Reforming Policy to Promote Local Broadband Networks

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Most existing assessments of local Wi-Fi projects have concentrated on either top-down, government-driven endeavors, or bottom-up projects developed by volunteers or community organizations. In both Canada and the United States, existing local Wi-Fi projects—both top down and bottom up—have failed to fulfill expectations that they could increase digital inclusion. Current policy frameworks may play some role in these failures. This article argues for a policy approach that favors hybrid public broadband that is neither completely bottom up nor top down, and for the development of policy frameworks that support hybrid public broadband.

Keywords: broadband policy; digital inclusion; community and municipal Wi-Fi; case studies

Research increasingly demonstrates that broadband is becoming central to full participation in North American civic life. Yet broadband adoption rates are dropping in both the United States and Canada (Horrigan, 2008; OECD, 2008). While the problem has been recognized and addressed by diverse groups, in this article we specifically focus on how governmental policy makers and citizen or community groups have approached it. Generally, these two groups have used either top-down or bottom-up approaches to this problem, but individually most of these efforts have failed. Clearly, there must be an alternative to providing local broadband that occupies a middle ground between purely top-down or bottom-up approaches. New policies should be developed and supported that can enable this type of community broadband development.

In this article, we examine three cases of broadband Internet being deployed by organizations other than traditional telephone, cable, and Internet service providers (ISPs). These three cases fall within both the United States and Canada, in different policy environments, but with similar telecommunication agendas. We examine the cases of both municipalities and community groups attempting to provide telecommunications services to citizens to fill gaps left by traditional providers. In all three cases, these efforts began with great hopes to use broadband Internet to solve social

problems in the communities and ended with unmet expectations and limited service. While there are many explanations for this lack of success, we offer the argument that unidirectional approaches, either top down or bottom up, have limited hopes for success, while bidirectional hybrids may promote greater chances of successful deployments, coverage, access, and usage, including digital inclusion.

In the following sections, we define hybrid public broadband and our approach to the study of public broadband. Next, we offer a discussion of the North American policy environments in which these public broadband efforts are taking place. Subsequently, we provide data from three cases and end with our analysis and discussion.

Hybrid Public Broadband

In recent years, a rift has opened between researchers who study the social context of broadband networks. The dividing issue seems to be the origin of the network. On the one side exist community broadband networks that originate in the hands of interested, concerned, and technologically able citizen and community groups (Auray, Charbit, & Fernandez, 2003; Bar & Park, 2006; Meinrath, 2001, 2005; Sandvig, 2004) which have conventionally been opposed to municipally sponsored or owned broadband networks, in which the city acts a convener, leader, provider, and designer of the network (Gillett, 2006; Ortiz & Tapia, 2008; Tapia & Ortiz, 2006, 2007). Community cases have typically been characterized as *bottom up* or grassroots (Gurstein, 2000, 2003) while municipal projects are framed as being as *top down.* In some of the earliest case studies, several of these networks were often framed as in conflict or opposed to the other form. We believe this dichotomy to be useful in describing the origins and establishment efforts of networks but less useful as networks age and mature.

We argue for something called hybrid public broadband. With the growth in quantity and size of broadband networks, we have seen a marked hybridization in which partnerships between local governments, industry, and community groups redefine ownership, management, maintenance, and use (see Tapia & Ortiz, 2006, 2007). The networks are neither purely municipal or community nor private. Clement and Bryne-Potter call this hybrid *public broadband* or *broadband in the public interest*. They define it as broadband networks that serve the public interest, regardless of the ideology upon which they were founded and the means by which they are provided (Clement & Bryne-Potter, 2007). In addition, Meinrath describes ideal community broadband networks as small and locally based; often comprised of nonprofits, unincorporated, municipally supported, hybrid partnerships; usually constructed from off-the-shelf hardware; action- and result-oriented; and possessing a mission to support both social and economic development (Meinrath, 2005).

The research questions that drive this article are as follows:

1. Why does current media policy lead to failure of both municipal and community networks?

2. What kind of broadband network would be successful?
3. What might a hybrid public broadband network look like?
4. What kind of media policy would support the construction of such a network?

In the following section, we identify our overall approach to the study of broadband and provide a comparative policy context in which we will situate our cases.

Our Approach to the Study of Broadband

Research suggests that broadband is not a luxury and that it is an essential component of any developed country's national infrastructure. Citizens who have access to and the skills to use the Internet are (1) more successful economically, with respect to education, jobs, and earnings; (2) socially participate more in terms of political and civic engagement; (3) and receive more government services and other public goods than those who do not (Katz & Rice, 2002; Kennard, 2001; Oden, 2004; Oden & Strover, 2002; Servon, 2002; Tufekcioglu, 2003).

Municipalities and community groups have fundamentally different goals in providing broadband Internet access than private industry. While community groups may be interested in promoting civic engagement or cultural capital among members of specific groups (Cho, 2006), municipalities are interested in promoting civic engagement, social inclusion, and economic development across all neighborhoods and communities through the deployment of their broadband network. Private industry's business mode is focused on the bottom line and, thus, provides service with a mind toward profits rather than social welfare. Traditionally, the United States has relied on private industry and competition to achieve greater quality and efficiency in the provision of Internet services (Lehr & Sirbu, 2004). However, this approach is no longer efficient: the United States and Canada are falling behind the rest of the world in terms of their broadband rollouts and average speed and quality of service. In addition, significant portions of inner cities and rural areas remain without service and the price of the service offered continues to rise. U.S. broadband penetration growth dropped from 15th to 17th place worldwide, from June 2007 to December 2007 (OECD, 2008). Canada was ranked 18th, just behind the United States according to the same data. Most of these measures rely on the marketplace to address the nation's need for broadband connectivity.

The United States has recognized the importance of broadband and has adopted a variety of measures to promote broadband. In the United States, policies concerned with universal access to telecommunication services exist at the federal, state, and local levels. Such efforts follow a long tradition of "universal service" programs that attempt to provide low-cost telecommunication services both to low income persons and those living in areas where it is costly to provide such services, namely, rural areas (Schement & Forbes, 1999). At the federal level, Internet access is subsidized to certain schools, classrooms, health care providers, and libraries through the universal service fund, which is administered by the Federal-State Universal

Service Joint Board (Prieger, 1998). Additional efforts at the state levels include programs to improve the benefits of Internet access (see Strover, Chapman, & Waters, 2004) and tax incentives for fixed line operators to deploy broadband "last mile" networks. However, together these efforts have been insufficient to guarantee ubiquitous low-cost broadband access.

