For many cities, the current availability of broadband Internet, coupled with affordable wireless networking technology, creates an environment of great community broadband potential. With many homes and businesses connecting to the Internet via high bandwidth broadband services and using standard wireless technologies, it is now common to detect multiple wireless signals in public and private spaces. While many wireless signals are often protected to block unauthorized access, others are left in an unprotected or “open” state. Whether intentional or not, this creates an abundance of disorganized but accessible high-speed wireless connections that blanket parts of these urban areas. A variety of different wireless groups have recognized the potential for this broadband “backhaul” to be transformed into some form of community service. These groups typically differ from each other in their vision for what these services could be, how they might be organized, and what philosophies drive their work. However, these groups are unified in their goals for value-added access and infrastructure for individuals and communities.

This chapter explores the theme of converting existing wireless broadband backhaul into services designed to benefit communities. This work is primarily based on case study research conducted on Wireless Nomad, a Toronto-based
Internet service provider (ISP). In addition to Wireless Nomad, Île Sans Fil and Wireless Toronto, two similar Canadian community groups, as well as FON, a worldwide personal Internet sharing organization, will also be explored. These wireless networking organizations will be discussed in relation to their various approaches to transforming wireless broadband backhaul into community-oriented services. This discussion will also consider the ways in which these organized possibilities for signal sharing can be further explored for greater infrastructure potential, decreased cost, greater accessibility, and reliability.

BROADBAND SERVICE AND INTERNET CLOUDS

Over the past decade, Internet use in countries around the world has grown dramatically, particularly in large Canadian cities. Canada is widely acknowledged as having strong broadband penetration rates (Ngini, Furnell, and Ghita 2002; Frieden 2005; Wu 2004), and the statistics available from Canadian census data suggest Internet growth across the country. Internet use in Canada continues to rise, with Statistics Canada reporting increases in usage in the most recent Canadian Internet Use Survey (Statistics Canada 2008). At that time, the national average rate of Internet use in Canada was 73 percent, with British Columbia, Alberta, and Ontario all above the national average. Major census metropolitan areas, such as Calgary (85%), Victoria (83%), Vancouver, Edmonton, and Québec City (each 78%), demonstrated Internet usage rates for people aged 16 or older that were higher than the national average. Users are increasingly relying on the Internet in connection with many facets of their lives, including communication, entertainment, commerce, education, and information seeking, to name but a few popular uses.

One influence in the growing use of Internet services is the standardization of wireless Internet technology, or Wi-Fi. Wi-Fi uses radio technology coupled with sophisticated software and hardware transmission protocols in order to transmit data that computers can quickly and easily send and receive. These transmission protocols fall under a family of standards known as the 802.11 standards, as devised and regulated by the Institute of Electrical and Electronics Engineers (IEEE). Wireless networking is being used as a way to provide access in new places and the effect that this growth has had around the world is striking. It is roughly estimated that some 200 million Wi-Fi chipsets had been sold in 2005 (Shah and Sandvig 2005, 7). With wireless, individuals can now create opportunities for Internet use without being tethered to a wired location. Wireless signals, being radio waves, often overlap one another and create dense “clouds” of wireless coverage. When left in an open state, wireless devices can detect a signal and use it to access the Internet. Alternatively, shared access can be granted by providing users
of the signal with the requisite security key\(^2\) that corresponds to the particular Service Set Identifier (SSID). Another form of intentional sharing uses captive portal technology, which redirects users to a login page requiring a password. Both of these approaches have been employed by individuals and organizations in order to explore opportunities for sharing. However, by and large, these wireless signals, while overlapping, remain discrete and disconnected from the other signals that surround them. These disparate network nodes have been described as “islands,” an accurate moniker despite their collective connection to the Internet (Sandvig, Young, and Meinrath 2004).

