Co-productions of Technology, Culture and Policy in North America's Community Wireless Networking Movement

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Abstract

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This thesis investigates the visions and realities of community WiFi's social and political impact, examining how communication technology and social forms are co-produced and providing a communication studies perspective on the transformation of social visions of technology into technological, social, and policy realities. By following the development of local WiFi projects and the emergence of broader policy-oriented mobilizations, it assesses the real outcomes of socially and politically progressive visions about information and communication technologies (ICTs). The visions of advocates and developers suggest that community WiFi projects can inspire greater local democratic engagement, while the realities suggest a more subtle bridging of influence from community WiFi actors into policy development spheres. The thesis describes local WiFi networks in Montreal and Fredericton, NB, and the North American Community Wireless Networking (CWN) movement as it has unfolded between 2004 and 2007, arguing that its democratic visions of technology and their institutional realities have been integral to the politicization of computing technology over the last four decades. Throughout the thesis, WiFi radio technology, a means of networking computers and connecting them to the internet by using unlicensed radio spectrum, acts as an example of how a technology's material form is co-produced along with its symbolic social and political significance.

Acknowledgments

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This thesis is dedicated to my mother, Dr. Barbara Jean Pezalla Powell

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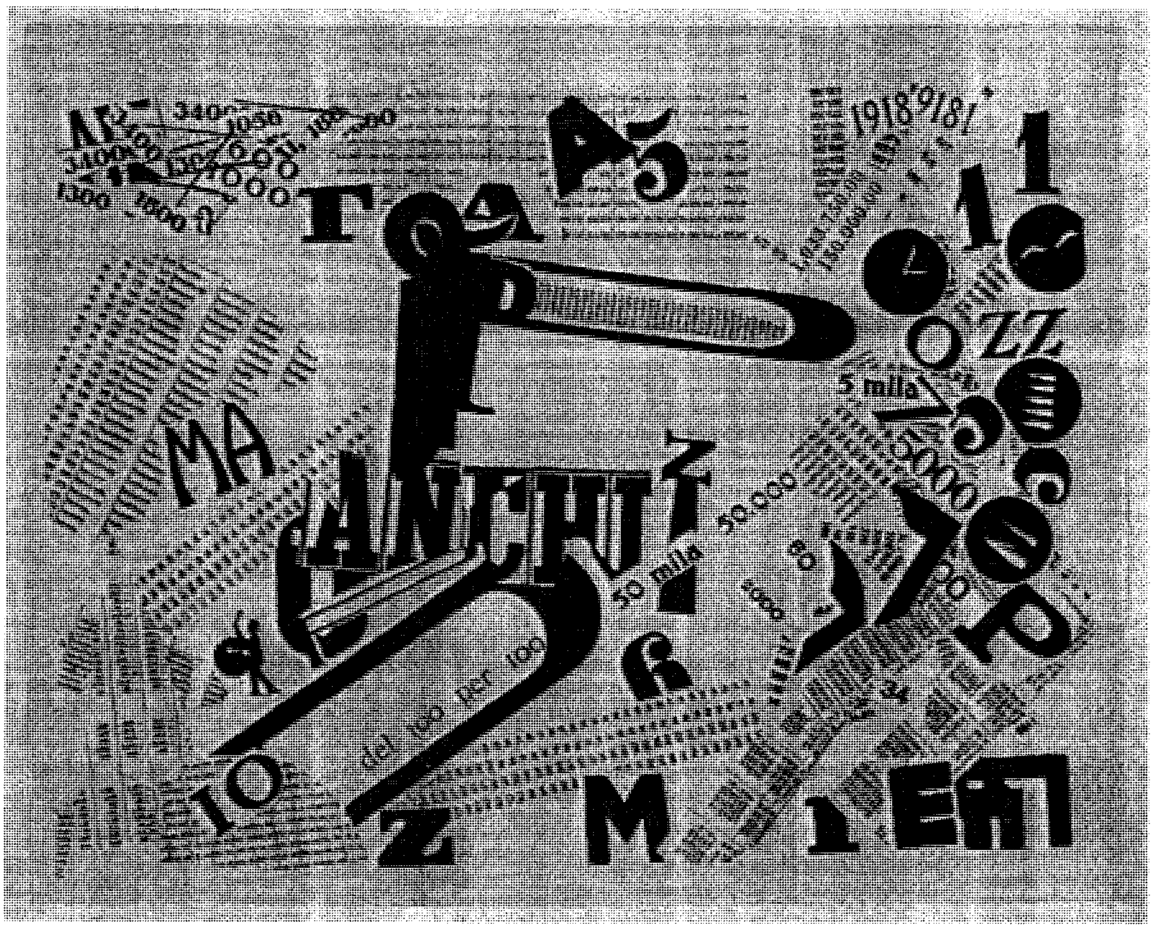
Epigraph