Canada made an early commitment to developing universal access to broadband through its National Broadband Strategy, launched in 1995. This strategy provided incentives to companies to develop broadband services in areas of the country that had not been well served by the broadband market. This was followed by the Broadband for Rural and Northern Development (BRAND) program in 2001. These initiatives were both part of the government's Connecting Canadians policy agenda, directed at making Canada "the most connected nation in the world" (National Broadband Task Force, 2002). This agenda provided incentives for broadband and Internet network developments and supported numerous public connectivity programs, such as SchoolNet, VolNet, and LibraryNet (dedicated to providing connectivity in all of the country's schools, volunteer organizations, and libraries) that expanded free, community-based public access locations as well as encouraging market aggregation for rural and remote areas of the country.

The BRAND program was meant to help in "meeting the Government of Canada's commitment to bring broadband technology to all Canadian communities" (National Broadband Task Force, 2002). Although these programs were not entirely successful in providing equivalent broadband service in all areas of Canada (the BRAND program in particular was criticized as a weak response to the Task Force recommendations), they have provided very good broadband connectivity at reasonable prices to subscribers in most urban regions of Canada by encouraging competition in local broadband provision.

Currently, the lack of fair distribution of broadband has resurfaced as a public policy issue.[1] Canada was once a leader in broadband provision, but the shortsighted design of the 1990s policies meant that many providers pulled out of less financially viable regions once government subsidies were no longer available. In addition, funding for projects which supported education and digital inclusion projects were cut. With the elimination of funding for these projects and the reality of market failure for broadband in many areas (Longford & Shade, 2007), Canadians in rural and low-income areas may have difficulty accessing broadband and will likely not receive education and training on how to best use high-speed Internet, which as we argue below is part of a policy environment that could better support hybrid public broadband.

Current State of Local Broadband Policy

In the United States, policy addressing telecommunications services provided by local municipalities has been in a state of flux at both the state and federal levels.

Approximately one third of U.S. states have initiated some form of broadband-related policy that proposes to regulate the role a municipality might play in offering broadband services, although these differ wildly. In addition, several federal bills have been proposed that also address municipal involvement. Yet as of 2008, none have passed (Tapia & Ortiz, 2006, 2007).

The central goal of most policy that supports municipal entry into the telecommunication arena is to deliver high-quality broadband service to all citizens at a reasonable price. The argument is that the incumbent providers do not offer ubiquitous service because it is not cost effective in some areas. Those who oppose municipal entry do so with the belief that municipalities possess unfair advantages and incumbents would not complete upon a level-playing field. In addition, it is argued that municipalities may not possess the organizational competencies to deploy and manage the network without jeopardizing taxpayer dollars and assets.

Fueled by strong objections of incumbent telecommunication providers, state legislatures have been the locus of policy regarding municipal broadband. The central argument on the part of those lobbying state legislatures is that the public funding and support of municipal broadband networks unfairly affects competition in municipal markets between traditional private telecommunications providers and new ventures funded in part with public tax funds (Tapia, Maitland, & Stone, 2006). These private providers have expressed concern that cities providing wireless broadband service have several advantages. These include an unlimited base from which to raise capital, the ability to regulate local rights of way and tower permits, existing public infrastructure that is necessary for network deployments including streetlights, and status as tax-exempt organizations. Many companies have sought legislative relief at the state level to regulate or restrict a municipality's ability to provide wireless broadband services to the public. These legislative initiatives made use of a variety of tools that aim to ensure that a majority of local residents are behind the initiative, the broadband project will not negatively affect a city's finances, and the broadband deployment does not compete or competes on a level-playing field with private carriers.

Interestingly, the number of new U.S. municipalities who are entering as telecommunications providers is dropping, and many more municipal projects have been abandoned or failed. As of 2009, some community-municipal projects are idle (Madison, Wisconsin; Federal Way, Washington; and Tempe, Arizona). Many small municipalities abandoned their projects altogether, and several large-scale projects (San Francisco and Chicago) have ended their development efforts very publicly. As of late 2008, broadband providers such as Earthlink and MetroFi have retreated from the municipal broadband market (Horrigan, 2008; Panettieri, 2007).

Given the different broadband environment in Canada, local broadband projects came in the form of Wi-Fi projects. In 2004-2005, many major cities announced plans for entire municipalities to be covered with Wi-Fi. Open competition in local broadband markets made it possible for municipalities (such as Fredericton, discussed below) and for provincial government organizations (like the province of

Saskatchewan, which provided free Wi-Fi in the downtown areas of its three largest cities) to own Wi-Fi networks and to provide access for free.

Community organizations and grassroots groups of volunteers also created Wi-Fi networks in Canada. In addition to Montreal's Île Sans Fil (ISF) discussed below, other major cities hosted Wi-Fi groups, each of which linked Wi-Fi development to specific social or political goals such as increased civic participation (Cho, 2006) or individual engagement in expanding broadband access to underserved areas (Powell, 2006).

While Canada's early advances in broadband policy foregrounded digital inclusion and education, the current government has advocated for greater deregulation of broadband, although governments are still allowed to act as local carriers. The shift away from a policy focus on digital inclusion may also have inspired bottom-up efforts to involve "Wi-Fi geeks" in building community-based networks as a form of civic participation, a practice which is beneficial for participants but not necessarily for the broader local community (Powell, 2006, 2007).

In the following section, we provide data from three case studies in which we see broadband network failures and the policies, which may be partially responsible for those failures.

Research Design

In this section, we provide data from three case studies: (1) Portland, Oregon, the United States, (2) The ISF community Wi-Fi network in Montreal, Quebec, Canada, and (3) Fredericton, New Brunswick, Canada. We provide these case studies as examples of top-down and bottom-up networks that have not met their own expectations.

We will use comparative case studies in this research. The selection of case study as a methodology for conducting this research is appropriate for three reasons. One, case studies have been identified as an appropriate and important tool for the study of information and communications technologies in organizational contexts (Darke, Shanks, & Broadbent, 1998). Two, the case study is viable method for studying areas that are underdeveloped in the literature (Benbasat, Goldstein, & Mead, 1987). Three, the case study method is particularly well suited for studying phenomena that cannot easily be distinguished from its context.