Indeed, many of these so-called islands are likely to remain separated, as Wi-Fi signal sharing is often the result of networks being inadvertently left open, as opposed to intentionally so. Users are often cautioned about leaving their networks unprotected for fear of hacking, privacy invasion, or unauthorized use (Shah and Sandvig 2005). A CRACIN study of wireless Internet users confirmed these concerns, as well as demonstrating the contradictory attitude of some respondents to freely use other people’s unprotected wireless signals, while being opposed to others using their signal over concerns about over-use and security (Wong and Clement 2007). Thus, in this environment of wariness toward sharing and presumed unwanted contact, promoting sharing as a viable form of service can be daunting. Sharing one’s connection with others when fair access, usage, and payment may all be in question can present an unappealing proposition. Furthermore, since 802.11 networks operate in the crowded, license-exempt 2.4 GHz industrial, scientific, and medical (ISM) band, interference often creates signal reliability issues that reduce the appeal of longer-ranged Wi-Fi connections. With the potential for a multitude of commercial devices (such as microwave ovens) to disrupt signals, interference can often pose a serious problem. However, with the abundance of wireless signals carrying high-bandwidth broadband, and the motivation by dedicated wireless interest groups to create something better for the people under these wireless clouds, there is a clear potential for unifying even some of these signals into greater Internet projects, thereby creating a network that is more than the sum of the individual, disparate parts (see chapter 11 in this volume, “Wi-Fi Publics,” for a broader analysis of producing community with Wi-Fi). Andersen (2003) described this evolving ubiquitous use of wireless networks as a new paradigm and speculated that “the future belongs to small, connected devices that will wirelessly allow the user—and the technology—to self-organize, creating something smart out of many small and simple nodes and connections.”

Toward creating these new networks, numerous organizations have sprung up in recent years, trying to tap into the potential of wireless networks. Sandvig (2004) noted that in 2003, there were dozens of Wi-Fi co-operatives in the
world. Tapia and Ortiz (2006) identified nearly 360 municipal wireless projects in the United States alone. There are probably many smaller, less formalized, grassroots community initiatives as well. The interests and objectives of community and municipal wireless Internet projects can be loosely grouped into two broad goals: improving access through wider availability and lower costs, and improving democratic ownership over public goods, in part by gaining control of communications infrastructure that would otherwise be in the hands of private telecommunications companies (Gibbons and Ruth 2006; Goth 2005; Lentz 1998; Wong 2006). However, not all groups interested in utilizing Wi-Fi are the same, with the presence of distinctions between even broad categories of description. For example, there are differences between projects of large-scale municipal governments and small, neighbourhood ones, and differences between urban and rural networks. There are also groups interested in opening hotspots, as well as those interested in social and community technology (Powell and Shade 2005, 6).

APPROACHES TO CONVERTING WIRELESS BROADBAND INTO COMMUNITY SERVICE

The following sections present three examples of organizations attempting to transform existing individual wireless broadband connections into some form of community service. The first example details the case of Wireless Nomad Co-operative, a Toronto-based ISP. Wireless Nomad is discussed in more detail than the other examples, given my long-term working experience with the organization. From 2005 to 2007, I maintained a volunteer working relationship with the Wireless Nomad team, studying their planning and approach, and helping with network installation. Wireless Nomad was a community partner in Toronto for the CRACIN project, and they met with the CRACIN researchers numerous times during the life of the project. CRACIN also provided a small funding grant to the Wireless Nomad team to help develop their open-source software and pilot test some of their technology. I formally interviewed the two principle members of the Wireless Nomad team twice, once near the beginning of the project in 2005, and later in 2007. Furthermore, throughout the two years spent working with Wireless Nomad, significant supplemental field notes were also taken. Wireless Nomad’s approach combined a residential monthly-subscription service with a free wireless access component, and was administered as a co-operative.

The second example looks at FON, a Spain-based worldwide wireless network company. In many respects, FON can be seen as a vastly scaled-up version of Wireless Nomad’s access model. This applies not just to FON’s international reach, but also by its significant financial backing and technology. Finally, the
approaches of Île Sans Fil, a Montréal-based community networking group, and its companion organization, Wireless Toronto, are examined. Their approaches are technically hotspot models; however, their vision is to do much more than just provide Internet connectivity for the community.