"We speak of our society as though it were an information society, just as we once spoke of industrial society or a mechanical society. How long will it take us to discover the human beings and social relations behind the technologies? How long will it take us to realize that there is a universal conflict over socially different ways of using information and organizing communications?" (Alain Touraine, 1999 p. 251)



(Filippo Marinetti: *Une assemblée tumultueuse. Sensibilité numérique*, 1919 © Estate of Filippo Tommaso Marinetti / SODRAC (2008))

Introduction: Co-productions of Social and Technical Change

In the middle of the 1920s, as Europe recovered from the First World War, industrial production turned from military production to consumer goods. In an era of relative plenitude and massive technological innovation, avant-garde artists like the Futurists envisioned new social forms evolving along with technologies of scale and power never before imagined – wireless radio transmission, airplanes, factory floors, electrical stations The Futurists wrote poetry about robots and manifestos inspired by car crashes. If mechanics and technics were going to change warfare and transportation, they were also going to change how to write, make art, and think. The Futurists, especially the Italian Futurists, created new ways of visualizing words and used wireless radio to transcend the oppression of fixing words in space and time. Technology implied speed, danger, and risk (Kahn 1992) and Futurist poetry combined brevity with strong images to channel this energy (Martin 1978). Futurism also created new ways of making art and doing activism, and eventually contributed to political movements that emphasized radical change, and a new kind of world[1] that could be liberated from the past just as technology like radio was liberated sound from space.

In this thesis I describe how the products of innovation are simultaneously social, technical, and political. Like the Futurist art that was inspired by technology and in turn created new ways of thinking about modernity, contemporary explorations in developing WiFi[2] technology for communities create new forms of social and political engagement – and impact the development of communication institutions and policies. I describe how groups of people working outside corporate and commercial structures influence not only the material forms of this new communication technology, but also the social organization and policy landscape that surrounds these forms. I argue that social and technical forms are co-produced, and further, that alternative, critical forms of technology, organization, and policy can arise together from phenomena like community WiFi. Developing at a critical juncture in the political economy of communication in North America, these new critical forms have a range of potential consequences extending from creating local communications infrastructures and mobilizing local citizens in new forms of knowledge exchange to influencing policy discourses at the national level in North America.

Three overarching questions guide this thesis' examination of the North American community WiFi phenomenon. How do community WiFi projects leverage the progressive visions of ICT technology to create new technologies and organizations that are appropriate for their local areas? To what extent do these projects contribute to a democratization of communication? How do discourses and practices associated with these non-commercial WiFi experiments bridge between technically-competent "geeks," policy advocates, and local government officials? In addition, the thesis argues that situated, participatory research is a productive way to investigate and assess the social and political outcomes of socio-technical phenomena like community WiFi.

The thesis presents case studies of two community WiFi projects in North America, along with an historical study of previous "computerization movements" that illuminate how these self-organized, non-commercial groups advance progressive visions for computing and information technology. The framework of "computerization movements" conceptualizes how activists, hackers, geeks, municipal government officials, and public interest lobbyists influence the contemporary communications landscape by developing local WiFi networks, establishing discourses that align WiFi networking with innovation, and developing knowledge sharing practices. The thesis documents the shifts as these discourses, practices, and innovations move from being alternative, oppositional and critical, to creating new institutions. In particular, it tracks the shift from local WiFi projects involving small groups of volunteers to larger-scale municipal WiFi connectivity projects, noting that both of these projects use the symbolic connection between WiFi and innovation to brand their communities. At the same time, knowledge sharing between WiFi geeks and media reform advocates introduces new stakeholders and strategies to policy processes. As Mueller (2002) notes, processes of experimentation outside of large institutional structures influence the development of institutions that govern technical systems: "there is a life cycle in the evolution of technical systems. Systems that create new resources and new arenas of economic and social activity can escape institutional regimes and create moments of disequilibrating freedom and social innovation. But eventually a new equilibrium is established." (p. 266).

