domestic spectrum

policy is set out in the Telecommunications Act and in coordination with other countries and international bodies. Canada has provided spectrum for wireless broadband in several frequency bands with plans to create additional spectrum. The 2500 MHz band is currently licensed for Multipoint Distribution System (MDS) and for wireless Internet Multipoint Communication System (MCS) services. In the 2001 public consultation on opening the 3500 MHz band for Fixed Wireless Access (FWA) and Wireless Communications Services (WCS) in the 2300 MHz range, Industry Canada allowed that up to 200 MHz for FWA and 30 MHz for WCS could be opened in the 3500 MHz band.

Industry Canada is currently undertaking a review of the use of spectrum in the 3 to 30 GHz range, which could allow for more wireless broadband access. The May 2005 *Consultation on a Renewed Spectrum Policy Framework for Canada and Continued Advancements in Spectrum Management* contains a set of core objectives and policy guidelines for public consultation in modernizing Canada's spectrum program. Four broad themes for policy development have been identified: 1) facilitating access to spectrum, 2) providing spectrum availability for priority requirements and societal needs, 3) improving the utilization of spectrum resources, and 4) delivering the Canadian Spectrum Management Program. Industry Canada's intent is to also facilitate access to spectrum for licensed and license-exempt application; give priority to spectrum usage for national security and public safety needs; provide a degree of international harmonization; and allow for flexibility in the application of frequency allocations.[10]

Industry Canada is also conducting a Telecommunications Policy Review, the mandate of which is to review Canada's telecommunications policy and regulatory framework. The Panel will provide recommendations "on how to move Canada toward a

modern telecommunications framework in a manner that benefits Canadian industry and consumers."[11] [If you could paraphrase this, it would eliminate the need to enter a page number or an explanation that this was an online source.]Technological developments that have created a more challenging policy environment include shifts to IP-based technologies, the deployment of fiber-optic technologies, and the increasing prevalence of wireless technologies. Commenting on the 802.11 Wi-Fi standard, the Panel noted that this rapid use "may already be having an impact on the revenues of the licensed wireless providers, in particular on data revenues." [11] [If you could paraphrase this, it would eliminate the need to enter a page number or an explanation that this was an online source.]

Given these ongoing telecommunication reforms, several aspects of community wireless developments require policy attention, particularly with regard to a possible reform of spectrum allocation policy. Most community wireless projects use the license-exempt section of the radio spectrum, at 2.4GHz. As time passes and more and more devices use this section of the spectrum, interference will undoubtedly increase and data transfer will become more difficult. Policy-makers need to be aware that providing more unlicensed spectrum may not only provide more affordable "last mile" communications potential but could also expand the ability for community groups like Île Sans Fil to develop creative local applications. Policies which promote the opening of more unlicensed or license-exempt spectrum, or which help to prioritize signals sharing the currently license-exempt spectrum, would permit communities to choose the manner in which they distributed or shared their Internet signals. This would ensure that policies

benefit not just industry and commercial interests but also local communities and the public interest.

Context: Canadian community networks, past and present

What differentiates the early community networks of the 1990s from the Wi-Fi community networks of today is that for many community members, community networks were the only tangible way for them to connect to the Internet. Pre-Web, the Internet was relegated to those in academia, the high-tech industry, or the military. Internet Service Providers did not become prevalent until the mid-1990s, and their eventual concentration into a few major service providers occurred only the late 1990s.

Therefore, community networks in Canada represented for many a powerful model for enabling citizens to support and sustain community (both geographically based and "virtual"), to access and contribute to local community content, and to reinforce national identity. As a community owned and controlled service, community networks emphasized the posting of local resources, services, and culture. In Canada, at their high point between 1995-96, there were 35 operating community networks across the country, with between 250,000 and 600,000 members.[12] They were concerned with ensuring universal access to the network free of charge or with a very nominal cost to all members of the community. Schools, libraries, recreational centers, and shopping malls often served as the public access points. Proponents of community nets also believed that they could contribute to community development and strengthen and revitalize communities through positive and interactive communication between residents and local institutions. Canada's telecom regulator, the Canadian Radio-television and Telecommunications

Commission (CRTC), also recognized the value of community nets by recognizing their role in supporting Canadian content, network literacy, and universal access.[13]

However, with the rapid diffusion of the Internet into the academy, workplaces, and homes, the original impetus of community networks – to provide access to the Internet at no cost, especially to those who would not otherwise have access – has waned, and community networks face challenges in maintaining members and creating and sustaining locally relevant content. This is not to say that community networks are obsolete; Canada's federal "Connecting Canadians" agenda, launched in 1995, held as a central goal making Canada "the most 'connected nation on earth.'"[We will need a source and page number for this – if you cannot paraphrase.] Led by Industry Canada, the Connectedness agenda included such programs as SchoolNet, the Community Access Program (CAP), VolNet, LibraryNet, and Smart Communities programs. Other recent federal and provincial programs have pursued related goals (e.g., Industry Canada's Broadband for Rural and Northern Development (BRAND); the National Satellite Initiative (NSI); Human Resource and Skills Development Canada's Community Learning Networks; Government On-line; and the SuperNet project in Alberta.[14]

As CRACIN noted in its first round submission to the Telecommunications Policy Review Panel, the sustainability of community networking organizations has been exacerbated by a variety of institutional and organizational factors. Government-funded access initiatives have created complex and frustrating accountability and reporting mechanisms, budgeting cycles have complicated long-term program planning and staff allocation, and "the 'sustainability' of public access to the internet has been defined rather narrowly in terms of a project's ability to cover its own costs. This focus on

economic sustainability over community capacity building threatens to undermine rural and remote broadband access."[15] [Is it possible to paraphrase this? I do have a question regarding this footnote – please see the footnote section.]

CRACIN also pointed out the recent vulnerability of community networking groups, with the closure of over 2000 Community Access sites in the last few years and the suggestion from Industry Canada that at least one third of remaining CAP sites "would reduce service or close altogether without continued government funding." [Is this an online source only?]CRACIN recommended that:

> Connectivity policy and programs should be designed and implemented with a strong community-based component in mind. This means not only better funding for community-based ICT initiatives, but involving communities and community organizations in connectivity policy making, defining access needs, designing programs, etc.[16] [Is this an online source only? If so, we can just note that there are no page numbers. If it has a paper source, we may need the page numbers.]

Canadian municipal Wi-Fi ventures

Wi-Fi seems to offer a potential technical fix to these connectivity problems, which has led to its adoption in municipal and community contexts. Several municipalities in Canada have explored deploying Wi-Fi for community economic development – for both business and tourist applications, and for municipal policing and other services – such as remote monitoring of parking meters and the automation of other services. Many municipal Wi-Fi projects are the result of private-public partnerships

(P3) where private companies receive a license to distribute wireless Internet signals to citizens.