**Wireless Nomad Co-operative**

Wireless Nomad (WN), was a Toronto-based ISP that began in early 2005 as the collective idea of founders Damien Fox and Steve Wilton. Damien and Steve originally met in late 2004, at a Wi-Fi meet-up group in Toronto. Steve, who had spent some time working as a network administrator, and Damien, a law student with an interest in Internet law, shared an attraction to wireless networking and its potential for experimental customization in connectivity and signal sharing. With guidance and advice from a local business development centre, Steve began working on a business plan for a wireless Internet company and came up with the name Wireless Nomad. In January 2005, the two incorporated Wireless Nomad Co-operative. Originally, there were to be two business streams: a residential DSL service at 1 Mbps, and Hot Wireless, the brand name for their business DSL service. Some of the original premises for the co-op were:

- There would be full user access, such as the ability to run servers (commonly prohibited by ISPs) and not blocking ports (e.g., email protocol ports).
- There would be free accounts for wireless access within the network.
- Revenue would be reinvested in the co-operative and the network.

Their slogan was “Internet done right,” representing their interests in a more accessible Internet for their subscribers and also in providing free access for other users. However, they were careful to throttle the connection speed of free accounts to 128 kbps, since those connections were using the bandwidth paid for by subscribers. They did not want to impair or associate their brand with slow speed.

Their original plan called for providing customized wireless hardware that would run WN’s software. Linksys WRT54G routers would be reprogrammed to use the OpenWRT Linux-based software platform. These customized routers would then be enclosed in all-weather housings to be mounted outside the subscriber’s homes for increased signal accessibility. The equipment setup would also include a DSL modem. The original subscription model would have subscribers pay a CAD $150 fee for ownership of the equipment.

It was not until September 2005 that WN started to sign up their first customers for one Mbps DSL service. The original rate they charged for this service was $30 per month. Even at this early stage of the co-op’s life, it was evident that the business plan was flawed in a number of ways. For one, they realized
that the people in the business development centre that they had relied on for input lacked experience in the Internet provider market. As a result, some of the approaches they had implemented, such as door-to-door sales and putting up posters in the neighbourhood, were not very effective. Damien noted that the business development planners they spoke with probably had more experience with individuals setting up small bricks-and-mortar businesses for arts, crafts, and similar goods, as opposed to Internet service. Furthermore, their original plan to sell their equipment as a one-time $150 equipment cost was ill conceived. Even their friends were reluctant to get involved with the project with costs for the equipment being that high, in addition to a monthly fee that was very similar to existing incumbent service providers. Exacerbating this problem was the sharing aspect, which users did not perceive to be much of an advantage. WN quickly changed the equipment sale to a deposit and started investigating the use of mesh network technology in order to broaden their network, while reducing some of the expensive DSL connection costs. In October 2005, they ended up dropping the Hot Wireless business connection side of their operation altogether, after experiencing little success with it.

In late 2005, after some experimentation with modified, two-radio routers, WN deployed an experimental mesh network in the neighbourhood located around Damien’s house. (For more on mesh networking, see O’Brien [2003] and Xue and Ganz [2002].) In the first quarter of 2006, more nodes were deployed until eventually a peak of seven mesh nodes were operating with five DSL connections as backhaul. Unfortunately, despite this initial successful foray into mesh networking, two things eventually doomed the mesh project. Firstly, a combination of people moving away or abandoning the service dropped the number of active nodes to only three, including two at Damien’s own house. Secondly, outdoor deployment of the routers started to become a problem due to inclement weather, the necessity of having a vehicle for the installations, and the placement of the drilled holes in the house (i.e., the location of the hole was not necessarily aesthetically compatible with the best signal position). In fact, since this was a problem with the regular routers as well as the mesh routers, WN also discontinued outdoor deployment altogether during this period. Damien and Steve were both quite disappointed with this outcome, particularly as they had had some success in a neighbourhood where they had not anticipated it. By March 2006, things were looking bleak for WN. They looked at different ways to change the organization and decided on three major alterations. First, they increased the price of the service to $33 per month. Second, they got rid of the deposit system, which was a problem when people moved and the equipment needed to be recovered, and switched back to selling the equipment, albeit at a lower price. Third, they
stopped renting the small office at a business development centre they had been using at a cost of $600 per month. Finally, they cut what little advertising they had been doing.