Experiments in technical innovation can establish ideological links between technological changes and increased justice and freedom. In 1970, Carey and Quirk (reprinted in Carey, 1989) wrote, "an increasingly prevalent and popular brand of the futurist ethos is one that identifies electricity and electrical power, electronics and cybernetics, computers and information with a new birth of community, decentralization, ecological balance, and social harmony" (Carey, 1989 p. 114). Community WiFi is the latest in a series of social mobilizations of technologies that express this ethos. These are "computerization movements" where non-commercial actors develop and promote computer technology. Often, computerization movements connect technical innovation with political or social goals: for example, in the 1970s personal computers were connected with the California counterculture and its goal of developing communitarian self-sufficiency. The concept of re-mediations explains how mobilizations like computerization movements transform society and technology. Developed by Touraine (1988) and refined by Lievrouw (2007), re-mediation describes how elements of media and technology that belong to one period of time or social order can be taken up and transformed by contemporary critics of that social order. This has occurred, I argue, in previous computerization movements and it is now occurring with community WiFi – with some important consequences for the development of WiFi technology, telecommunications and media policy.

In this context, the study of the community WiFi movement is timely and important since it reiterates that technology and policy are not exclusively developed from the top down. Social movement theory has noted how the grassroots – self-organized social and political participation inspired by community interest – influences political change by involving a greater number of people in social movements (Langman 2005). The outcomes of community WiFi projects demonstrate that a similar process occurs in technology projects, and suggests that this process may also have political influence. Local WiFi projects are often begun as solutions to local problems, but they introduce their participants to the political potential of local networking technology and to broader organizations that in turn influence larger institutional structures. This thesis argues that grassroots actors in the technology realm influence the organization and significance of computing, communication, and public policy. WiFi communities and WiFi publics can contribute to the development of emerging technologies, but also their politics, their governance, and their symbolic importance – sustaining the public interest.

Research Sites

This thesis focuses on community wireless networking (CWN) in North America as it developed between 2004 and 2007. Case studies of two local CWN projects in Canada are detailed: Montreal's Île Sans Fil and Fredericton, New Brunswick's Fred-eZone. These local case studies are integrated into a discussion of a broader North American CWN "movement" that has created a more politicized identity for WiFi networking, embedding it into broader movements for media reform concerned with equitable access to communications media and an expansion of local and community media. The politicization of WiFi draws on its symbolic value as a new, flexible innovation developed from the "bottom up" – that is, by tinkerers, amateurs and volunteers rather than in corporate research and development departments. This provides WiFi with an amateur cachet that, combined with the fact that it is inexpensive and flexible, helps to establish its somewhat oppositional socio-political context. For example, in each of the case studies, WiFi technology stabilizes into technical structures that are appropriate for the places where they are built. Local CWN projects create different contexts for "community" and "public" media and information technology, including expanded opportunities for civic participation and social capital development, novel institutional frameworks for managing communication as a public service, and configurations of WiFi as a media distribution channel. When these local projects are linked together in a more global "movement," tensions are produced between opposing understandings of WiFi's potential political significance, characterized by attention to features and possibilities of the technology. These tensions, like those in previous computerization movements, produce a productive dialectic. The outcomes of this dialectic in turn influence discourses of "community" and "public" media and information technologies, as well as practices like "policy hacking" that attempt to influence the broader political-economic structures governing the adoption and use of media and communication technologies.

Like other computerization movements, community WiFi is a product of its time: it draws on the technical possibilities and social organization of the early 2000s. Three contextual elements are particularly important: first, tinkering and hacking WiFi technology occurs in the context of a worldwide shift towards distributed software production as part of the free and open source software production movement. Second, local WiFi projects return control over communications technology to the local "community" scale in a contemporary context of ubiquitous, global connectivity. Third, WiFi networks permit new ways of thinking about media publics – both mutable and mobile publics that can form around media delivered via WiFi as well as a broader public interest that can be served by progressive policy making at a critical juncture in media and communications. McChesney (2007) describes the current North American media and communications landscape as being at a critical juncture produced by a lack of confidence in existing media sources, a volatile political situation marked by widespread criticism of government, and new technological developments that promise alternative means of creating media, as well as by neoliberal governance structures characterized by deregulation and erosion of public service models for communication media. These three elements of context appear throughout the thesis, which contains six core chapters.

