



CWIRP – COMMUNITY WIRELESS INFRASTRUCTURE RESEARCH PROJECT¹

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Wireless Nomad Case Study

¹ Production of this case study has been made possible through a financial contribution from Infrastructure Canada. The views expressed herein do not necessarily represent the views of the Government of Canada.

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1. Introduction

1.1 Brief Case Study History

Wireless Nomad Co-operative Inc. (“Wireless Nomad”) is a Toronto, Ontario-based Internet Service Provider (ISP) primarily serving residents and small businesses in the Greater Toronto Area. To a lesser extent, Wireless Nomad also serves customers in Ottawa and Kitchener/Waterloo, Ontario. Wireless Nomad has been incorporated since February, 2005 and began operating their network soon after that. Wireless Nomad is mainly run and organized by Toronto residents Damien Fox and Steve Wilton. It all started in January 2005 when Steve Wilton was looking to create a job, doing something interesting. Damien Fox was interested in "keeping the Internet the way it is". They both had a philosophy about the Internet, and believed in it. Damien Fox recognized a business opportunity for WiFi that would be "smarter" than paying \$10/hour in a coffee shop. They recognized that the existing telco model was not the only one. Steve Wilton and Damien Fox started with DSL and WiFi. Steve Wilton had the name, logo and business plan: home Internet for \$45/month. They sold home Internet gear (DSL modem) plus WiFi equipment (router) for \$150. They had to figure out how to make it cheaper, how to compete on price. They thought they could use meshing, so that they'd need fewer DSL circuits going into a community. It wasn't a bad idea, but it was a "hard idea". They needed to find the next connection for the mesh to work, and lots of people were already using wireless. Outdoor mounting of wireless boxes was the original plan. These ideas evolved over time, as will be detailed further in this report.

Wireless Nomad currently re-sells DSL Internet service and provides subscribers with a DSL modem and a wireless router. The wireless router is a modified commercial unit (802.11G) that allows for signal sharing among other Wireless Nomad account holders (both free and paid accounts). The Wireless Nomad sharing system works on a priority access model. The ‘owner’ of the wireless router (node) gets full access to their Internet connection via wired or wireless use. Other Wireless Nomad users who also have a paid account may connect to the wireless signal broadcast by the router and access the Internet. Other, non-paying users who can detect the Wireless Nomad signal can also connect to the Internet in order to create a free account with Wireless Nomad. Once they have a free account, these users can also access Wireless Nomad wireless signals to access the Internet. However, their connection is limited to 256 kbps and TCP/IP ports used for email are blocked. In theory, this would create an ever-expanding network of wireless access for Wireless Nomad users as increasing numbers of nodes are added to the network as more subscribers sign on.

In the nearly two years of operation (as of January, 2007), Wireless Nomad has grown to include 126 wireless nodes with over 3500 users (combined paid and free accounts). Wireless Nomad was directly responsible or has helped in providing wireless Internet access to Hillcrest and Dufferin Grove parks. Wireless Nomad has been featured on

www.boingboing.net, in NOW Magazine (in an article as well as #5 in the magazine's Tech 2005 Top 10), and Damien Fox also appeared on CBC's The Hour. Wireless Nomad has also had a long-standing association with the CRACIN project. Damien Fox and Steve Wilton both share many of the administrative and day-to-day operational responsibilities of the co-operative. However, the technical side of the operation is mostly Steve Wilton's department. The majority of their systems rely on the Linux operating system of which Steve Wilton is an experienced user and administrator. Both are advocates for open source software use. Damien Fox also organizes the Toronto WiFi meet up group.