In May 2006, the co-operative was surviving, but Damien and Steve were looking at alternative ways to generate new business. While both were gaining tremendous experience with running an Internet business and interacting with their co-operative members, they were still accumulating debt on high bandwidth costs. They identified two specific areas where they could find new subscribers. One was providing service to people who did not own a landline phone but still wanted an Internet connection. The other was for “budget retail” locations, such as the small businesses in their neighbourhoods. These businesses might not be able to spend $100 per month for a typical business connection, but might be interested in paying $10 to $20 per month for lower-speed wireless access. Unfortunately, neither prospective plan worked. Individuals without a phone line turned out to be a non-starter since they primarily seemed to be students who were only looking for limited, short-term connections. Furthermore, Bell, the owner of the lines, would charge an additional $10 per month to maintain the “dry-line” (the DSL connection without an accompanying phone service). As for the wireless service for the budget retail locations, Damien (pers. comm., 15 April 2007) admitted: “In the end, I think we had some really good ideas and the technology, I think, would have worked. But there was no way to prove it, and without a very good degree of certainty there was no way I was going to try and get money from people and there was no way I was going to spend another six months on it. You know, I think it had a shot, but it wasn’t a sure enough thing for us to continue on with that.” Late in May 2006, Damien met again with researchers associated with CRACIN, including me. Damien sadly noted that WN had seemed to have run its course. It was becoming increasingly too much work for the pair of them to continue operations with very little payoff (they were in considerable debt at this point). However, they did not want to strand their current subscribers, which at this point numbered somewhere around fifty to sixty. As a result, Damien and Steve tried to find alternative providers, such as the Toronto Free Net (a philosophically similar DSL provider), that they could shift their subscribers over to.

Surprisingly, in what Damien considered a series of miracles, WN’s fortunes seemed to turn around. Despite a higher price and being required to buy the equipment once again, people kept signing up for the service. Also, in a major improvement, they switched their bandwidth wholesaler to a different company. Previously they were being charged $23/month per DSL circuit (one per subscriber) plus an additional $2/gigabyte of transfer. This pricing plan was considered prohibitively expensive. Their new wholesaler was instead
charging $26/month per circuit plus the first ten gigabytes of transfer were free and pooled. This meant that they collectively had a pool of ten gigabytes per month per circuit that they could draw from, meaning that high-capacity users were balanced out by lower-capacity ones. While they still owed thousands of dollars to the old wholesaler, WN felt that at least under the new plan their business had a chance. For the next several months, until November 2006, the co-operative remained afloat. However, things were getting so tenuous financially that Damien and Steve both found full-time jobs and switched to running WN on the side.

In December 2006, disaster struck when a massive server failure severely affected WN’s service. Users lost the ability to log in because the authentication server was down, and voicemail and email services stopped functioning. To make matters worse, Steve was out of the country during this time and even when he returned, he did not have reliable Internet access to interface and repair the server. After many days of no service, subscribers started to leave, and by January 2007, Damien and Steve thought that WN was finished. However, the problems were eventually resolved as Steve was able to find some time to work with the server. WN did stop signing up new subscribers though. The following month they had a meeting with their co-operative members in order to discuss the future of WN. Much to Steve and Damien’s surprise, the meeting was well attended and suggestions were offered by the members. They decided to raise the price to $36.95/month for the now up-to-3 Mbps connection and contract the bandwidth wholesaler to also provide technical support from 9 a.m. to 9 p.m.. Previously Steve had been answering all technical support calls on his cell phone. WN also began to finally collect on some of the previous outstanding bills they were owed. Due to billing errors, some individuals had not been charged for various legitimate fees for months at a time. For just over two years, the co-operative continued to remain operational, although new subscriptions stayed offline while they fine tuned their billing services (e.g., switching to online billing, using credit card only transactions, etc.). However, by early 2009, it seemed again that WN had run its course. With declining membership and the co-operative never regaining the number of subscribers it had in its early years, Damien and Steve decided to end WN. In March, 2009, WN shut its doors and transferred their remaining customers over to TekSavvy, another Toronto-based ISP and the bandwidth wholesaler whom they had partnered with in 2006.