For example, Calgary's Wireless City initiative, funded by the Province of Alberta, the City of Calgary, the federal government, and private initiatives such as Cisco and Fringe Solutions Inc., has created four separate access zones in downtown Calgary (see https://www.wirelesscity.ca/). The city of Hamilton, Ontario, is testing whether Wi-Fi can interact with the deployment of utility smart meters that are being installed in homes and businesses in the next year. This move is propelled by the mandate from the Government of Ontario that 800,000 smart meters be implemented by the end of 2007. Utility companies would thus like to be able to seamlessly send and receive date related to billing and load-management. Hamilton Utilities uses a Fibrewired affiliate that already has a municipal-wide fiber-optic network that can be easily connected to Wi-Fi stations.[18]

Perhaps one of the most successful municipal Wi-Fi endeavors is Fredericton New Brunswick's Fred eZone, a free municipal Wi-Fi infrastructure initiated in 2003. Fred eZone's coverage includes the downtown business district, municipal parks, local arenas, business hotels, Kings Place Mall, and the Fredericton Mall. Eventually, it is anticipated that Fred-eZone will encompass all of Fredericton's business corridors and public spaces. Fredericton is a small (population 80,000) yet vital eastern city hosting two universities, a burgeoning high tech sector, and government: the provincial capital and several federal government offices are located there (see http://www.fred-ezone.ca/).

As a "smart community"[19] whose mandate is to provide low-cost, high-speed Internet access to its citizens, Fredericton faced a duopolistic broadband market which

compelled municipal leaders to set up their own non-profit company to become a non-dominant carrier. In 1999, the government invested in a municipal fiber-optic network backbone, but it took until 2001 before an appropriate last-mile solution (in this case wireless) was found. E-Novations is a not-for-profit municipally owned corporation licensed as a CRTC non-dominant carrier. Local business and universities support its co-op model. The 22km fiber-optic community network interconnects partners with each other and with the Internet, as well as with community members through Motorola Canopy long-distance wireless technology. This fixed wireless installation broadcasts signals from antennas strategically placed in locations with broadband connectivity. Fredericton's project uses a variety of high-powered transmitters fixed to antennas, bridges, and other structures to broadcast strong Internet signals. However, it is not self-healing, nor does it extend to every neighborhood in the city at this point.

The project's success can be attributed to its municipal orientation: basic wireless signals are provided to Fredericton's citizens as part of taxpayer-supported municipal infrastructure. For residents who want web space, e-mail, or other services, partnerships with local businesses provide these for a cost. Fredericton's unique public-private partnership has been held up as an example of successful municipal network development, especially now that newly-passed US laws (in Nebraska, for example) forbid the development of similar networks in American municipalities.

Some recent work[20] has suggested that municipalities could partner with community groups instead of public partners to provide wireless services. This would provide sustainable funding for community wireless groups while helping municipalities provide universal service and community content**.** However, before such partnerships are

launched, it is important to take stock of the current state of such community initiatives and consider the ways in which they might contribute to such partnerships, as well as their current limitations and the challenges they face.

Community networks go Wi-Fi

Community groups working with wireless Internet technologies have sprung up in nearly every North American city. These groups have developed either independently or out of existing community networks and have focused on the relatively flexible nature of commercially available Wi-Fi technology – that is, the interoperability of devices operating in license-exempt spectrum. Open-source software enthusiasts are active in the community Wi-Fi movement, attracted by the challenge of developing new functionalities and expanding connectivity. Common to all community wireless groups is the desire to keep certain parts of the wireless spectrum unlicensed and to provide free and open possibilities for computers to connect with each other and with the Internet.

However, all community-based wireless groups are not created equal. The objectives and missions of these organizations vary, from providing a space for discussion of new technological developments by enthusiasts to creating a mesh network of Wi-Fi nodes that would permit the development of an alternative 'intranet' network, not necessarily connected to the Internet. Some groups dedicate themselves to opening hotspots, while others are concerned with the social and community aspects of wireless technology.

The best-known community wireless groups are Seattle Wireless, CUWin (in Champaign-Urbana, Illiniois), NYCWireless in New York City, Wireless London (made up of several distinct smaller groups), and Paris Sans-Fil. Many of these groups have

been working for several years on networks of hotspots, as well as on the development of mesh networks. Recently, some of these groups have moved away from their initial goal of primarily providing wireless Internet access towards broader community goals. For instance, CUWin has recently released software that can easily be used in any context to create a municipal mesh network (see http://cuwireless.net/news), NYCWireless is advocating a citywide deployment of meshed Internet nodes, and members of Wireless London are experimenting with location-aware mapping and content development (see http://wirelesslondon.info/LondonNodeMap?v=15kb).

Similar to the first community networking experiments in the early 1990s[21], the interests of wireless groups depend on the interests and ideals of their mostly voluntary members. Groups tend to be loosely organized, decentralized, and somewhat anarchic in their approach. Many of them are informal, quasi-social groups of technology professionals and interested amateurs. These factors contribute to the heterogeneity of these groups and may influence the choice of technically focused primary missions. Sandvig[22] argues that the primary missions of North American and European wireless community groups do not necessarily offer significant challenges to dominant telecommunications policy or delivery mechanisms, depending as they do on ethics of "accidental sharing." However, as wireless technology becomes more ubiquitous, and as private companies and municipalities develop high-level, and potentially expensive wireless Internet services, wireless groups can potentially contribute something other than frameworks for sharing signals: a community focus that could permit the development of local content and civic participation.

Coming after the more established North American Wi-Fi projects, Canadian wireless projects are considered to be the "second wave" of community wireless innovation. Aware of achievements of more established groups in the United States and Europe through their participation in conferences and online forums, Canadian community wireless groups are adopting goals that speak to a range of issues beyond simple wireless access. Many groups, including Île Sans Fil, hold as primary goals the promotion of free wireless Internet in their local areas. Secondary goals, like "promoting local community"[23] or "developing appropriate technology,"[24] [If these don't appear in paper versions, I think we can just indicate that these are online sources and eliminate the need for page numbers. However, paraphrasing may make it clearer to typesetters at the publisher.] may accompany these primary goals. However, while they share some characteristics with the previous generation of community networks,[25] they do not, as the early free-nets did, necessarily explicitly aim to address the digital divide or to promote local communities through the provision of locally produced community content.