For each case study, we have collected multiple forms of evidence from multiple sources (Flyvbjerg, 2006; Jick, 1979). These sources included city documentation, archival records, and interviews. Documentation included items such as policy handbooks, usage statistics, design documents, and data schemas. Archival records such as meeting minutes, contracts, and change-logs were collected for tracking the evolution of the system. Interviews were both structured and semistructured (Berg, 1989). The interview guide contained several categories—basic access, expectations,

general technical knowledge, usage behaviors, and general perceptions of municipal and community networks.

The above method yielded a wealth of data. Using analytical induction as a backdrop, the data analysis consisted of digitally recorded and transcribed interview data. The documents were analyzed and coded for emergent themes. These themes were classified into categories.

Below, each of the three cases is introduced. Next, we present the intentions of the network, a discussion of the failure of the network, and finally a discussion of how policy played a role in this failure.

United States Case

Portland, Oregon

Since June 2005, we have created a dynamic and evolving database of all municipal-community wireless initiatives in the United States (see Ortiz & Tapia, 2006, 2008; Tapia, Maitland, & Stone, 2005). The data collected spans multiple categories including information on the shape, form, uses, and technologies of the municipal-community network itself; the business plan and/or service delivery plan; the status of the development/deployment of the network; and the like. This database has been populated through a variety of methodologies. In most cases, information was obtained through the use of the Internet, using crawling techniques via municipal-community sponsored Web sites, press releases, public documents, and online news and web logs.

Although our database was extensive, we selected Portland, Oregon for in-depth case study analysis. This case study is based on interviews with approximately 10 community broadband stakeholders. Interviews lasted between 30 and 60 minutes. The semistructured interviews were conducted with council members, the city's economic development director, project manager, other key leaders, and non-municipal-community city partners.

Like hundreds of other U.S. cities, Portland deployed a broadband network and decided to launch its project in early December 2006. The launch included more than 70 access points (mostly downtown), and the stated goals of this project were to increase digital inclusion and promote economic development.

MetroFi was Portland's private contractor of free broadband Internet access. The company signed a public-private agreement with the city to design, build, and operate a Wi-Fi networks for residents, visitors, and city workers. Metro-Fi provided broadband access to Portland residents in two ways. For US$19.95 per month, some users received speeds of 1 Mbps with a 256 Kbps upload channel without advertising, and others got a free version of the service by accepting advertising. Since its launch, Metro-Fi announced in late 2007 that its network had 19,900 registered

users. Portland's Wi-Fi project was terminated in June of 2008 in that the free, ad-supported, wireless network ran by Metro-Fi was shut down due to financial problems. One could argue that the project in Portland failed because it became too costly and did not make a profit. However, those are Metro-Fi's goals, not the goals of the city. Metro-Fi failed to make a profit, so it pulled out of the project. Because it pulled out, the city's network failed. The source of the failure was the partnership and reliance with Metro-Fi.

The failure of Portland's network can be credited to several factors: (a) the lack of federal, state, and local policies; (b) the city's top-down approach; and (c) Portland's poor link with its community. The latter was expounded on by a local community member:

> We haven't found the Portland Metro-Fi solution to be very workable. Despite efforts that I would applaud whereby placing the receiver near low-income buildings, there is very little penetration into the building. The way it's set up is very hard to repeat that signal from Metro-Fi to inside buildings. I have a concern, does the free model create a perception that it's there, but in reality we're actually worst off than when we started. (Subject No. PO-6026, Interview, June 20, 2007)

In the year 2003, and then again in 2005, Oregon attempted to pass Oregon House Bill 2445, which would have severely restricted any Oregon municipalities' ability to own or manage a network. This bill would have required municipalities to publish a cost-benefit analysis done over an unrealistic 3-year time frame and then obtain a majority vote in a referendum before providing any communications services or facilities. The bill died in committee.

Despite the fact that Oregon currently has no functional legislation restricting municipal provision of broadband networks, we argue that three factors have encouraged Portland to act as if it were operating under such legislation. First, the legislation is likely to be proposed again, as has been threatened by current legislators. Second, similar legislation has already been passed in a majority of surrounding states. Third, there is a flurry of activity at the federal level seeking to restrict municipal entry into the market.

The single strongest effect of state-level legislation on the choice municipalities make concerning entering the telecommunication market is a change in business plan so that the municipality would not be the sole owner of the network (see Tapia & Ortiz, 2006, 2007). For those municipalities located within a state, which has passed restrictive legislation, this legislation serves as the sufficient driver to push the municipality into a partnership with private telecom providers. We believe that legislation enacted in one jurisdiction may have power to influence the behavior of organizations in other jurisdictions even though there is no legal requirement to do so. Fundamental to this is the fact that municipalities in all states, regardless of the status of state and federal legislation, have incorporated accommodations in their development of municipal networks (Tapia & Ortiz, 2007).

We suggest that Portland may perceive the need to keep up with potential state or national policy developments. High levels of federal activity may act as a signal to these municipalities that future legislation concerning municipal roles in telecommunications provision will be determined at the federal level rather than at the state level. Municipalities, like Portland, who have created networks managed via public-private partnerships, may be preemptively transferring ownership or sole ownership of the network in anticipation of future mandates to do so. As a result, Portland was forced into a defensive posture and a now-defunct partnership with Metro-Fi.

Another possible reason for the failure of Portland's network was because it was too top down. The city made unrealistic claims and promises on which it failed to deliver. The rhetoric surrounding the city of Portland's network was that the building of the network would solve many social problems, including digital inclusion problems, economic problems, and educational problems. However, the mechanism to solve these social problems was through offering access alone. This technological solution to a social problem met with misunderstandings and mistrust among the citizens of Portland. The citizens wanted social and educational programs that would draw them out of poverty that might incorporate technical elements. This was not what the city offered. For instance, Subject No. PO-6021 added,

> I know there was quite a lot of buzz and fuzz about the network in the beginning, but I don't know now if it's made any difference in the local economy. I know there's some excitement in many other cities. I think it's interesting that there's a citizen movement that's creating Wi-Fi networks from the ground-up that people can use and it's kind of a grassroots based thing. Why that didn't happen in Portland? I don't know. Maybe that's why it's gone through so many hurdles to not fail. Will it succeed? I don't know. (Interview, July 7, 2007)

The city failed to establish partnerships and relationships with local organizations engaged both in social support and technical support. When Portland announced its Wi-Fi plans, the city was contacted by different groups stating they were interested in supporting the program and officially partnering with the city. However, several years into the project, the city still had not formed many partnerships with community groups or nonprofits. A respondent from a Portland community-based organization stated in regard to the network project, "I personally don't see the city of Portland partnering or making an effort to partner with [omitted], or other organizations like [omitted]." Another subject echoed this by stating, "Categorically speaking, I don't see the city pursuing any formal partnerships to ensure the success of the network. It actually refuses to engage in any kind of collaborative process. It's just not a priority." The city failed due to its poor link with the community. Portland did a poor job of incorporating the local community and its needs into its plans for the municipal broadband network. Local community members interviewed in Portland revealed that their public officials "did not utilize local human capital," or that they felt like "the voice on the outside shouting in."