While WN ceased operations, through their connection with their members and the broader Wi-Fi community, the philosophy of WN lives on. Damien summed up the general ideology of the organization as “user empowerment first”: their typically more-sophisticated users could control their Internet resource, meaning that they could run a server, not have ports blocked, and have
their privacy and legal rights protected as much as possible. When asked about the co-op’s feelings toward sharing, which was mandatory, Damien added: “Selfish user aims are being denied, whereas user aims that contribute towards [the co-op are promoted] . . . it’s sort of trying to avoid the prisoner’s dilemma situation. No one is allowed to rat out, no one is allowed to not share. Because if everybody else shares and I don’t, I’m ahead. I [benefit from] this sharing but I don’t have to deal with sharing [back]. We don’t allow that. Everybody has got to contribute back.” This perspective highlighted wns’s philosophy toward forced sharing, in that they recognized that if provided, in an opportunity to not share but still reap the benefits of a shared network, there would be no incentive for anyone to participate. To avoid this problem, everyone was required to participate in the sharing network. In terms of having the free accounts, Damien’s reasons for that were quite pragmatic, if not altruistic. He stated that “free accounts are important to us because if you don’t have that [then] people who aren’t willing to pay are shut out and letting them in doesn’t cost anything . . . so why not let that happen?” Consistent with this notion of fairness to others, Damien believed that it was fair to charge users a fee if they were going above and beyond occasionally checking email using one of their free accounts. He suggested that there needed to be an acknowledgment that the service incurred costs that someone has to pay. Damien succinctly noted that “some philosophical commitment to free Internet is not going to change [the costs] . . . someone has to lay a cable, someone has to pay guys like Steve to run servers . . . and you want people who are good at it, or else what happens is that half the time [the network] doesn’t work.” However, Damien was quick to point out that there was some middle ground between having a service that maximized profit and a service that tries to make the offering entirely free. This is what Damien considered their “fair and reasonable” philosophy, in that there are kinds of services that are free but there are also kinds of services worth paying for.

**FON**

FON is a worldwide organization operating primarily throughout Europe, although they are expanding into North America and Asia. FON is one of the largest of the community groups examined here, and certainly the most well funded. After receiving USD$22 million from Google, Skype, and various venture capital firms, FON went live in November 2006 (BBC News 2006a). In June 2006, BBC News (2006b) reported that FON had some 54,000 people signed up worldwide, primarily in cities. The same article quoted the general manager of FON North America as aiming to have 50,000 hotspots by September 2006, 150,000 by year’s end, and one million by the end of 2007. According to the founder of FON, Martin Varsavsky, one of FON’s dreams is
“a unified global broadband wireless signal” (BBC News 2006a). In October 2007, FON partnered with British Telecom to expand FON’s community to include existing British Telecom Wi-Fi broadband customers, a reported three million users (BBC News 2007).

FON’s service comes in two configurations. In the first, a user already subscribing to another ISP’s service purchases a specialized FON router called La Fonera for approximately $40 USD. This individual is called a “Fonero” and may choose between one of two different paths. By becoming a “Linus,” Foneros freely share their connection with other members of the FON network. In exchange, they may freely access any other FON node that they can detect. Alternatively, a Fonero may become a “Bill,” so access to their wireless node costs money to external users (administered by the FON network). In exchange, they receive 50 percent of the money generated from use of their node. However, unlike Linuses, Bills must pay for any use of the FON network beyond their own node. Bills and Linuses are able to restrict the amount of bandwidth available for communal connections. In June 2007, the model was changed such that Bills and Linuses both got free access and part of the proceeds. The second service configuration creates individuals known as “Aliens,” or external users, who are free-floating pay-as-you-go users. FON service is similar to WN in that sharing is promoted through the use of one’s own network connection. Also like WN, roaming users are able to connect to network nodes wherever they can find them, which would likely be near residential homes (FON makes use of existing broadband connections, after all). However, in both cases, there is a strong requirement for a large, extensive network in order for the roaming service to have maximum usefulness. Clearly, the goal of the FON network is to continuously build the network, in order to not only provide greater access, but to also encourage more users.