Outline of the Thesis

Chapter One situates the thesis as an application of science and technology studies (STS) methodologies within communication studies. It argues that throughout the entire process of development, institutionalization, and use of communication technologies, social and technical forms are co-produced. It also describes the participatory, qualitative research approach used to investigate this process in the case of community WiFi, which I believe is particularly appropriate for investigating these new socio-technical phenomena. In this chapter, I define some of the social categories I use to describe groups of people brought together, inspired, or mobilized by different aspects of the community WiFi phenomenon. In particular, I define WiFi "communities" and "publics" as two types of social categories leveraged by community WiFi, further arguing that "publics" are more politicized than "communities."

In Chapter Two I describe how computerization movements from the 1970s onwards create alternative political frameworks for computerization technology. I draw on Kling and Iacono's (1995) understanding of computerization movements as being actions by actors to promote computerization, using the rhetorical form of technological utopianism. I then argue that computerization movements operate around a dialectic between criticism of the dominant structures of computerization and the development of alternatives to them. Chapters Three and Four are local case studies of community WiFi projects – Chapter Three describes the role of "geeks" in developing a cultural and social identity for community WiFi in Montreal, and Chapter Four assesses one of the first municipal government efforts at building a community-wide WiFi network, the Fred-eZone in Fredericton, NB. After these local case studies, Chapters Five and Six take a broader perspective. In Chapter Five I describe the efforts at constituting a North American "Community Wireless Networking Movement," analyzing how different movement actors create different kinds of symbolic linkages between technology and politics, and how these differences are resolved through the creation of a common discourse, practice, and progressive political orientation. Chapter Six describes "policy hacking" as bridging the Community Wireless Networking Movement and a much broader media reform mobilization in the U.S. (and to a lesser extent in Canada). The thesis concludes with a reflection on the outcomes of the community WiFi phenomenon on WiFi technology, communication policy, and knowledge sharing among activists and scholars in communication studies.

Contribution to Communication Studies

My approach to studying community WiFi positions it as a destabilizing, emerging technology that is co-produced along with novel social forms, some of which aim to criticize or destabilize the institutions involved in technology production and regulation. Over time, the outcomes of this co-production influence the material form and symbolic importance of WiFi networks in local areas, as well as, potentially, communication policies. This thesis contributes to a growing body of constructivist analysis within communication studies that consider the co-production of symbolic, cultural, and technical aspects of communication technology. In addition to conceptual work conducted by Boczkowski and Lievrouw (2007), Bowker and Star (1999), and Dutton (1996; 2006), empirical work includes Douglas' (1987) investigation of the cultural, policy and technical impacts of amateur radio operation in the 1920s, Haring's (2006) study of ham radio operators, and Laegran's (2002) study of the intersection between Internet and automobile technology. The work in this thesis also draws from previous studies of WiFi as a technical innovation and a growing industry (Bar and Galpernin 2004b, 2005, 2004a; Sirbu, Lehr, and Gillett 2006), and as part of a set of resistant or countercultural social practices (Sandvig 2004). From a cultural and critical theoretical perspective, Mackenzie considers the cultural significance of a technically unstable and "kludgy" technology being used to define public space (2003) or as a form of resistance (2005). More recently, a much broader critical literature describing new applications for local development of WiFi and other wireless technologies (Fuentes-Bautista and Inagaki 2006; Powell and Shade 2006; Tapia, Maitland, and Stone 2006) their policy implications (Lehr, Sirbu, and Gillett 2006; Osori 2006) and their social and cultural impact (Cho 2006; Middleton 2003; Powell 2006) has emerged in the scholarly arena.

Modifying WiFi hardware and software began as what Haring (2006) calls a technical hobby: a "productive recreation [that] must require some technical understanding or skill beyond simply how to operate a technology" (p. 2). Haring describes amateur photography, recreational computer programming, and ham radio as examples of technical hobbies. She also argues that technical hobbyists represent aspects of their personality with respect to the technology, creating a technical culture that establishes what a technology is and how it is to be used. As I explore, "WiFi hackers" and

"WiFi geeks" also develop their own technological identity, in turn defining a social and political role for WiFi.

Of course, the technical culture of WiFi has not been confined to groups of geeks, and the thesis also explores how the politicization of WiFi has moved into other spheres, including municipal governments and nascent social movements including media reform. This politicization of WiFi technology occurs at the same time as an expansion of the commercial WiFi industry, and its eventual contraction. In the final chapters and conclusion, I place the overall development of community WiFi technology, organization, and policy contributions in context with the municipal WiFi networking boom – and eventual bust.