BCWireless British Columbia, Canada (www.bcwireless.net)

BC Wireless (BCW), established in 2000, experiments with wireless infrastructure in order to provide the infrastructure to the greatest number of people possible. Their explicit goal is to build digital communities at the local level, not to provide Internet access. Many of their projects are thus oriented towards developing and deepening mesh networks, especially for use in rural and remote communities. Their volunteer-run group requires participating members to set up a mesh access points and network them with others. However, the group collaborates with other community

groups and for-profit providers to deploy technologies that will be useful in local settings, including Internet services. They also coordinate the Community Hotspot Program, which uses Wi-Fi software developed by volunteers at Montreal's île sans Fil, to open centrally managed hotspots with unique visual identities. The group has recently developed a prioritization of users to determine who will be permitted Internet access over BCWireless mesh networks, considering that Internet access over the network is donated by volunteers. Those who own the nodes will be permitted Internet access, while active BCW participants will be allowed access on a discretionary basis. Users with BCW accounts who do not contribute will be allowed to interact with the local community but not to access the wider Internet resources. This provides a metrics of trust in which those who contribute to the project should be more trusted than those who solely create usernames. However, it does create another level of control on the Internet, and defines a very specific "community" of users.

WirelessToronto (www.wirelesstoronto.ca)

This group has just begun to organize and to "unwire" Toronto locations. According to their website, they hold as goals, "lowering the barrier for entry into the unwired networking world and exploring how wireless internet can be used to build community." They will provide Internet access free of charge in public and "semi-public" places. The group is deciding how to use technology as well as how to define community. For the moment, they have begun their work using the hotspot model borrowed from Île Sans Fil, including the Wifi Dog software and its interface. Their first

hotspots are hosted by arts organizations such as the 215 Centre for Social Innovation, and they hope to continue to work with the cultural sector.

All of Canada's community wireless groups attempt to respond to their specific local circumstances. In some ways, these groups hold some of the core values of community networks, as outlined by Schuler[26]: information and communication; conviviality and culture; education; strong democracy; health and well-being; and economic equity, opportunity, and sustainability. At the same time, though, community wireless networks are a product of a specific socio-technical moment; in Canada, computing and Internet access are becoming more and more ubiquitous, while government-funded Canadian public Internet access is suffering from a withdrawal of public funding.[27] In this unique and evolving context, community wireless initiatives can play a variety of roles. Montreal's Île Sans Fil is a good example of how local forces temper the mix between amateur technical experimentation community content development and local engagement.

Île Sans Fil (http://www.ilesansfil.org)

Île Sans Fil (ISF) is arguably Canada's most successful community wireless network: at the time of writing, the group had installed 60 wireless hotspots, and over 10,000 people had created user accounts. A completely volunteer-run initiative, ISF has become the dominant provider of wireless access points while growing as an important part of Montreal's community-based media community. To illustrate, in March 2005, ISF received the Montreal Prix d'Innovation Sociale for its contributions to the social use

of information technology, and in May 2005, they were voted one of the five best Internet service providers by the Mirror independent weekly newspaper.

ISF not only provides free Internet access in public places but also creates the means for local community content and new media art to reach new audiences. ISF differs from other community wireless groups in two ways: their primary stated goal specifies "the deployment of numerous free Internet hotspots in public spaces (cafes, parks, etcs.)."[28] [Is "ects." spelled this way in the source? Could this be paraphrased/] This focus on the Internet as a "public" technology – one that might be suited to free distribution in public spaces – is a unique point of departure. ISF's secondary goal is variously expressed as, "connecting Montrealers to one another," "creating community," or "empowering individuals and fostering a sense of community."[29] The group actively pursues this goal, and that pursuit has resulted in the creation of specific software that displays unique content at each hotspot, the drafting of a "social contract" regulating the relationship between the partners who provide Internet service, and Île Sans Fil, and ongoing partnerships with arts organizations and libraries. In addition, ISF continues to plan for "the creation of a high speed rooftop to rooftop wireless network (a mesh network) open to everyone in the metropolitan region."[30]

As one of the ISF founders writes:

> We are a group of concerned and motivated citizens taking control of ICT infrastructure in our city. That's empowering as an example to others that this important part of our life isn't only the domain of companies and corporations or even governments. To me, that's a more significant impact than the actual fact that we

> have 55 hotspots and 9000 users. We are hacking the built city… Where this gets exciting is that by citizens, artists and non-profit groups developing and adapting these technologies (portable devices, wireless connectivity, mobile- and location-based applications) and their model (who is supposed to use them and for what purpose) we are able to impact and change this enhanced space and through that have an actual impact on how the built city is experienced.[31]

Like all community wireless groups, ISF is a product of its location, and of its members. In its particular case, these two forces have given rise to a unique contribution to local culture.

Local Culture

Montreal is a city of two million people located on the St-Lawrence seaway in central Canada. It is historically bilingual (French and English) and increasingly multicultural[32] (32), facts which are reflected in the makeup of ISF, which is officially bilingual. All meetings are held in both (or either) French and English, as members choose to speak in the language in which they are most comfortable. Montreal's climate is one of extremes, with long, dark, snowy winters and hot humid summers. As a result, the city still hosts a vibrant "café culture" where cafes, restaurants, and bars act as important "third places"[33] [Since this is a reference to a print source, we will need page numbers for these phrase quotes ("café culture" and "third places")], especially during the winter. Not surprisingly for a city with four universities and numerous colleges,

Montreal has a large student population, and its high social quality of life[34], combined with the fact that it is one of the least expensive major cities in the world[35], have made it attractive for freelance workers.

These factors may contribute to the popularity of ISF's hotspots. In fact, before ISF began their installations, the public locations equipped with wireless were limited to downtown hotels and university campuses. Students and professionals who wanted public Internet access were thus drawn to ISF, as were activists committed to the development of a "public internet."[Is this phrase widespread enough that we could eliminate the quotation marks?] The core membership of ISF is made up of technology workers, freelance consultants (including programmers, graphic designers, and community technology consultants), students (of urban studies, sociology, and communications), community activists, and artists. Members join for a variety of reasons, but a member survey[36] indicates that most enjoy the convivial, social nature of the volunteer group.