Wireless Nomad has faced several challenges during its life, notably almost ceasing operations in May, 2006. When Wireless Nomad first began it featured an extensive advertising campaign of posters and door-to-door flyers in several Toronto neighbourhoods. Wireless Nomad also rented an office in the business development center in the King St. West area where they assembled modified routers. Unfortunately, business was slow, including investing a great deal of time, ultimately for naught, in trying to deploy a number of nodes in the Bain Co-operative housing complex. By the middle of 2006, Wireless Nomad was facing steep costs such as rising network access fees. As a result, Wireless Nomad raised their monthly subscription prices, abandoned their deposit system on the equipment (instead charging a one-time fee and granting ownership) as well as scaled back virtually all of their physical advertising. At a May, 2006 meeting with members of CRACIN, Damien Fox indicated that Wireless Nomad was strongly considering ceasing operations and transferring their customers over to any friendly free-net they could find in Ontario. Already they had scaled back their services in that they were no longer providing email service (@wirelessnomad.com) for new subscribers. They had also cut back on installations of equipment. Fortunately, a few months later Wireless Nomad was able to make a recovery. Switching to a new and much more favourable network provider with better rates, as well as experiencing a boom in new subscribers, Wireless Nomad seemed to be in a much more sustainable position. However, both Steve Wilton and Damien Fox have recently transitioned to full-time work in other sectors, mostly running Wireless Nomad on the side. This is understandable given that Wireless Nomad consumed not only copious hours of unpaid labour, but also was an expensive use of their personal savings.

As of March, 2007, Wireless Nomad has stopped adding new customers and has actually been turning down requests. Damien Fox has said that they will be resuming new subscriptions next month.

1.2 Mission Statement and Goals

From the Wireless Nomad website in response to the FAQ question “What are the benefits of membership in the Wireless Nomad co-op?”

“Wireless Nomad is a co-op. That means that when you sign up, you become more than just a customer, you become a member and part owner of Wireless Nomad. There are many benefits to joining Wireless Nomad.

As a co-op, Wireless Nomad's members are the owners of the co-op, so the profits that shareholders would normally receive are used to improve the network, support our community and lower access costs for everyone.

Individuals benefit from becoming a wireless nomad because you control your own wireless Internet experience by participating in the co-op's decision making process. Each nomad has a vote and can raise issues, make suggestions and/or actively work for the co-op.

The community benefits by making the Internet available to everyone and deploying access where it is needed rather than where it will most benefit some company's shareholders.

The world benefits because Wireless Nomad is an open source model that can be deployed anywhere. The tools we build together can be picked up and used anywhere.”

In response to the question “How is Wireless Nomad different from commercial ISPs?”

“Wireless Nomad removes some of the limits commercial Internet Service Providers (ISP's) place on the subscribers' use of their high-speed connection in their Acceptable Use policies and the Terms of Service and provides features you can't get from a wireline ISP.

Take Wireless Nomad with you. Your account is good anywhere on our network. If you have a high-speed account at home you have a high-speed connection everywhere.

* No bandwidth limit

* Servers

o While you are encouraged to check out Wireless Nomad's co-location and managed services, subscribers are allowed to run their own servers for legitimate services and within reasonable limits.

* Connection Sharing

o Most commercial ISP's bar users from sharing their connection with others even if no money is involved. In simple terms making your connection freely available to others may violate the subscriber's contract with the ISP possibly making them subject to disconnection.

o Wireless Nomad removes these limitations. In fact, the ability to share resources to the benefit of all is one of the reasons Wireless Nomad was founded.

* User Input

o Have you tried getting your ISP to change a policy you don't agree with? Wireless Nomad's policies are based on the input of individual Nomads like you. Want something changed? Craft a proposal, get it in front of your fellow Nomads and, if they agree, it will be changed.

* Take it with you!

o Your paid account gets you a high-speed connection anywhere on the Wireless Nomad network. The same way your node is open to others in the community theirs is open to you.

o Wireless Nomad plans to have roaming agreements with other providers to allow access beyond our network.”

1.3 Network Type

The Wireless Nomad network is a bit of a hybrid. The stated organization of the network is “co-operative” in that its members own it and funds collected from the members are re-invested in the co-op. Furthermore, co-op members are also supposed to be able to provide direct input into the administration and management of the network. One of the stated goals of Wireless Nomad is community empowerment, partially via Internet access at ‘fair prices’ and also through this democratic co-operative model of ownership. Membership is open to anyone who becomes a subscriber, accomplished by paying the (currently) \$32/month fee. However, the network is somewhat of a hybrid in that while the organization is technically a co-op, it is more run as a traditional commercial ISP in that the ‘head office’ tends to make the decisions unilaterally. That is, Damien Fox and Steve Wilton tend to make most of the decisions together and then carry them out. As far as we know, Wireless Nomad has only had sporadic member meetings. To be fair, this is not to suggest that Wireless Nomad was secretly intended to be a standard commercial ISP all along, but rather, perhaps member interest in participation and decision-making has been lukewarm at best. Since Steve Wilton and Damien Fox seem to be running things fairly smoothly, perhaps there has been no need (to date) for member intervention.