In sum, both the lack of state-local policy and the looming threat of future federal policies can be attributed to Portland's failed municipal Wi-Fi attempt. It forced the city into a complex and weird business partnership with Metro-Fi that often worked against their goals and best interests of the city. Although the city wanted to address the digital divide and poverty initially with their network, the for-profit nature of Metro-Fi's business model forced the city to rethink about the money-making goals of the network—something contrary to their nonprofit, community goals, their municipal mission, or their original intentions of building the network in the first place. This conflict may have contributed to Portland's failure. Most important, this case study reveals that advances in municipal broadband reform such as key partnerships, diversity of approaches, human and financial resources, and the integration of policy will improve the success rate of such deployments.

In the following section, we examine two Canadian cases: one, a community network and another, a municipal network. These cases take place within a different policy environment but respond to their respective environments similarly further supporting our argument that media policy has the potential to limit broadband projects, and also, in some cases, to provide support for some of the characteristics of true hybrid public broadband.

Canadian Cases: Community and Municipality

In Canada, two cases illustrate the problems with defining networks as either "bottom up" or "top down" and also suggest how more flexible policies that give cities more control over telecommunications can lead to the development of hybrid public networks. These cases were both very early experiments with community Wi-Fi, and each inspired subsequent projects, making them exemplary of a key phase of local broadband development. The data used in these two case studies were collected by the second author as part of a larger project on community and municipal Wi-Fi networking (see Powell, 2008). The multimethod study, conducted over 2 years in Montreal and over several months in Fredericton, included interviews with stakeholders including network developers, collaborators, business owners, and local government officials (15 interviews at each case study site) as well as an analysis of relevant documents. Each was accompanied by observation of the uses of the networks and informal interviews with network users.

The ISF community Wi-Fi network in Montreal, Quebec demonstrates how limited resources and unstable organizational forms can limit the development of a "bottom-up" network. The case presents how these limits may be transcended through a partnership currently in process between the community group that launched and currently manages the network, and the municipal government. The second case also demonstrates how purely top-down organization is not as effective as a hybrid approach. The small city of Fredericton, New Brunswick created a Wi-Fi

network as an extension of a municipally owned fiber broadband backbone. The Wi-Fi network was not intended to fulfill any specific social goals, but was simply offered free of charge in public areas, using excess bandwidth from the city's fiber network. This case reiterates that a broadband network, even if it is offered by the municipality itself and not through a franchise agreement, is not a priori an adequate response to bridging the digital divide or creating digital inclusion (DiMaggio, Celeste, & Shafer, 2004; DiMaggio & Hargittai, 2002). The analysis of these cases ends with a series of examples that focus on the potential for hybrid public models to develop in Canada.

ISF

ISF (in English, Wireless Island) was begun by three university students in 2003, who were frustrated with the lack of access to Wi-Fi in public places in Montreal. They established a volunteer-based, nonprofit organization that developed its own Wi-Fi software, installed Wi-Fi hotspots in cafés, bars, and parks, and created location-based arts and media content for presentation on the splash pages visible at each hotspot.

From 2004 to 2007, approximately 100 volunteers contributed to developing ISF's software, to installing 150 access points, and to developing art projects that would illustrate the potential for Wi-Fi hotspots to be used as ways of distributing location-based information or to host location-specific applications. ISF members created a nonprofit business model for hotspots, offering businesses and community organizations a Wi-Fi system at wholesale cost, plus a 50-dollar annual donation (see ISF, 2007 for details). In exchange, the organizations signed a "social contract" guaranteeing that they would not charge end users for the Wi-Fi connection. Since Montreal had not been well served by commercial Wi-Fi providers, this offer was compelling for many independent cafes, bars, and community organizations who wanted to offer Wi-Fi to their visitors, or who wished to cut costs by sharing Internet connections wirelessly.

The group's vision statement reads, "We believe that technology can be used to bring people together and foster a sense of community. In pursuit of that goal, ISF uses it's [sic] free public access points to promote interaction between users, show new media art, and provide geographically- and community-relevant information" (ISF, 2007). In pursuit of this vision, ISF's network of more than 150 Wi-Fi hotspots provides Wi-Fi in locations that are open to the public (though not, strictly speaking, public) including parks, cafés, bars, restaurants, artist and community centers, and the public areas of some hospitals and academic institutions. The idea of using Wi-Fi as an electronic "third space" away from work and home (Oldenburg, 1989) has been central to ISF's vision: one volunteer compared Wi-Fi hotspots to public parks: "I'm most excited about is the idea that ISF is building soccer fields. This is my new favorite way of explaining a major thing that I think is

important about ISF . . . I loved hearing the example of the soccerfield and having the idea legitimized of providing platforms that were not explicitly geared towards this or that agenda but that strengthened community" (Lenczner, 2005).

Members of the group also envisioned ways that the Wi-Fi hotspots would provide service to a broader public; they discussed how the portal page could act as a form of "alternative press" that would help people get to know their neighborhoods better: "it could be very simple: in each neighborhood, with each cafe we could go around and find one interesting person . . . take a picture and help people get to know someone. It could be very interesting. Did you know that your taxi driver was a brain surgeon in Iran before he had to flee . . .?" (Interview, Daniel Drouet, February 15, 2005). These ways of thinking about ISF's contribution focused on the potential of the network to transform the city by acting as a new platform of civic engagement.