ISF's unique features, such as its provision of multimedia art, may also be a consequence of its location in Montreal. The Quebec government arts subsidies are generous compared to those in other Canadian provinces, allowing many artists to live in Montreal. However, multimedia artists struggle to find exhibition space. A unique partnership between ISF and the Mobile Digital Commons Network (MDCN)[37], a large-scale arts research project funded by Canadian Heritage to explore the artistic possibilities of mobile communication technologies in urban cultures, has financially supported the development of specific software functionalities that have permitted artists to exhibit their work on the portal pages of each hotspot. One of the most unique works

was the “Pattern Language” project (see screen shot in Appendix One). [Are you referring to Figure 2?] In this project, each hotspot is associated with a particular character in novella. As an ISF subscriber logs on at each individual hotspot, one sentence is added to a customized version of the novella. Therefore, a user who visits many different hotspots will read a story from many different perspectives, and a user who accesses the service from one location will eventually construct the story from a single point of view. Thus far, this financial support from MDCN is the only major public funding ISF has received.

In short, local factors have been instrumental in leading ISF to its current success, where it has not only provided sixty hotspots but also covered two major thoroughfares (a central shopping, entertainment, and restaurant district, and a historic square) with wireless signals and extended service far outside of the central areas covered by the telecom companies. However, its success has also depended on the involvement of local business and community partners.

Community partnerships

Local support by businesses and organizations for ISF has been enthusiastic. Montreal, and Quebec in general, were not well served by early commercial wireless Internet installations. Thus, businesses that wanted to offer wireless Internet to their customers were intrigued by ISF’s service, especially after media coverage portrayed partnerships with ISF as progressive and community-oriented.[38] Furthermore, Quebec has had a long tradition of community media and of integration of ICTs into the community sector.[39] [40] Partnering with a community group provides businesses and

non-profits with a sense of having positively contributed to their community while providing a useful service. In addition, some of ISF's installations have helped other community organizations to lower their Internet connection costs by wirelessly sharing a single connection.

ISF works closely with Communautique, a Quebec-wide, non-profit umbrella organization dedicated to bridging digital divides and providing community organizations with appropriate technologies.[41] This group is also active in lobbying for community-based media and public communications infrastructure. Communautique, along with other Montreal non-profit groups, is encouraging ISF to continue to develop their mesh networking project, which would permit community groups to exchange information with one another as well as to potentially gain wireless access to commonly-owned Internet bandwidth.

In order for a wireless mesh network to be developed that would satisfy the desires of the community sector, a reliable and plentiful supply of bandwidth would need to be secured, either through co-operative purchase from a wholesaler or an agreement with the municipality, a university, or some other reliable source of bandwidth. In Montreal, in contrast to Fredericton and Champaign-Urbana, neither the municipality nor any of the city's four universities (which each have their own closed wireless networks) have expressed interest in providing bandwidth to be shared by the community at large. This means that a mesh project would have to be supported by the community sector itself. This is still a long-term goal requiring negotiation with many different stakeholders. In the meantime, ISF is concentrating on delivering the services they do

provide to businesses and community groups and preventing the burnout of their core volunteers.

Services provided by Ile Sans Fil

ISF is not an Internet service provider. As part of its central mandate to extend wireless Internet and build communities, the group provides software, hardware, and technical support to people and organizations who want to share their Internet signal. The software (which is produced and distributed by ISF) simultaneously creates a platform for wireless access that promotes community development while managing and tracking users of the service. The software, called Wifi Dog, is programmed through a "hack" onto a commercial wireless modem. ISF provides these routers to hotspot hosts for wholesale cost. For a yearly donation of fifty dollars, the group installs the router and conducts technical support of the hotspot on a volunteer basis. In exchange, the hotspot host signs a contract promising not to charge for access to wireless Internet services. Some business owner hosts may require users to purchase items in order to stay in their location, but other hotspots, such as public libraries, arts organizations, and community centers, do not require payment of any type to use wireless services facilitated by ISF. The social contract, which guarantees that no end user will ever have to pay directly for wireless Internet service at an ISF hotspot, and formally defines the hotspot host as a partner, is a formal declaration of ISF's secondary goals. These goals are also expressed in the technical development of the Wifi Dog software.

Technical development

The Wifi Dog software serves two purposes: it is the local management utility for an individual access point that features individualized elements within a consistent 'Île Sans Fil' look, and it also regulates the system as a whole through an authorization server, which also collects aggregate information about usage patterns. The local management software can be installed on a LinkSys WRTg wireless Internet router, and the authorization server needs to be run from a dedicated server. Wifi Dog permits both increasing specialization of services for users and a reduction of each user's anonymity. When a user registers for an ISF account, he/she provides a valid e-mail address, which is stored in the authorization server and can be used to (at least partially) identify anyone who is abusing the service– for example, someone who is using too much bandwidth or who has engaged in illegal activities. At the same time, the authorization server makes it possible for users to see the screen names of other people who are online at a specific location. This functionality has the promise of permitting unique "social software" applications, where users can post profiles describing themselves or read the profiles of others. So far, this functionality has not yet been fully developed. ISF considers that any information provided in such a profile would be entirely public, and entirely voluntary. While the group has no written privacy policy as yet, members have always agreed that any retrieval of information about users would only be used for academic purposes, or in the rare case of an abuse of the system.

Although the authorization server holds the promise of unique computer-mediated methods of local communication, the hotspot hosts seem most enamored with Wifi Dog's other functionality: the possibility for each location to customize its own portal page.

This creates a place for content created in or about the local area, as well as the multimedia art curated by the Mobile Digital Commons Network. Currently, these portal pages can display photographs of the hotspot location, news feeds chosen by the hotspot hosts, and at some locations, shared content (photographs, for example) contributed by users (see Appendix 1 for an example of a portal page).

ISF hopes that these portal pages will become useful virtual clearing-houses of "ultra-local" information on events, news, politics, and issues of interest to the area surrounding each hotspot. According to a questionnaire distributed to ISF users in April 2005, a majority of people would like to see this type of information available at hotspots.[42] Providing this type of information would involve ISF in the kind of local content creation facilitated by the original community networks active in Canada in the 1990s. However, as at community networks, the uses of ISF services points out the delicate balance between access to local information and access to globally networked services and the Internet.

Uses and users

Currently, over 10,000 people have active ISF accounts, and internal logs indicate that just over 8,000 individuals have accessed the Internet using ISF's services. In order to use the services at an ISF hotspot, a user must either possess a wireless-equipped device or visit one of two locations that provide desktop computers. As a result, most of ISF's users tend to be people who already have access to mobile computing technology, as well as interest in new technology. One might consider these members to be a technical elite: well educated, interested in, and adept with new technology. A November

2004 online survey indicated that the most active and engaged sub-section of ISF users were bilingual males between the ages of 18 and 30 who were studying or working in the technology field.[43] A more detailed questionnaire distributed in-person to users at nine different hotspots in April 2005 confirmed the trend of youthful users: the vast majority of respondents were between 18 and 30 and either students or professionals of some sort. (see charts in Appendix 2 for a breakdown of surveyed users by gender, age, occupation, and primary use of services). [Please list the specific Figures to which you are referring.] All of the respondents said they had Internet access at other locations, including school, libraries, and other public locations, suggesting that Internet access at a wireless hotspot acts as only one of "a constellation of internet access locations" [May we eliminate the quotation marks in this phrase?] that make up the ubiquitous Internet access that many urban residents have come to take for granted.[44] Given that a wireless hotspot is only one among many Internet access locations, will community information be accessed as frequently as the information provided at home by the original community networks?