The Importance of Material Structures

One of the central assumptions in this thesis is that technical and social structures grow in concert with one another. This suggests that the material forms of technologies are not neutral and are instead part of the cultural and technological forms that are co-produced. Some previous work, most notably Galloway (2004) has already assessed the cultural and social implications of communication technology's material forms. For example, Galloway (2004) conceptualizes technologies in terms of their ability to provide means of control. He argues that protocol, or the regulation of access to distributed information networks, is one of the most powerful forms of control that contemporary postmodern societies can produce. Galloway's insight suggests that analysis of material communication structures is also a study of social shifts. Therefore, before continuing with the rest of the thesis, I present a brief discussion of some of the dominant forms and structures – wired and wireless -- common in North America. These forms, and the way they have been framed as significant within various social and political formations, are discussed throughout the chapters that follow.

Wired Network

Wired networks require each individual subscriber to have a connection to the main line. Wired networks include telephone, DSL and ADSL internet services, cable television, and electrical systems.

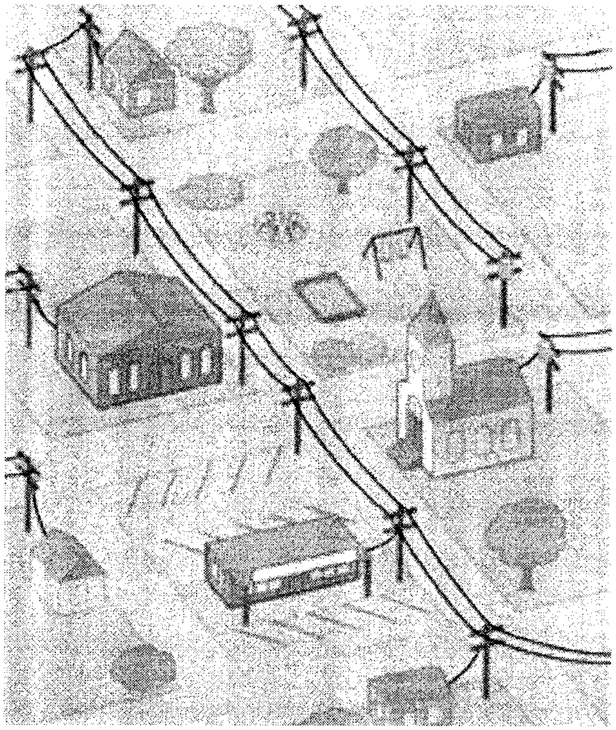


Figure 1: Wired Network

(All network schematic images courtesy of CuWiN and created by Darrin Drda)

Wireless Networks

There are three general types of wireless or WiFi networks: hotspots (also known as wireless access points), hub and spoke networks (also called point-to-multipoint), and meshed networks, which are either static or dynamic.

Hotspots

Hotspots are locations at which signals are broadcast wirelessly to the immediate geographical area. If internet connectivity is required, a backhaul link must be made to a source of internet bandwidth. The Île Sans Fil project is based on creating a large number of hotspots, each of which is connected to its own source of bandwidth.

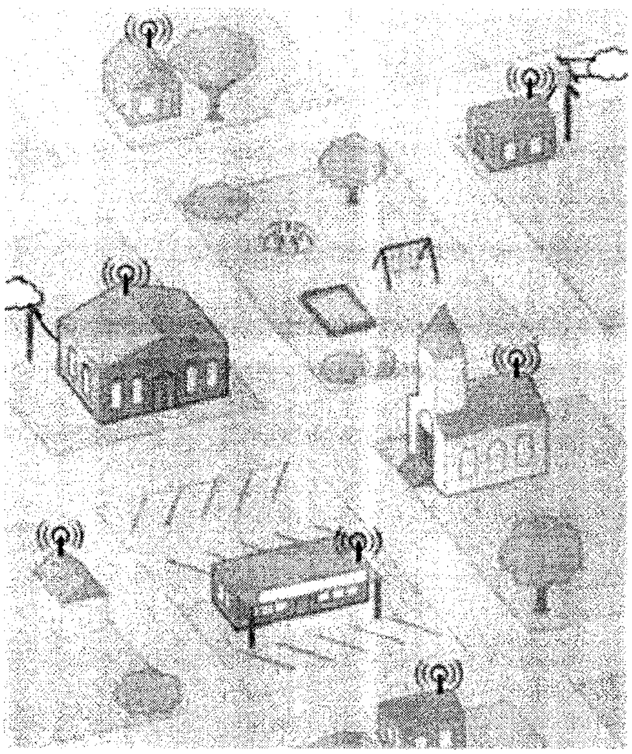


Figure 2: Hotspots

Hub and Spoke Networks

Hub and Spoke networks use a broadcast model to broadcast signals. Hub and spoke systems are often used in fixed wireless installations where wireless is used to disseminate a signal in areas where fiber-optic cable cannot be laid due to geographic or economic limitations. The Fred-eZone network primarily uses hub and spoke architecture.