The FON business model is based on piggybacking off of existing ISPs’ bandwidths and connections. FON generates revenue from its pay-as-you-go customers as well as from the sale of their equipment. However, much to their advantage, since FON does not own or maintain the backhaul network equipment, their obligations and responsibilities from a financial perspective are rather limited compared to those of most other ISPs. The general manager of FON North America described this as “changing the economics of Wi-Fi” (BBC News 2006b). This can be problematic because many ISPs prohibit individuals from reselling their Internet connections or sharing it without authorization. Indeed, as one analyst described it, FON is “treating Wi-Fi as communal property when it is not” (BBC News 2006a). FON’s response has been to seek explicit authorization from local ISPs but otherwise suggest that Foneros check and comply with their ISP’s terms and conditions. FON believes that they can create workable relationships with ISPs:
a FON France representative said: “We tell the ISP...basically ‘come with us, let’s strike a deal...because you, as an ISP, can benefit from something you never thought of’” (Reid 2006).

FON considers itself a community as well as a social movement. However, it is unique as a movement because while its prime motivation is to possess a widespread sharing network, it sells itself to potential members by catering to individual interests. For example, one FON executive said: “When we are trying to sell the idea of FON, we are not telling people ‘share your Wi-Fi because it is good for your community, it is good for your neighbourhood, it is good for your country’...we are saying ‘share your Wi-Fi because it is good for you because, when you’re going to move around, when you’re going to leave your home and you want to connect to the Internet, you can’” (Reid 2006).

This is an interesting way to promote the service because it specifically addresses a very powerful motivator in Internet use: personal gain. However, in terms of community motives, it is a bit suspect to promote socially progressive notions based primarily on selfish aims. While FON describes itself in terms of a community approach as well as calling its participants “members,” it is unclear whether or not the members have much say in the operations of the greater FON network. However, it is true that Foneros retain elements of control over their own connections, such as limiting the bandwidth. Otherwise, FON appears to operate much like a regular ISP in that they sell the hardware as well as administer the network, particularly the payment schemes.

**Wireless Toronto and Île Sans Fil**

Wireless Toronto (WT) and Île Sans Fil (ISF) are two similar, community wireless networking organizations based in Toronto, Ontario and Montréal, Québec, respectively. Since in many ways, WT is based on the ISF model and approach to wireless, it is useful to describe these projects together (see chapter 10 in this volume, “Community and Municipal Wi-Fi Initiatives in Canada,” for a more in-depth review of ISF). Wireless Toronto (WT) is another wireless networking group in Toronto that operates within the city, although moreso in the urban core as opposed to the suburban extremities. It was founded in April 2005 as an all-volunteer, not-for-profit community group. Like WN, WT formed as a result of an initial meeting among interested parties, in this case, at Social Tech Brewing, a forum promoting communities and technology. At this particular meeting, one of the co-founders of ISF was present, and explained how this community organization worked and how a similar one might operate in Toronto (Cho 2006, 15). Soon after, WT was formed. Both ISF and WT operate on a hotspot model of access at local cafés and other venues, which provide the broadband backhaul to the wireless equipment set up by...
ISF or WT volunteers. In addition to Internet access, ISF and WT also provide a number of other artistic and community services that host and promote various projects such as artwork, music, virtual space, and information. In contrast to WN and FON, ISF and WT are not residential services and do not promote their network nodes for homes.