Results of the survey indicate that email and web-based information searching are the most common activities at hotspots, although some users also admit using the service for paid work. Canada's national newspaper, *The Globe and Mail*, recently reported that freelance workers in Montreal are increasingly expecting to have wireless access in bars and restaurants.[45] The "technical elite"[May we eliminate the quotation marks in this phrase?] who seem to make up ISF's core membership are considered to be valuable clients for café owners: a café owner is quoted as saying, "People do their meetings here, and there are a ton of freelancers who use the Internet here instead of at home . . . someone with a laptop has a little more money to spend."[46]

It would seem that ISF's services primarily benefit freelance workers and students. Analysis of the authorization server logs reveals that the most popular hotspots are downtown cafés where both food and alcohol are served, and that these locations are busiest in the early afternoon, midweek. The most popular hotspot receives over 25 unique visits per day, and several other hotspots receive over ten unique visits each day. Clearly, the service is popular and well used, and provides benefits to the businesses that partner with ISF. But what about the role of community content? Because this feature is not yet fully developed, it is difficult to say how useful users consider it. However, the most recent user survey revealed that two thirds of users would like to see local community news. The majority of respondents also indicated that, besides the fact that the service was free of charge, they enjoyed using a wireless service that was provided by a non-profit community group, an observation in line with Meinrath,[47] who noticed that users of the CUWin network described themselves as proud to be associated with a community endeavor. For ISF, though, the tensions between expectations of professional-quality service by the business owners and technical workers who use their services most heavily, and the further development of community-based content functions must be balanced considering their limited volunteer resources.

Sustainability

Like all volunteer-based groups, ISF must worry about long-term sustainability. The organization is worried that over time their core volunteers will eventually be unable to take on the responsibilities of deploying and servicing a larger number of hotspots. This issue is even more pronounced for a group which aims to provide a specific

telecommunications service like free public wireless Internet when technological developments make it likely that cities like Montreal will soon be covered with ubiquitous wireless internet signals (see http://www.cwta.ca/CWTASite/english/whatsnew_download/may25_05.html for one example of new developments by telecommunications companies). Because of this, ISF's connections to other organizations and relationships with potential government funders have become increasingly important as a means of procuring funding and developing a sustainable model.

ISF is a participant in the CRACIN research alliance.[48] This participation has facilitated contacts with government officials interested in community applications for technology, such as Canadian Heritage and Industry Canada. However, despite the interest by government funding agencies for new technical projects, the only public funding for ISF that has materialized has been through its partnership with the Mobile Digital Commons Network. This partnership mandated the creation of new hotspots in locations chosen by artists and the development of the functionality for adding local content and interactive art. Although this has been a very productive relationship, ISF continues to lack sustainable funding, particularly funding that is not linked to commercial interests. Given the potential benefits of ISF's technology and community and industry partnerships, the group is hopeful that public funding agencies and organizations will be interested in supporting them. However, initial contact with federal representatives from other departments, especially Industry Canada, which provides grants for technological development, has been positive but confused. Canada's funding initiatives are increasingly designed to promote the development of new initiatives in the

"social economy," [May we eliminate the quotation marks here?] which refers to the entrepreneurial, not-for-profit sector whose objectives include enhancing the social, economic, and environmental conditions of communities. The social economy, which received policy attention in the February 2004 Speech from the Throne[49], aims to create economically viable businesses that provide important social services; for example, day care services are considered social economy enterprises. However, there is no provision for funding the research and development of a product that is freely given away, not sold for commercial benefit, making it difficult for ISF to receive Industry Canada funding for the development of Wifi Dog software.

As an organization, ISF, therefore, falls between the cracks of government funding programs: it is neither purely an incubator for eventual mass market technologies nor does it have an explicitly social mandate. However, it is poised to contribute greatly to both of these areas and might be motivated to do so if an appropriate funding organization could be found. In the meantime, ISF has been approached by several different businesses interested in creating partnerships. For the most part, these proposed partnerships have not, in the opinion of the group, provided much of a financial or strategic advantage nor have they allowed ISF to maintain its autonomy. Only one partnership has thus far been undertaken: an agreement with a wireless telephony provider compensated ISF for opening some of their communication ports to telephony traffic. This partnership has recently resulted in a small payout by the company, which will go towards financing core ISF activities, including future fundraising.

ISF is presently attempting to negotiate strategies for sustainability. They are proposing to extend the partnership with the mobile telephone company; begin grant

writing projects aimed at competing for grants to support the development of community-based information services, e-government, and local content creation; and potentially explore more marketing options. The group is primarily interested in remaining self-sufficient and sustainable and would like to remain relevant as a community-oriented technology facilitator and delivery system for local content and art.

ISF continues to improve its system of provision of hotspots, its portal pages, and the functionality of its authorization server. The group's name has become well known through positive media coverage and word-of-mouth; some group members consider the media interest in ISF to be one of the group's major advantages. However, they are not the only group working on providing wireless access in Montreal. ISF is facing competition from commercial groups, while a similar community-based group, Laval Sans-Fil, operates in the nearby suburb of Laval. In Montreal, Zone Wi-Fi, which is also interested in unwiring sections of the city using a "social economy" business model, continues to lobby municipal government officials for support. In addition, local for-profit hotspot providers (including Eye-In and other smaller operations) are opening their own networks of hotspots, and large wireless Internet aggregators (such as Boingo) are adding Montreal hotspots to their lengthening global lists of access points. Furthermore, the major wireless carriers in Canada have just announced a partnership aimed at expanding Wi-Fi service between major carriers (see http://www.cwta.ca/CWTASite/english/whatsnew_download/may25_05.html). This service would make it easier for customers of every major wireless telecom company to purchase Wi-Fi services, even those provided by their provider's competition. All of this creates an enormous pressure for Ile Sans Fil to either transform itself into a commercial

entity or to form strategic alliances with other groups. Given that Ile Sans Fil prides itself on its self-reliance and innovation, these pressures may be difficult to negotiate.