By 2007, ISF had developed a robust network of hotspots, but the location-based art and content projects never developed as initially planned. Economically, ISF has virtually eliminated the market for pay-for-use Wi-Fi in public spaces in Montreal: "we have done a great job of domesticating free Wi-Fi in Montreal" (Michael Lenczner, personal communication, November 17, 2007). However, the media attention that the group attracted because of its grassroots, volunteer orientation raised its profile and inspired the municipal economic development office to propose a partnership with ISF, beginning in 2008. However, the proposed partnership between ISF and the city of Montreal will not create a ubiquitous broadband network throughout the city. Instead, it will provide funding for a full-time employee to manage ISF's volunteers, in return for an expansion of the network to eventually include 400 hotspots, some of them in city parks and public squares. A municipal representative explained that he felt that the partnership structure should support, not replace, what he saw as a fragile organizational form that was unique to Montreal (Bill Tierney, personal communication, November 18, 2007).

This type of partnership, where the organizational resources of the municipality leverage participation by volunteers, may serve as a type of hybrid public network, although the model adopted in Montreal does not provide home connectivity. For another response to a policy environment that suggests the limits of top-down planning, we can examine the case of the small city of Fredericton, New Brunswick.

Fred-eZone, Fredericton, New Brunswick

In 1999, the city of Fredericton, the provincial capital of New Brunswick, created its own utility telecommunications company and built a substantial fiber network operated as a cooperative with other local partners. The reason for constructing this infrastructure was that the city of 50,000 people, despite its status as provincial capital and its development as a regional center for knowledge industries, had been bypassed by many broadband service providers, making it very expensive for small businesses to connect to the Internet. Until 2001, only one ISP served the city. Broadband connectivity was only available in certain areas. The cost of bandwidth

was at least twice as expensive as in major centers: some businesses paid $800 a month for dedicated broadband lines. The market was small enough that large providers did not want to sell in it, and one small operator even went bankrupt. In response, the municipal government's technology department, which had been laying fiber to connect its own city offices to a local area network, created the Fredericton Community Network, a consortium of local businesses including the city government, who partnered to buy wholesale bandwidth delivered over infrastructure owned by a nonprofit, city-owned company. The company obtained a license as a nondominant telecommunications operator[2] and began operating as an ISP. As the city's CIO explained,

> This was not something they [the telcos] wanted us to do. They tried to dissuade our councillors, our managers, that we shouldn't be doing this that this was unfairly competitive . . . But we had done our research, we knew what the price points were, we knew what the price points could be. We knew that there was a fairly predictable pattern of objections from the telcos. (Maurice Gallant, Interview, February 18, 2007)

The fiber "Community Network," allowed the municipal government and other local businesses to aggregate their demand for bandwidth. This lowered the costs for businesses significantly and also incited other ISPs to provide connectivity in more areas of the city as a means of achieving greater market share. As a result, more areas of the city received broadband connectivity from either the municipal nonprofit, the incumbent, or by other providers at market price.

This municipal intervention was intended to bridge a local digital divide by providing connectivity service that would otherwise not be available. It also inspired the city to offer a free Wi-Fi network using the excess bandwidth available on the fiber network. This Wi-Fi network, which began operating in 2004, was one of the first in North America and consists of a combination of hotspots, hotzones, and point-to-multipoint transmission to cover certain areas.

The success of the Fred-eZone Wi-Fi network depends on the fact that the city purchases trunk line connections to the main Internet traffic routes at wholesale cost, using the bandwidth not devoted to connecting its offices as a free "gift" to its citizens. Through its operation of the municipal fiber network and the offer of free Wi-Fi in public and municipally owned locations, Fredericton has integrated "community Wi-Fi" into municipal government and economic development institutions. The network is managed by city employees and is used to promote the city's tourism industry, as it primarily covers public areas in the downtown core and selected municipal sites. The city's mayor states, "I don't really look at it as something that is economically beneficial and creating a revenue but more providing a service, a service that is beneficial" (Brad Woodside, Interview, February 10, 2007).

Despite the fact that it has created hotzones across 40% of its city's territory, and that hundreds of people use the free Wi-Fi service daily, Fredericton's network has also failed to expand. In addition, the municipally provided Wi-Fi has not increased

the levels of Internet access for individual citizens and residences, despite the fact that it draws on municipal infrastructure that has contributed to lowering business costs by providing a competitor in the fiber arena. Fredericton's residential broadband continues to be provided by the ILEC, and the Wi-Fi network remains limited to the downtown business corridor. According to the network operators, most users of the Fredericton network connect three times or fewer, suggesting that the network is mostly used by visitors and occasional users rather than as a reliable source of primary Internet connectivity.

Discussion

In all three of these cases, the organizers and sponsors of these networks did not successfully achieve their goals. These failures are all complex, multidimensional, and still remain largely unexplained. However, we argue that telecommunication and media policy played a large role in their limited success. Another argument can be made that pop culture and media influence caused the collapse of the municipal Wi-Fi market in the United States and can certainly be a meaningful and fruitful discussion in subsequent research studies.

Regarding the case of Portland, Oregon, the perceived restrictive state-level policy and the perceived impending federal policy contributed to the project's failure. Municipalities, like Portland, which have created networks managed via public-private partnerships may be preemptively transferring ownership or sole ownership of the network in anticipation of future mandates to do so. This acts as a form of perceived or indirect policy coercion in that although there exists no current regulation of the municipal telecom space, these municipalities anticipate there will be. To protect their investment of capital, rights of way and tax dollars, these municipalities are hedging their bets. As we have seen with Portland, the result of the partnership brought about conflicting goals between municipality and its ISP partner, leading to the eventual failure of the network. Most important, this case provides evidence that the policies in question encourage a flawed top-down model. Portland's project suffered first because of its forced partnership and also because of its poor efforts to include the public in its plans and choices. The potential hybrid public model suggested by the Portland case would (a) build awareness and understanding of the potential impact of ICT for development; (b) encourage governments should take ownership of the policy reform process at the local level; (c) include multistakeholder collaboration (government, private, public, etc.); (d) seek active participation of at-risk groups in the community; and (e) be flexible to adapt to local needs.