Ideology plays a large role in both the ISF and WT projects, as both share strong goals and values when it comes to community wireless networking and access. For example, one of WT’s goals is “to facilitate public awareness over the social and economic benefits of non-commercial, community-based provision of wireless Internet, as well as encourage new and innovative approaches to building community with the technology” (Cho 2006,16). Similarly, as Powell (2006, 8) wrote, ISF’s goals include creating “wireless Internet access points accessible free of charge in public places, and . . . [using] emerging technologies to build communities.” These goals clearly suggest a strong allegiance to promoting communities, and to this end, both groups work hard to incorporate local interests, arts, and media in their projects. Also, the commitment to free access is very important to both groups. For example, hotspot owners are required to sign a social contract with ISF or WT, which “codifies the relationship between the host, ISF [or WT], and the end users as social rather than commercial” (Powell 2006, 8). This contract also specifies that the hotspot owner cannot run ads on the router. In order to maintain the principle of free access, hotspot owners are also not allowed to charge users for Internet use. That is, presumably not more than the cost of a cup of coffee or a snack.

**Reviewing the Different Approaches to Community Wireless**

The preceding review briefly highlighted a number of community wireless groups and their various approaches to transforming Internet backhaul into a community service. In the case of WN and FON, the approach relied on sharing to transform what would otherwise be personal or business broadband access into a service that others could use. This approach presented opportunities and challenges for both providers. One significant hurdle, and one that WN clearly experienced, is that any network of this type has a benefit for users proportional to the density of the network. In other words, both services would need to achieve a critical mass of users and network nodes. It does no good for a WN or FON customer to have access to a network that is limited to a few sporadic houses in locations all over a city. Furthermore, there is the added concern that if you happen to be the node located in a popular location—for example near a downtown square or café—you could very well be
overwhelmed with connection requests. Another challenge is the ownership of the network connection. WN became the ISP to address this challenge, while FON relied on “donated” bandwidth from Foneros’s pre-existing broadband subscriptions. It is unclear whether this is sustainable from a legal perspective as well as an industry perspective. That is, until explicit arrangements are made between ISPs and FON, it is unclear whether it is legal to resell or share a wireless connection in such a systematic way. FON’s partnership with British Telecom, however, would seem to suggest that FON has been able to successfully enter into co-operative agreements with major ISPs.

A sharing approach does present several opportunities for success, however. First, in WN’s case, by forcing sharing on users, the playing field between subscribers is levelled, in that everyone has to share. Requiring everyone to share or providing a strong incentive to share may be the only ways to ensure sharing between participants and the growth of a shared network when participants might otherwise elect not to. Second, an administrated shared network addresses many of the concerns individuals may have with sharing, such as addressing security and privacy (mandatory authentication), fair usage (controlled communal bandwidth), cost sharing, and access to a wider network of coverage. In fact, many commercial providers in both Internet and cellular access already share connections; they merely hide this from the consumer. FON may have also had the right idea about market sharing—that it is good for the user. This might be the best way to build critical mass, as it is likely an ideology that people can identify with. WN’s pragmatic approach, as indicated by Damien, as to what is fair and worth paying for might also resonate with individuals, particularly those already paying for Internet.

In comparison, the approaches by ISF and WT, while technically hotspot oriented, but socially more progressive and less commercial, present a different perspective. There is a notable distinction in that these groups are not aiming for residential access, but rather to improve Internet accessibility in public locations and the content available there. In fact, the distinction that these groups aim to provide not just access but community-relevant content is an important one. Whereas FON and WN would likely be best described as access providers, ISF and WT probably prefer to be considered more as community development enablers. ISF and WT are very ideologically driven, with commitments to both free wireless and promoting local interests in the arts, media, and information. (WN and FON are also ideologically driven, albeit by a different ideology.) As Powell (2006) found in studies, for many of these community groups, it is more than just providing an opportunity for people to surf and check email, but rather an emerging form of civic participation. However, it is possible that this ideology might be less appealing for some, particularly with wariness surrounding “free”
wireless. Other CRACIN research found less interest in the community aspects of wireless compared to the individual benefits (Wong 2006). However, this is not to suggest that community aspects are problematic or even off-putting, but rather, that it is relevant to consider whether some of the strong messages of community growth may fall on deaf ears. This is particularly important for non-profit and volunteer groups, such as ISF and WT, that rely on community support for their sustainability. Then again, since many of these groups are located in large urban environments such as Toronto and Montréal, it is more than likely that there are enough interested individuals whom these messages inspire and excite. Certainly this suggests that it is possible for both personal-benefit and community-oriented organizations to co-exist in the same locations.