Conclusion

Both Canadian municipal and community Wi-Fi initiatives are in an early stage of inception and development, and it is therefore difficult to speculate on their trajectory given the uncertainty of the outcome of current telecommunication policy reforms and a rapidly shifting technical terrain. However, it is interesting to reflect on the optimism and nearly evangelical fervor with which earlier community networks were created and to perhaps exercise caution in our assessment of whether and how the current crop of community Wi-Fi ventures can remain rooted in the local community and contribute to local cultural content creation.

Although community WiFi projects share many of the same goals as their predecessors, and groups such as ISF are fueled by the exuberant energy of committed volunteers, the sustainability of these initiatives is perhaps more fraught. So far, a wider populace needs to be actively engaged in using WiFi public spots – and to get around the current elitism of the user population, more partnerships need to be created among a diversity of community organizations and public spaces so that citizens who do not own their own laptop can use WiFi services with laptops provided. Synergies with municipalities might be a powerful incentive to develop diverse community WiFi initiatives where content can go beyond the provision of municipal services to include more targeted local content. So far, public-private partnerships in Canada appear to be mutually advantageous; however, as commercial entrepreneurs and industry become encouraged by the popularity of hotspots, care must be taken that content does not reflect

only commercial interests. The potential for using Wi-Fi and other forms of mobile technologies for cultural production is increasing, as initiatives like the Mobile Digital Commons Network highlights.

Research directions

ISF is not unique among community WiFi groups in its need to broaden its user base. Fuentes-Bautista and Inagaki, in their study on the multiple dynamics and stakeholders configuring WiFi access in Austin, Texas, point out "wireless divides" [May we eliminate the quotation marks here?]wherein service is limited in areas where ethnic minority and low-income citizens live. They write, "Austin's public Wi-Fi initiatives as a whole have failed so far to turn the opportunity provided by the unlicensed spectrum into a program attending to the issue of digital inequalities in the city." They challenge Wi-Fi providers, local governments, and policymakers to attend to creative efforts to "deliver the promise of universal broadband access through the unlicensed spectrum" (2005, p. 33). [50] These challenges apply equally to ISF and other Canadian Wi-Fi projects, especially in urban areas. However, Wi-Fi technology may be particularly useful in rural areas. BCWireless has attempted to develop technologies that can be inexpensively and flexibly adopted by remote British Columbia communities. Its testing and experimentation may help rural areas find better last-mile solutions permitting high-speed access. As time passes, it seems likely that more and more of these local initiatives will replace or augment services provided by major telcos. However, since fixed wireless services remain out of reach for many municipalities, it is important that Industry Canada continue to provide adequate license-exempt spectrum for open wireless installations. In addition, Canadian municipalities should monitor the laws being passed in some

American jurisdictions that forbid public-community partnerships. These laws are based in a presupposition that government-supported, universal access to information infrastructure is inherently dangerous for competitive telecom development. An adoption of this type of law in Canada would limit the development of community-based projects such as Île Sans Fil and the Fred eZone and would go against the policy position that telecommunications are a public good.

Meanwhile, more research needs to be undertaken to investigate the developing community wireless experience in Canada. If, over time, portable wireless devices become more affordable, will the uses of community-based wireless services change? Or, will the development of this technology follow that of Canada's original community networks? We could do well to heed the advice of Meinrath who admonishes us to become technically savvy and engaged with these technologies: "The challenge then is for an engaged public to build these cost-effective alternatives and become active agents in determining the future of the wireless telecommunication infrastructure" (2005, p. 236).[51]

Acknowledgments

Thanks to the Social Sciences and Humanities Research Council of Canada (SSHRC) for their support of the CRACIN project in writing this paper.

Footnotes

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[Footnote #17 was missing in the text. In your original references, you listed the following (below) as footnote 17. Please let me know where in the text we should insert footnote 17.

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[19] Smart Communities are geographically bounded areas, from neighborhoods to regional enclaves, that utilize and deploy ICTs to enhance their communities through the promotion of economic, social, and cultural services and content. Typically relying on government and industry partnerships, Smart Communities can be found in major western cities and regions, including San Diego, Hong Kong, Singapore, Ottawa, and Calgary, as well as suburban communities such as Vaughn, Ontario, and in developing countries such as Malaysia's Smart Masyarakat. Smart Community initiatives are an "integrated approach to helping entire communities go on-line to connect local governments, schools, businesses, citizens, and health and social services in order to create specific services to address local objectives and to help advance collective skills and capacities." See Coe, A., Paquet, G., & Roy, J. (2001). E-Governance and Smart Communities: A Social Learning Challenge. *Social Science Computer Review*, *19*(1): 80-93.

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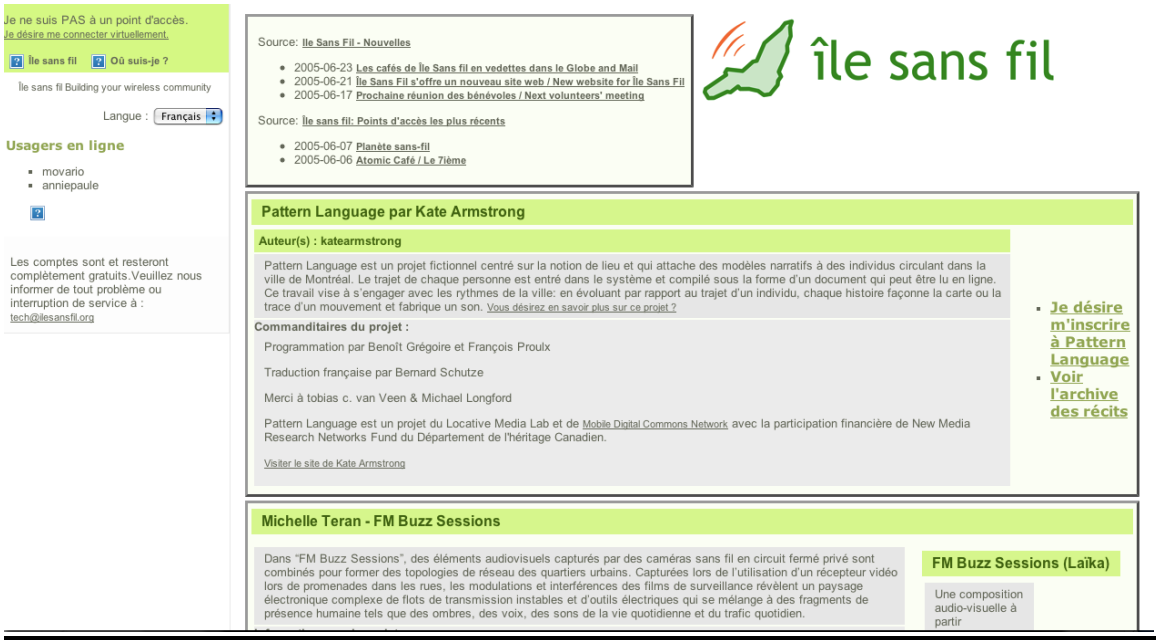

Fig. 1. Beta version of community portal site for Laïka Café.