The failures of the initial hopes for the Canadian case studies also indicate the gaps in existing broadband policy. ISF, for example, never managed to introduce a new community media form using Wi-Fi, although the project forced the development of a new economic model by reducing people's willingness to pay for Wi-Fi in

public places. Similarly, the Fred-eZone provided Wi-Fi for free in some public places, symbolically establishing its community as innovative but did not provide comprehensive challenges to the existing models for broadband delivery in Fredericton, meaning that broadband savings at the municipal government level were not passed on to households. These outcomes suggest that purely bottom-up or top-down community Wi-Fi projects may not present commanding alternatives to current structures of communications ownership. Instead, hybrid forms may provide better alternatives, as suggested by some hybrid institutional forms developing in Canada.

Currently, a new set of local Wi-Fi networking projects are establishing institutional frameworks that integrate local—and sometimes community—ownership and management with local culture. These models provide the ability to support local community organizations, providing alternatives to the franchise models used in municipal networking. Failed municipal partnerships in the United States have provoked discussions of municipal-community partnerships: For example, the collapse of the municipal Wi-Fi market in 2008 in Portland led Metro-Fi to announce that it was planning to dismantle and sell the components of the network. In response, the City Controller's chief of staff reported that "future investments by the City in wireless provisions will be more project based partnering with local non-profits such as PersonalTelco, One Economy, and Free Geek [all volunteer-based CWNs]" (Churchill, 2007). This kind of partnership, like the ISF partnership with the Montreal government, could help Portland recover from MetroFi's failure to complete its network.

In Canada and especially in Quebec, the new institutional form of the public-community partnership has been successfully adopted as a means of easily and inexpensively developing local communications infrastructure. Between 2006 and 2008, Quebec City, Sherbrooke, Drummondville, and the Montéregie region of Quebec all began Wi-Fi projects, adopting the ISF model of hotspots sponsored by businesses and community organizations. Quebec City's "Wi-Fi geeks" branded their hotspot project "Zone d'accès publique" (public access zone) or ZAP, which helped them to leverage funding from government and other sources. In Sherbrooke, the Pôle Universitaire, a strategic alliance between the area's postsecondary institutions, applied for funding from Innovation et Exportation du Québec, and received $70,000 to build a network of 150 hotspots which was completed in January 2008.[3] Plans are for a further expansion: The project began with hotspots at universities and then expanded to commercial properties through a partnership with the Chamber of Commerce, and the final pillar of development aims to connect more hotspots within the community sector. The project adopted ISF's hardware and developed the ZAP brand in the local context. Although ZAP Sherbrooke has no employees, it does not use volunteers to install or maintain the network, instead contracting out to local companies. Volunteers participate in cold calling businesses and distributing promotional materials.

ZAP Sherbrooke leverages its strategic alliances to integrate Wi-Fi in various social service contexts. More than one third of ZAP sites are in universities, libraries,

or community centers where connectivity is supported by the City of Sherbrooke. Bruno Lacasse, one of the members of the Pôle Universitaire in Sherbrooke, remarks that the ZAP model for providing "secondary" Internet access is "the best of both worlds" because it provides inexpensive Wi-Fi to universities and community organizations and establishes a nonprofit model that could become the basis for a future cooperative telecommunications operator managed by the municipal government and the Pôle Universitaire. ZAP Sherbrooke brings together the organizational model of ISF with some of the frameworks for public ownership developed in Fredericton.

Some academics and researchers assert that a mix of bottom-up and top-down approaches are more suitable for the successful implementation of a municipal-sponsored project (Gurstein, 2003; Orlikowski & Robey, 1991). To them, a bottom-up view should be incorporated into the top-down approach. The bottom-up model assumes that technology is not determined by governments or telecom providers but is negotiated by all stakeholders in the community. A bottom-up advocate would argue that municipal-sponsored networks should be adjusted to public requirements (i.e., content and context), not the other way around.

Conclusions

These examples illustrate that a more flexible approach to both organization and regulation of local networks may be the key to promoting hybrid public networks. Permitting public or nonprofit ownership of infrastructure, such as was possible for Fredericton, may make the partnerships explored above easier to sustain. They may also help to increase competition and to provide coverage in areas where market failure means that ILECs do not provide service.

These developments establish some of the elements that we believe characterize a public hybrid network. Ideally, a public hybrid would

1. have digital inclusion strategies, frameworks, programs, activities, and solutions developed with community organizations and promoted by local government officials;
2. draw on community capacity such as citizen community groups, educational institutions (public-private or public-community partnerships), health care institutions, nonprofit and nongovernment organizations, community and computer technology centers, local chambers of commerce, small businesses, as well as the advocacy and public policy sector;
3. consider broadband support for media and community content services (as part of digital inclusion efforts); and
4. think of broadband as a utility and a public service.

Currently, neither Canadian nor U.S. policy fully supports the development of all these elements. Ideally, policy supporting a hybrid public broadband model would

1. include government intervention by way of fiscal and/or regulatory powers;
2. permit competition in local provision including ownership by governments and nonprofits;
3. acknowledge that digital inclusion and education are essential for integrating broadband into local contexts, especially in low-income and deprived areas;
4. provide latitude for a variety of ownership and business models; and
5. most fundamentally, accept that broadband is essential infrastructure—this may require the return to a national broadband strategy in Canada and the creation of such a strategy in the United States.

This policy would encourage both local and federal governments to take an active role in encouraging these hybrid networks. The policy would encourage both local government and local community groups to own and manage broadband networks or at least to take an active role in the creation of networks that cover the community.

Both the municipal ownership of broadband backhaul in Fredericton and the municipal-community partnership in Montreal provide some examples of Recommendations 1, 2, and 4. The digital inclusion program developed by Wireless Philadelphia, the nonprofit organization now managing the Wi-Fi network in that city provides an example of how to achieve Recommendation 2; Corpus Christi's wireless broadband network is also a good example of how to achieve Recommendation 2. Due to space limitations, these two U.S. cases were not included in this research study.

More broadly, policies should encourage hybrid municipal-community network owners to design, build, and deploy broadband service as reliable as the other common utilities, such as water, power, and the telephone, with clear performance standards established. The policy should also encourage these hybrids to build and deploy broadband service coverage, which would include every household, business, organization, public space, and public transit corridor in the communities' coverage area. This policy should also encourage these hybrids to charge for the broadband service prices that are affordable, nondiscriminatory, and universally available in order to ensure universal access for all.

Some mechanisms that policy makers might employ to encourage the formation of these hybrids are to first identify a common standard for broadband deployment including technological standards for fiber and Wi-Fi, reallocate underutilized spectrum for unlicensed citizen access, and encourage government to offer grants that could fund broadband deployment for both municipal and citizen groups.