INTRODUCTION

Wireless Nomad used to pay \$2 per gigabyte of transfer to their DSL wholesaler. The current network uses a 10 Gb circuit pooled across their 100 subscribers. Damien Fox has mentioned that this worked fine until everyone found YouTube. Bandwidth demand increased dramatically, even more than double. Subscriber average downloads went from 4-5 Gb per month up to 70 Gb per month. Wireless Nomad now has a new deal with the wholesaler: best effort bandwidth for new subscribers and high bandwidth users.

2. Organization

2.1 Overview

Given that Damien Fox and Steve Wilton have been running Wireless Nomad for some time mostly by themselves as well as running it while they have been working on other projects, it seems mostly sustainable with a very small staff. For example, Steve Wilton's sister also helped with finances, and they have tried to secure at least four hours a week of volunteer help. Given that they have scaled back operations from the original system incarnation (early 2005) the system is even more self-sufficient. The third party DSL wholesaler whom they operate with also handles a lot of the network equipment (servers and connections). However, as a recent severe network outage demonstrated, such a small staff is often overwhelmed, as Damien Fox and Steve Wilton were responsible for fielding numerous irate member phone calls and emails. Steve Wilton also spent many hours working on the servers with the DSL wholesaler to fix the network.

Damien Fox frequently updates the Wireless Nomad blog and the Toronto WiFi meet up site, while Steve Wilton handles most of the Wireless Nomad web page content including service updates and network status. Steve Wilton also added a Google Map interface of Wireless Nomad nodes to the site.

3. ICT Infrastructure

The following are a number of selected statistics from Wireless Nomad, as of January 2007:

Wireless nodes: 126
Network capacity: 340.2 Mbps
Number of users: 3039
New users this month: 170
Total data transferred since July 1, 2006: 3848.82 GB
Data transfer per node: 30.54 GB
Data transfer per user: 1.26 GB

Update: selected statistics as of March 12, 2007

Wireless nodes: 127
Network capacity: 342.9 Mbps
Number of users: 3630
New users this month: 119
Total data transferred since July 1, 2006: 6550.01 GB
Data transfer per node: 51.57 GB
Data transfer per user: 1.8 GB

Wireless Nomad utilizes 802.11G routers operating in the 2.4 GHz spectrum range. The routers are commercial Linksys Wireless G Routers (model number WRT54G) reprogrammed to use a scaled-down version of Linux. The router memory is “flashed” which erases the factory default programming and replaces it. The software they use is called OpenWRT, which is described as a “Linux distribution for embedded devices”.² As an aside, Steve Wilton and Damien Fox decided to use OpenWRT instead of WiFi Dog for their routers. WiFi Dog is the routing software used most notably by ISF in Montreal. It is not clear at the moment why Steve Wilton and Damien Fox chose OpenWRT over WiFi Dog.

Reprogramming the router deletes all of the standard interface abilities that the router normally possesses. As a result, users are no longer able to log-in to the router using a web interface to alter settings. Advanced users can log-in to the router still, but settings can only be altered at the command-line level which is typically well out of the range of

ability of most users. Creation of an interface is the main focus of the CWIRP funded student project with Wireless Nomad. Jorge Torres-Solis, an experienced web and network developer, and PhD student in the Department of Biomedical Engineering at the University of Toronto, is programming the interface.

Current monthly costs for subscribers are \$32.95/month for an up to 3 mbps (800 kbps upload) DSL connection. Wireless Nomad is in the process of upgrading their lines to 5 mbps and they anticipate that this process will be complete by the end of the summer. Their website suggests that there will be an increase in costs associated with this upgrade (13.5 cents per day listed, so approximately \$4 extra per month). The router is \$87 and the modem is \$56. The business subscription costs \$54.95/month (plus equipment) with the same bandwidth restrictions. Current organizational costs to Wireless Nomad are unknown at this time.