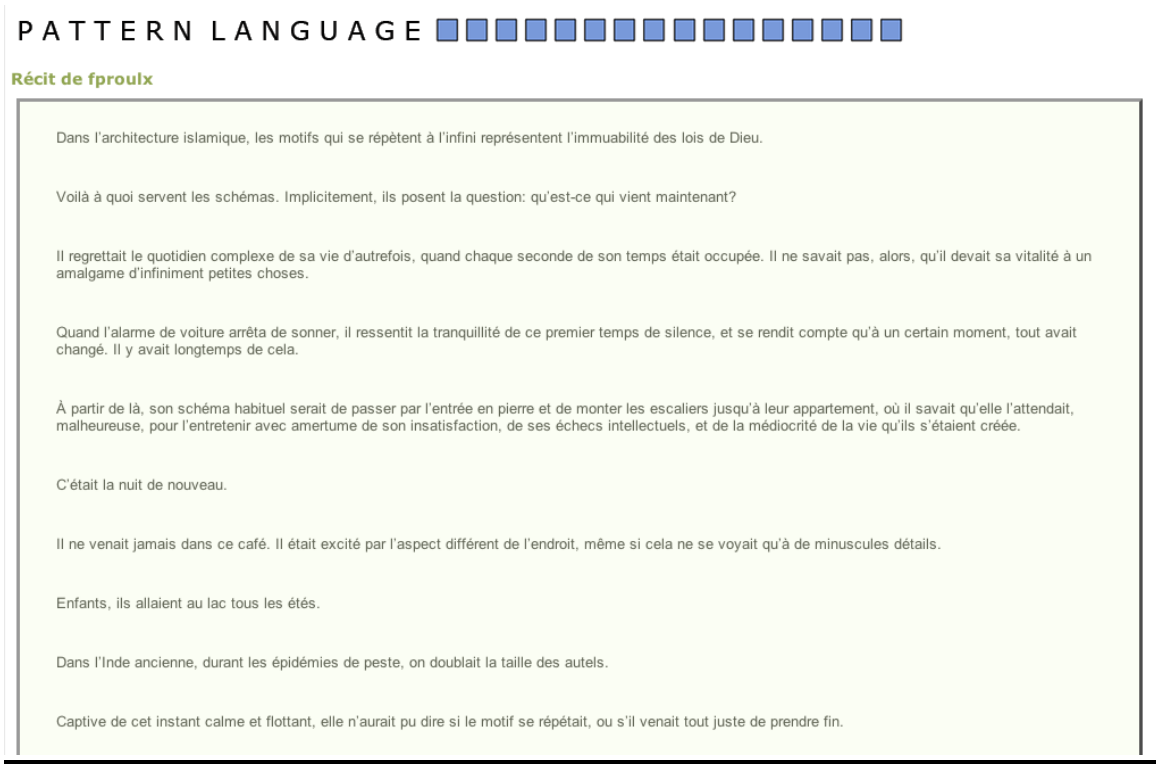

Fig. 2. One user's Pattern Language story constructed through visits to different hotspots.

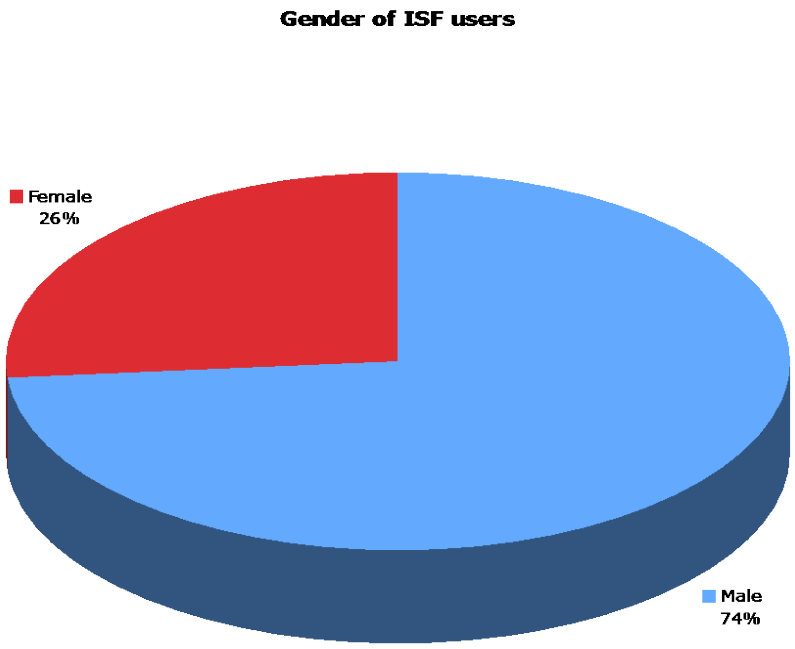

Fig. 3. Gender of respondents to ISF Survey, April 2005.