Considering Sandvig’s discussion in chapter 7 of this volume on what community networks are an example of, all of these cases might be seen as an example of “revolutionary infrastructure creation” in that they take an existing form of network infrastructure—individual broadband Internet—and through the use of wireless technology, alter it to serve the community. This concept is revolutionary in the sense that what would otherwise be disconnected, disparate networks are linked into one overarching network. It is also revolutionary in that the goal is to share connectivity rather than hoard it or make it exclusive, to varying extents. In fact, some of these networks might also be viewed as an example of user autonomy and protest. WN, in particular, sought to bring features to their users that conventional ISPs prevented, such as running personal servers.

Applying Sawhney’s (1992) infrastructure development model, these Wi-Fi networks may find themselves somewhere between stages three and five of development. Stage three is characterized by the new infrastructure being encouraged by the old system. In this case, the old system would be individualized, home broadband connectivity. The familiarity and expectation of high-speed broadband encourages the use of wireless for greater mobility and locations of access. Stage four is characterized by long-distance capabilities and system formation. While Wi-Fi as a technology is not necessarily conducive to long-range transmission, given interference and power limitations, things such as mesh technology can theoretically help to mitigate these problems and extend transmission range. Stage four is also noted for the process of isolated bits of the new technology becoming interconnected with one another. Stage five is characterized by the outright competition of the new system with the old system. In this stage, Sawhney (1992, 543) highlights the “need to protect the franchises of the old system” and how “emerging competition is depicted as wasteful.” This might be consistent with the recent debates over wireless spectrum and the use of legislation to prevent municipal wireless
networks from developing. It is unclear whether or not these emerging community networks will see the development model through to completion, when Wi-Fi networks would subordinate traditional landline networks until a newer technology in turn replaces them. In fact, given Wi-Fi’s dependency on backhaul connectivity somewhere in the infrastructure, it is more likely landline and Wi-Fi networks will remain complementary services. However, it is clear that Wi-Fi networks, which are altering the existing model of individualized, personal broadband into more community-oriented services that help to reduce costs, improve access, and create local Internet awareness and content, have the potential to change and complement this existing system for the better, over time.

**CONCLUSION AND FUTURE PROSPECTS**

I began by exploring the concept of urban wireless Internet clouds of access, the result of many individual wireless nodes broadcasting broadband connections in wide areas throughout cities. These clouds of access are a source of great potential for a number of wireless community groups who seek to turn this broadband backhaul into community services. Both the successes of and the challenges facing the groups described above suggest that, while wireless Internet is here to stay, what individuals have come to expect from it and what they wish to do with it are still in flux. This is fitting, given that this is still a formative period of infrastructure development for wireless Internet.

Still, there are unanswered questions about how people perceive their wireless connections in terms of ownership and sharing. For example, is one’s home Internet connection an extension of one’s personal property? Is connectivity perceived as a home service much like phone or television access? In the latter case, how much appeal might sharing have? Extending sharing to public spaces, what is the value to users beyond the ability to have access? Do individuals expect or want more from their connection than just access? Or do community and local content really resonate with the users? The groups reviewed here, among many others, seek to answer just those questions as they aim to transform some of these perceptions of Internet access into their own vision of community service. With a variety of different approaches and motivations available, it seems likely that the project of transformation will succeed to varying degrees if certain conditions are met. These might include addressing individual concerns about sharing, reducing costs collectively as individual costs rise, promoting interesting and valuable local content, and improving the stability and reliability of the networks.
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NOTES

1 Sandvig (2004, 583) also uses the term cloud in this sense, suggesting that these clouds are composed of “heterogeneous networks that interoperate by accident as often as by intent.”
2 Currently either Wired Equivalent Privacy (WEP) or Wi-Fi Protected Access (WPA).
3 Names used with permission.
4 Unless indicated otherwise, all subsequent dollar amounts are in Canadian currency.
5 It was not possible to determine the precise number of Foneros and nodes in existence at the time this chapter was written.
6 As of April 2010, converting £29.95.

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