As mentioned, quality of service for the network relies on a “best effort” philosophy. As a customer of a DSL-wholesaler, Wireless Nomad themselves are at the mercy of their wholesaler for network connectivity and reliability. Steve Wilton is responsible for all the tech support phone calls and emails that appear on his Blackberry. In terms of network traffic, Wireless Nomad is also “best effort” in that all traffic is treated equally and not prioritized. Indeed, one of their primary selling points is that they do not block any traffic, such as BitTorrent or other Peer-to-Peer applications. However, as noted, this can be problematic given the prevalence of applications like YouTube. Differential pricing has been considered but would be too difficult to implement given that they only DSL circuits, not accounts.

Future plans for the network are more conservative than their original plans (i.e. to capture 1-3% of the broadband subscriber market in Toronto) and revolve around wireless projects. As Steve Wilton and Damien Fox have mostly transitioned to full-time work, they seem to content to add a few new subscribers here and there every month. Their two main plans include:

1. Adopting a sharing model similar to Fon in that they will sell the modified router separately so that users who use other broadband providers can share Wireless Nomad signals much like Wireless Nomad subscribers (without having to activate a Wireless Nomad DSL connection). In addition to their reprogrammed router, with Jorge’s soon to be complete interface, they are also looking into reprogramming Mini Meraki³ wireless repeaters.
2. “Project Clementine” which is described by their website:

“Soon, through Project Clementine, Wireless Nomad will also begin accepting WiFi only members, people who want to be involved with the project and use the wireless Internet signal but for whatever reasons can't host a node. This has been in the works for a long time, and we think it is really important as a way to help increase access, make Wireless Nomad stronger, and bring people into the project that right now have no way to participate. Look for a beta version Project Clementine by the end of April, and a fully functional system by the summer!”

Damien Fox has also described this project as a way of addressing the gap between free accounts that have restricted access and full subscriber account. A possible method of implementing this system may involve a “host” who pays for the subscription and supports the DSL connection and wireless router. The wireless-only user would then connect to this signal remotely and have access to a 1 mbps connection at a “mid-range” price, of perhaps \$11/month. The difficulty is in sorting out the exact payment scheme since there needs to be some sort of benefit to the node host.

² See <http://openwrt.org/>

³ See www.meraki.net

4. Key Services

Wireless Nomad primarily exists to provide Internet access to its subscribers and free-users. Although created with co-operative and community supporting ideals in mind, it essentially operates as an ISP similar to any other commercial provider.

The free account access offered by Wireless Nomad is a notable feature of their Internet service. Creating an account is as simple as going to the Wireless Nomad website and creating an account online. This account is used to login to the Wireless Nomad captive portal at Nomad hotspots. However in practice, since typical 802.11 G network signals do not expand much past the boundaries of houses, access would thus be limited to the areas surrounding the node. This could be as little as only a few meters. Therefore, while it is true that free and paid users can connect to Wireless Nomad signals this would likely entail standing outside another user's house. This is not very appealing for extended periods of use. This limits the usefulness of most free accounts unless a free user happens to be a neighbour to a Wireless Nomad subscriber. Although Wireless Nomad does have hotspots in parks and some businesses, however, so free accounts still serve a purpose. While their reported statistics indicate a large number of free users (3500+), it is not known how many are actually regularly used. For example, it is possible to create as many accounts as you want, so it is not clear how many unique users there actually is.

A recently introduced feature of the Wireless Nomad service now also includes live technical support offered from 9am-9pm, Monday to Saturday. This service was introduced in response to feedback requesting "fast, friendly, and helpful technical support."

5. Users

Given that cost of the network, currently \$32.95/month (plus one-time equipment fee), is very similar to other ISPs, it can be assumed that most users are individuals who could easily have been customers of Bell or Rogers or one of the other providers. That is, Wireless Nomad does not specifically appeal to low income families or those without a lot of money to spend on Internet. Anecdotally, paid subscribers seem primarily to be individuals who were dissatisfied with the major providers and switched, or individuals who found the concept of a co-operative network to be appealing. Word of mouth between subscribers and their friends/family also seemed to have played a role.

As noted, the network is a co-operative and theoretically should be based on democratically concluded objectives and practices. However, it seems that the network mostly operates on the decision-making of Steve Wilton and Damien Fox, based on costs and what can be supported by the DSL-wholesaler and networking equipment.