We strongly argue for the need for a National Broadband Policy in the United States. In the case of Canada, we encourage a reinvigoration of the established policy. Both nations have adopted a deregulatory approach under the assumption that the market will build enough capacity to meet the demand. The market may do a good job of providing reliable infrastructure with reasonable quality of service, but it has no incentive to provide universal, ubiquitous coverage if it cannot generate sufficient profit doing so (Clement & Bryne-Potter, 2007; Middleton, 2007). The business pressures of providing connectivity do not ensure

that networks will be built with the standards deemed important by communities. It is essential that alternative approaches to infrastructure development remain a priority for municipal governments, communities, and national policy makers (Clement & Bryne-Potter, 2007; Middleton, Longford, & Clement, 2006). A uniform federal policy would be most helpful in enabling state and local governments in regard to broadband deployment.

It is essential that municipalities and communities remain engaged in the offering of broadband services. It is possible that public involvement in the provision of Internet service will diminish as the private sector continues to provide higher quality, more reliable connectivity than has been provided through most municipal or community projects. Citizens may be lulled by better service into thinking the networks offered by private industry serves all of their interests. Municipalities and communities have fundamentally different goals in providing broadband Internet access than private industry. Municipalities are interested in promoting civic engagement, social inclusion, and economic development across all neighborhoods and communities through the deployment of their wireless network. Private industry must be concerned with the bottom line and provides service with a mind toward profits rather than social welfare. Regardless of who offers the service, municipalities should take on the role of encouraging private industry to adopt the practices and policies needed to ensure their networks provide broadband connectivity that is in the public interest and meet all the needs of the municipality, not just access alone.

These policy arguments appear distant from experiences in local communities. In many urban areas, citizens have multiple choices for broadband service, which provide better quality and lower prices to the consumer. It is in these areas in which municipal broadband projects are failing. In smaller cities, towns, and rural areas, the broadband choices are few, and municipalities are stepping in to offer services. In some cases, this municipal action may spur incumbents on to offer more coverage and better service at lower prices, but where the population density is very low or impoverished, the motivations will be few. In many cases, the ownership of the broadband network is evolving through outsourcing ownership and management of the service, and more municipalities are forming complex partnerships with local incumbents.

Understanding the unfulfilled expectations surrounding municipal and community Wi-Fi projects helps to shift policy away from a determinist, technological imperative. Even as broadband connectivity becomes essential for full participation in North American life, connectivity policy should consider digital inclusion and integration of broadband infrastructure into a variety of existing or hybrid organizations. These policy goals shift the focus of broadband policy from a technological imperative to one focused on balancing social goals and economic development.

The importance of the hybrid public policy process is evidenced from policies that promote digital inclusion in the new information economy. Unfortunately, there can be a dangerous tendency by public elites to "play down," oversimplify, and polarize issues in the short-term. This might result in wasted resources and false expectations,

and may be due, in part, to politicians' short-term tenure in office. This can be problematic as most science and technology programs require a long-term and systematic approach (Bijker, Hughes, & Pinch, 1987; Rogers, 1995). Government policy rhetoric anchored in the value of municipal-sponsored networks needs to be met with significant funding, resources, community support, and direct involvement. As this research shows, there are dangers that a superficial investment will lead to surface change that does little to improve the reality of communities.

Notes

1. See the Web site for the Internet for Everyone campaign: http://www.internetforeveryone.ca

2. According to the Canadian Radio-Television Commission (the CRTC), a nondominant telecommunications operator is not required to file tariffs for telecommunications activity such as data transfer. This means that operators like E-Novation are not subject to government regulation of their data transfer (Internet) services.

3. More details about ZAP Quebec are available at http://www.zapquebec.org and more details about ZAP Sherbrooke at http://wwww.zapsherbrooke.org

References

Auray, N., Charbit, C., & Fernandez, V. (2003). WiFi: *An emerging information society infrastructure, socio-economic trends assessment for the digital revolution* (Vol. Issue Report No. 40). Milan: STAR project, IST Programme, European Commission.

Bar, F., & Park, N. (2006). Municipal Wi-Fi networks: The goals, practices, and policy implications of the U.S. case. *Communication & Strategies, 61*(1), 107-125.

Benbasat, I., Goldstein, D. K., & Mead, M. (1987). The case research strategy in studies of information systems. *MIS Quarterly, 11*, 369-386.

Berg, B. L. (1989). A dramaturgical look at interviewing. In *Qualitative Research Methods for the Social Sciences* (pp. 13-39). Boston: Allyn and Bacon.

Bijker, W., Hughes, T. P., & Pinch, T. (1987). *The social construction of technological systems: New directions in the sociology and history of technology*. Cambridge, MA: MIT Press.

Cho, H. (2006). *Explorations in community and civic bandwidth: A case study in community wireless networking*. Unpublished master's thesis, Ryerson University and York University, Toronto.

Churchill, S. (2007). *MetroFi quits installing Portland nodes*. Retrieved June 16, 2008, from http://www.dailywireless.org/2007/10/05/metrofi-quits-installing-portland-nodes

Cleland, S. (2001, February). *How broadband deployment skews economic/business growth*. Washington, DC: Precursor Group.

Clement, A., & Bryne-Potter, A. (2007). *A desiderata for wireless broadband networks in the public interest*. Paper presented at the 35th Research Conference on Communication, Information, and Internet Policy, Arlington, VA.

Darke, P., Shanks, G., & Broadbent, M. (1998). Successfully completing case study research: Combining rigor, relevance and pragmatism. *Information Systems Journal, 8*, 273-289.

DiMaggio, P., Celeste, C., & Shafer, S. (2004). Digital inequality: From unequal access to differentiated use. In K. Neckerman (Ed.), *Social inequality* (pp. 355-400). New York: Russell Sage.

DiMaggio, P., & Hargittai, E. (2002). *From the digital divide to digital inequality*. Paper presented at the annual meeting of the American Sociological Association, Chicago.

Ellison, C. (2007a). *Chicago backs away from Muni Wi-Fi*. Retrieved 29 August, 2007, from http://www.muniwireless.com/article/articleview/6364/1/23/

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. *Qualitative Inquiry, 12*, 219-245.