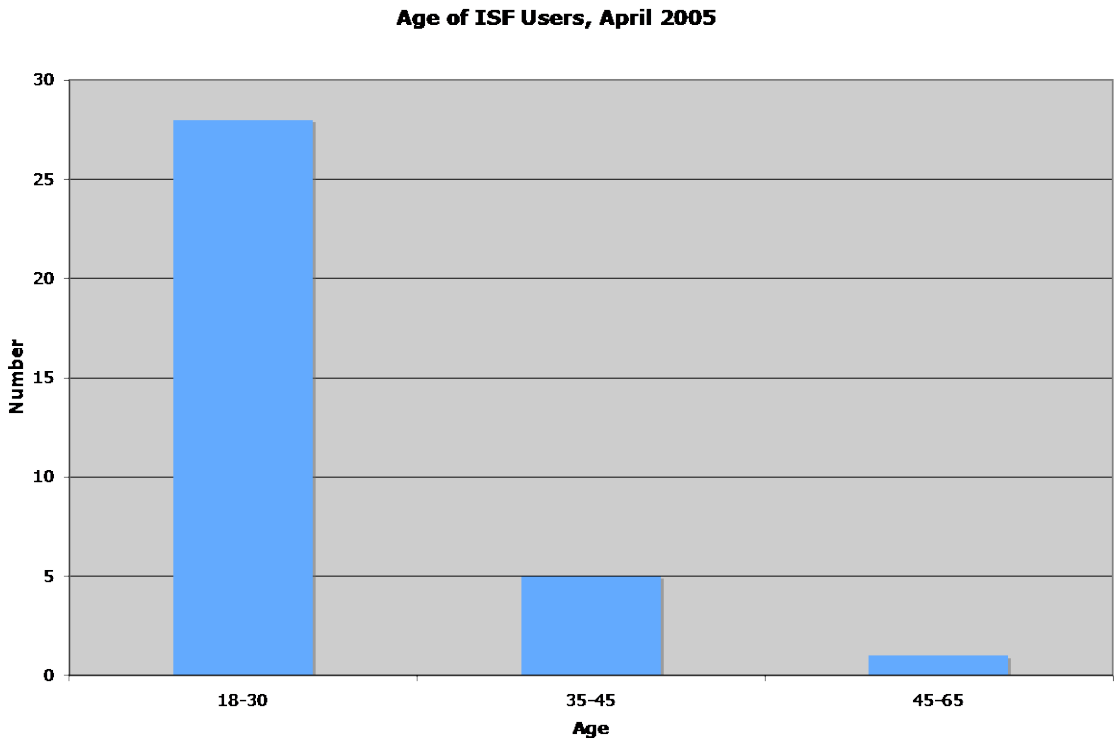

Fig. 4. Age of ISF user respondents.

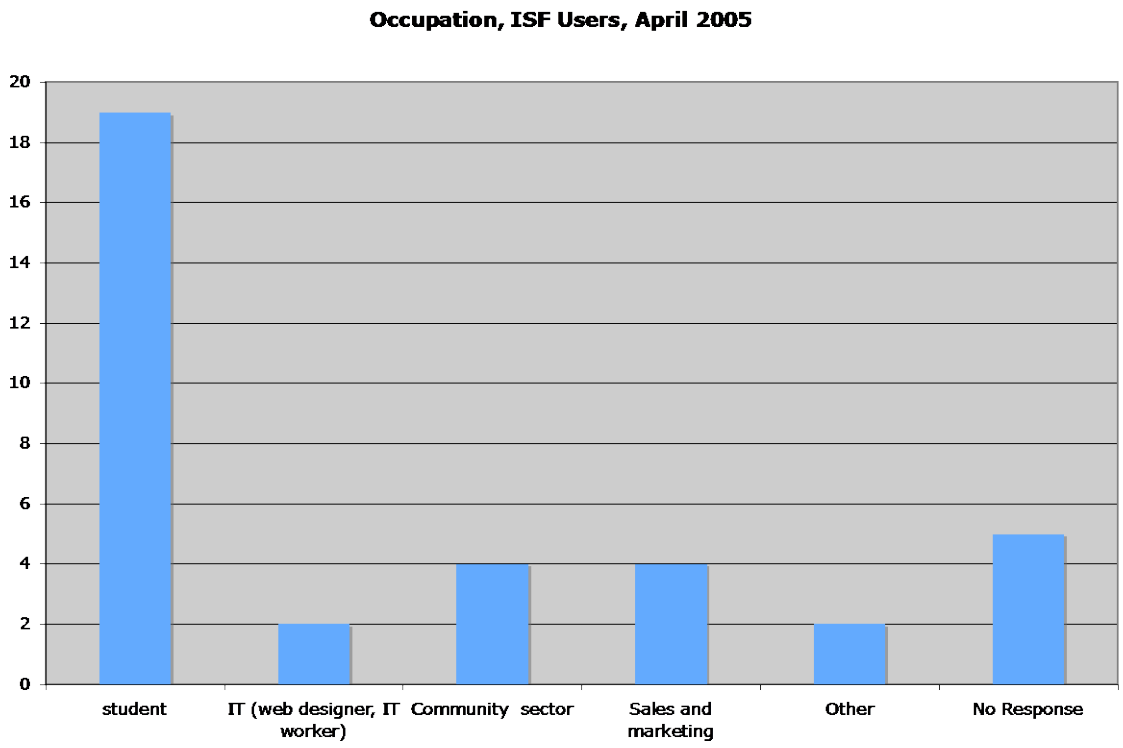

Fig. 5. Occupations of ISF user respondents.

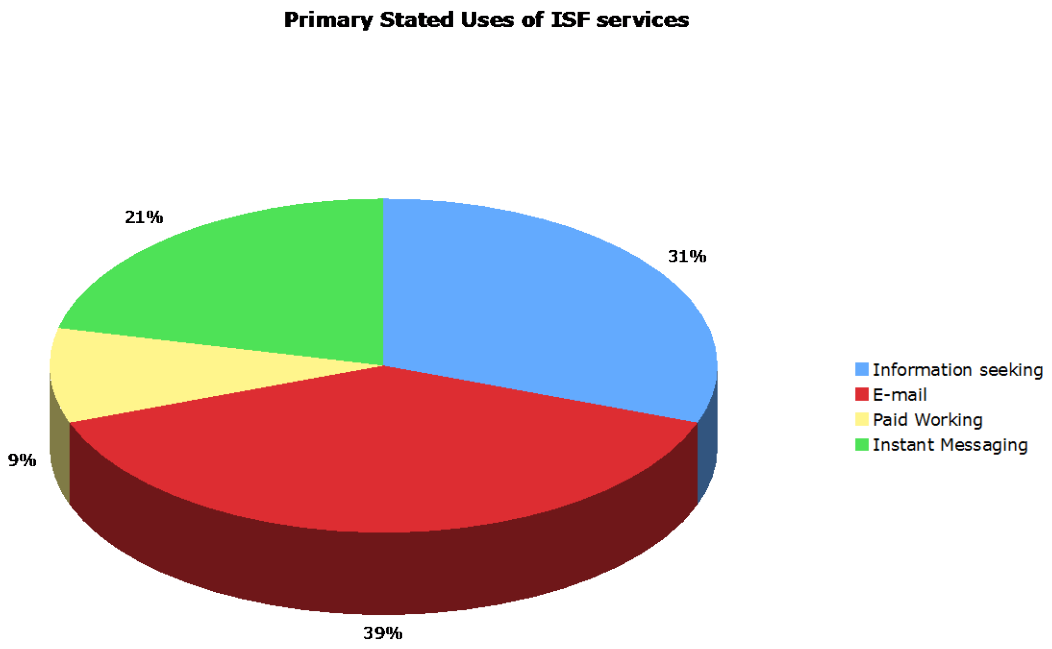

Fig. 6. Primary uses of ISF services, April 2005.