6. Financial and Other Resources

In a December 2006 meeting with CWIRP members, Damien Fox suggested that they are clearing \$500/month net in subscription fees. In addition to the member provided funding, Wireless Nomad has also been funded through the personal savings of Steve Wilton and Damien Fox. CRACIN, in late 2005, also contributed \$1500 in loans for equipment for a prospective system experiment that ultimately fell through (an experiment in mesh networking). CWIRP also funded a \$2500 student project to hire a student (Jorge) to create a Graphical User Interface for the modified routers. The intention was to create a more accessible interface (rather than command line instructions) for home users of the routers to modify settings.

However, Damien Fox also noted that Wireless Nomad is in debt for \$16,000, which includes \$8000 owed to their previous DSL wholesaler. Furthermore, Wireless Nomad is also owed a lot of money as well. This was mentioned at a recent meeting in March 2007 with no elaboration as to who owes them this money (this might, in fact, be the money that is owed to Damien Fox and Steve Wilton that they put in themselves).

Wireless Nomad was originally setup using Damien Fox and Steve Wilton's own savings and presently relies on subscription revenue to remain afloat. Damien Fox and Steve Wilton both contribute a lot of time to the organization without drawing a salary. They have also been recently bolstered by the efforts of volunteers, some made up from members of the WiFi community (who may also be subscribers).

7. Community

7.1 External Stakeholders

Damien produced a submission for the TPRC panel in 2005. In it he made the following comment:

- “ 4. Essential to this business model is our ability to obtain DSL circuits through a reseller at a reasonable cost with flexible quantities and the ability to add additional circuits as required. With today's technology, there is simply no better way to provide a backhaul for low-cost wireless networks in urban areas.
5. The current regulatory regime which requires incumbent carriers to resell access to the lines which they developed as a protected monopoly serves new and innovative businesses well. It has enabled us to create a totally new type of Internet service using a corporate structure and business model that is fundamentally different from that of other Internet service providers. Our subscribers own and control their own Internet connections, following the principles of user control, open access, and user input upon which the Internet itself was constructed.
- ...
8. Until then, our ability to create a new network and community-based business model depends entirely upon our ability to obtain access to the lines of incumbent carriers. We respectfully submit that the current regime that provides mandated access and resale be continued and possibly expanded where appropriate. It has served as an effective means to correct for the obvious market failures induced by our legacy of telecommunications and broadcasting monopolies, has greatly reducing the cost of market entry for new businesses, and has provided choice for consumers and citizens in the Internet services marketplace.”

Thus, the ability to have access to DSL circuits is an important aspect of the Wireless Nomad business. It should be noted that Wireless Nomad made numerous outreaches to Rogers to acquire cable access under the same regulatory regime that gave them access to DSL. However, Steve Wilton noted with much frustration and

disappointment that while Rogers did not specifically deny their requests, they simply never responded.

7.2 Impact and Benefits

Wireless Nomad's free accounts do provide the opportunity for free Internet access. However, this access is predicated on ownership of networking equipment (e.g. a wirelessly enabled laptop) as well as being in proximity to a Wireless Nomad signal source (i.e. a node). With the exception of Hillcrest and Dufferin Grove parks, these nodes would be confined predominantly to residential houses. As previously noted, this is not very conducive to general access for extended periods of time. It is also certainly not a ubiquitous service, even though Wireless Nomad claims a coverage area of 253227m² (it is unclear how this area figure is generated). However, the potential for project Clementine is good in that there might be opportunities for greater coverage and attracting new subscribers if there is a lower cost service that does not require DSL connections at all the houses.

Despite Wireless Nomad's ideals for increased community access and support, as well as membership input, my assessment is that Wireless Nomad is, for the most part, a conventional commercial provider. However, this is not to trivialize their efforts for local neighbourhoods and communities as they have been active in promoting open source and free WiFi to a much greater degree than any of their commercial provider counterparts. For example, the Toronto WiFi meet up group that Damien Fox organizes hosted an antenna-building workshop where participants created homemade antennas out of Pringles chip cans.