Gillett, S. E. (2006). Municipal wireless broadband: Hype or harbinger? *Southern California Law Review, 79*, 561-594.

Gurstein, M. (2000). *Community informatics: Enabling communities with information and communications technologies*. Hershey, PA: Idea Group.

Gurstein, M. (2003). Effective use: A community informatics strategy beyond the digital divide. *First Monday, 8*(12). Retrieved June 16, 2009, from http://firstmonday.org/issues/issue8_12/gurstein/index.html

Horrigan, J. (2008, July 2). *Home Broadband 2008: Adoption stalls for low-income Americans even as many broadband users opt for premium services that give them more speed*. Report of Pew Internet and American Life Project. Retrieved June 16, 2009, from http://www.pewinternet.org/PPF/r/257/report_display.asp

Île Sans Fil. (2007). *Île Sans Fil—English*. Available from http://www.ilesansfil.org/

Jick, T. D. (1979). Mixing qualitative and quantitative methods: Triangulation in action. *Administrative Science Quarterly, 24*, 602.

Katz, J., & Rice, R. (2002). *Social consequences of Internet use: Access, involvement, and interaction*. Cambridge, MA: MIT Press.

Kennard, W. (2001). Equality in the information age. In B. Compaine (Ed.), *The digital divide: Facing a crisis or creating a myth*. Cambridge, MA: MIT Press.

Lehr, W., & Sirbu, M. (2004). *Municipal wireless broadband: Policy and business implications of emerging access technologies*. Unpublished manuscript.

Letzing, J. (2007). *Google-Earthlink San Francisco Wi-Fi on hold*. Retrieved 29 August, 2007, from http://www.marketwatch.com/news/story/google-earthlink-san-francisco-wi-fi-project/story.aspx?guid=%7B305EBE69-80DA-44B7-8068-696F7F7540A3%7D

Longford, G., & Shade, L. R. (2007, January 11). *Telecom policy reform North of the 49th*. Paper presented at the National Media Reform Conference Media Research Pre-Conference, Memphis, TN.

Meinrath, S. (2001). *Wirelessing the world: Socio-historical and technological factors affecting the battle over (community) wireless networks*. Urbana and Champaign: Institute of Communications Research, University of Illinois, Urbana–Champaign, The Champaign-Urbana Community Wireless Network.

Meinrath, S. (2005). Wirelessing the world: The battle over (community) wireless networks. In R. McChesney (Ed.), *The Future of the media: Resistance and reform in the 21st century* (pp. 219-242). New York: Seven Stories Press.

Middleton, C. A., Longford, G., & Clement, A. (2006, September 29, 30, and October 1). *ICT Infrastructure as public infrastructure: Exploring the benefits of public wireless networks*. Paper presented at the TPRC 2006: Research Conference on Communication, Information, and Internet Policy, Arlington, VA.

National Broadband Task Force. (2002). *National Broadband Task Force Report: The new national dream: Networking the nation for broadband access*. Ottawa, Ontario: Government of Canada.

Oden, M. (2004). *Beyond the digital access divide, developing meaningful measures of information and communications technology gaps*. Austin: University of Texas at Austin Press.

Oden, M., & Strover, S. (2002). *Links to the future: Information and telecommunications technology and economic development in the Appalachian region*. Washington, DC: Appalachian Regional Commission.

Organization for Economic Cooperation and Development. (2008). *Households with access to the Internet in selected OECD countries*. Retrieved October 30, 2008, from http://www.oecd.org/sti/ICTindicators

Oldenburg, R. (1989). *The great good place: Cafés, coffee shops, community centers, beauty parlors, general stores, bars, hangouts and how they get you through the day*. New York: Paragon Mouse.

Orlikowski, W. J., & Robey, D. (1991). Information technology and the structuring of organizations. *Information Systems Research, 2*, 143-169.

Ortiz, J. A., & Tapia, A. H. (2008, August). *Bandwidthing together: The public policy process generating municipal wireless broadband networks*. IFIP Working Group 8.2 Conference on IT and Change in the Service Economy, Toronto, Ontario, Canada.

Panettieri, J. (2007). *Earthlink's biggest cut of all*. Retrieved 29 August, 2007, from http://www .muniwireless.com/article/articleview/6363/1/23

Powell, A. (2006, September 29-October 2). *Last mile or local innovation? Community Wi-Fi as civic participation*. Paper presented at the Telecommunications Policy Research Conference, Arlington, VA.

Powell, A. (2007). An ecology of public Internet access points: Exploring contextual access in an urban community. *Electronic Journal of Communication, 17*(1-2).

Powell, A. (2008). *Co-productions of community, technology and policy in the North American community wireless networking movement*. PhD thesis, Communication Studies, Concordia University, Montreal, Quebec, Canada.

Prieger, J. (1998, February). Universal Service and the Telecommunications Act of 1996. *Telecommunications Policy, 22*(1), 57-71.

Rogers, E. M. (1995). *Diffusion of innovations*. New York: Free Press.

Sandvig, C. (2004). An initial assessment of cooperative action in Wi-Fi networking. *Telecommunications Policy, 28*, 579-602.

Schement, J., & Forbes, S. (1999). *Approaching the Net: Toward global principles of universal service*. Paper presented at the Pacific Telecommunications Conference, Honolulu, HI.

Servon, L. (2002). *Bridging the digital divide: Technology, community and public policy*. Oxford, UK: Blackwell.

Strover, S., Chapman, G., & Waters, J. (2004). Beyond community network and CTCs: Access, development and public policy. *Telecommunications Policy, 28*, 465-485.

Tapia, A., Maitland, C., & Stone, M. (2006). Making IT work for municipalities: Building municipal wireless networks. *Government Information Quarterly, 23*, 359-380.

Tapia, A., & Ortiz, J. A. (2006, September 29-October 1). *Municipal responses to state-level broadband Internet policy*. Paper presented at the TPRC 2006: Research Conference on Communication, Information, and Internet Policy, Arlington, VA.

Tapia, A., Stone, M., & Maitland, C. (2005). *Public-private partnerships and the role of the state and federal legislation in wireless municipal networks*. Paper presented at the 33rd Research Conference on Communication, Information, and Internet Policy, Telecommunications Policy Research Conference, Arlington, VA.

Tufekcioglu, Z. (2003). *In search of lost jobs: The rhetoric and practice of computer skills training*. Austin: University of Texas.

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