7.3 Community Profile

Communities served by this network/organization primarily seem to be urban Toronto residential neighbourhoods. Given the relatively high cost of subscriptions (on par with many other commercial providers), it would seem to cater to middle-class/middle-income individuals/families at the least.

Their heavy use of Linux related material as well as their links to the Open Source and Toronto Linux communities (for example, they meet regularly at the Linux Café in Toronto) would also suggest a lot of participation from these groups. Furthermore, individuals who know more about Linux and command-line interaction would derive more benefit from Wireless Nomad system (i.e. interacting with their node).

7.4 Policy/regulatory/legal context

Interestingly, Wireless Nomad's original creation was designed to circumvent many of the terms of service agreements that commercial providers had that prevented individuals from sharing their connections, even at no financial gain. However, their decision to sell modified routers which share their signals by default (using other non-Wireless Nomad broadband connections) would seem to put them back at odds with

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this situation. Damien Fox also mentioned in an earlier meeting in May 2006 (when they were contemplating ceasing operations) that creating an ISP to get around the wireless sharing restrictions was not a good idea. This would probably be related to the hassles and difficulties that are part of the ISP business that they later faced which seemed to detract from their wireless sharing goals.

Wireless Nomad operates within the typical license-exempt frequency spectrum.

See also section 9 on how Wireless Nomad has benefited from the regulation granting access to DSL/cable lines.

8. Critical Success Factors and Lessons Learned

Wireless Nomad seems to be a moderate success in that nearly two years later they still seem to be operational and in an apparently sustainable manner as well. I suspect that they rely on the niche market of individuals dissatisfied with Rogers/Bell and/or individuals supportive of community and local initiatives. Word of mouth can also be a useful recruiting tool. However, this niche likely explains the small number of subscribers (126) and the slow trickle of new subscribers per month.

The fact that Wireless Nomad had to scale back operations (e.g. less advertising, removing email support, etc.) indicates some of the challenges that a new provider may face when trying to break into the Rogers/Bell dominated broadband market.

Many parts of my thesis focused in more detail as to the experience of Wireless Nomad and successes/challenges a new provider may experience.

9. Assessment

Wireless Nomad's general goal can be stated as follows (from their website):

"Our goal is to put you in control, get you connected and empower our community for a fair price."

Given these goals, Wireless Nomad has been successful in connecting people (except for the infrequent network outages), providing more control to users (allowing servers and sharing), empowering the community (by providing free access – with some restrictions), and having a fair price (given that they are making very little profit, it is relatively fair).

Even given the restrictions on their free access (reduced speed, no TCP/IP port-based email, limited geographical access) it still is free service that other networks cannot claim as easily. This does provide a public benefit.

Since Wireless Nomad is essentially Damien Fox and Steve Wilton's personal project, it really does represent a clear case of bottom-up ISP building. From an idea that the two shared about Internet access, open source use, and free WiFi, they created a fairly sustainable and active network. A key strength of this network is definitely its close contact with its subscribers and its pursuit of free access. Despite numerous challenges and personal sacrifices of both time and money, Wireless Nomad has persevered, for which they should be commended. They sought to provide an alternative to the major providers and they have accomplished this goal.

However, Wireless Nomad has a number of notable weaknesses including:

- Not enough staff or support (especially critical when the system is malfunctioning)
- Limited resources and income to expand and improve the network (including advertising it)
- Issues with commitment (though no fault of Damien Fox and Steve Wilton as they both need to support themselves), such as not being accessible during business hours
- Limitations in the 802.11 technology (including broadcast range, signal strength and quality)
- Reliance on niche interest for subscribers (as opposed to mainstream appeal, although not really their fault)

ASSESSMENT

It is difficult to assess just how Wireless Nomad could go about improving on these weaknesses, given that so many of them seem beyond their control or ability to address. Furthermore, some of their weaknesses are intricately connected to the fact that Damien Fox and Steve Wilton are so intimately involved with Wireless Nomad's operation when they often do not have the time or resources to devote to the network. In my opinion, until they can get a significant influx of funding that will give them some ability to implement changes or grow the network, growth and expansion will likely continue at the limited rate that it has been over the last two years. This is not necessarily a bad thing, however, as its current rate of growth seems to be just at the rate at which Steve Wilton and Damien Fox can support it.