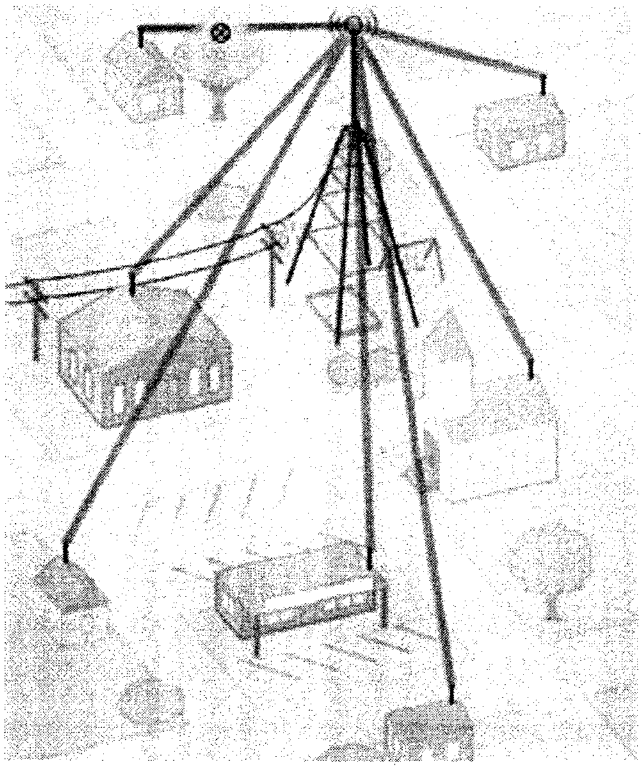


Figure 3: Hub and spoke Network

Static Mesh Networks

In a mesh network, wireless network nodes both send and receive information, making it possible to share one internet connection among a large number of locations that are not necessarily in proximity to a tower. Mesh networks also have multiple points of failure, unlike centralized networks. There are two types of mesh networks: static mesh networks and dynamic mesh networks. Connections over a static mesh network can be interrupted by interference to the radio transmission. The Fred-eZone network uses some portions of static mesh.

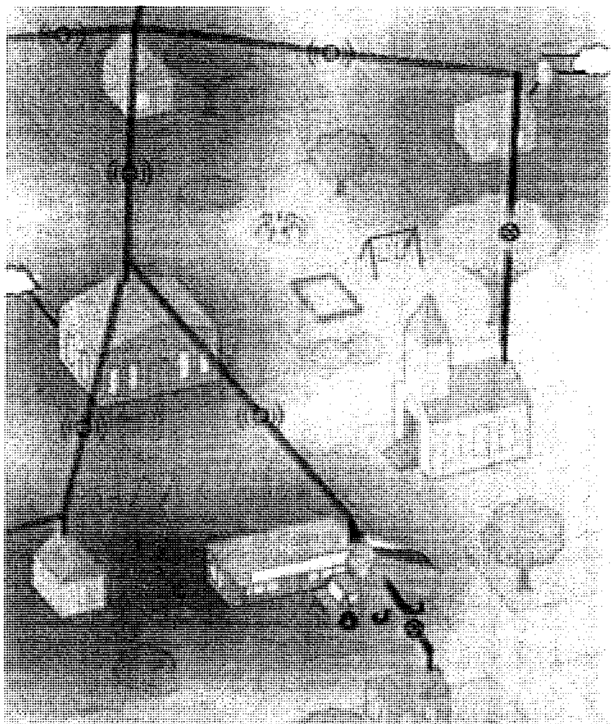


Figure 4: Static Mesh Network

Dynamic Mesh Networks

Dynamic mesh networks not only use nodes to both send and receive network traffic, they also route around any potential damage to network. Therefore, if one node is broken or not operating, network traffic will move to the destination using other nodes. Dynamic routing is also used to send packets over the wired internet.

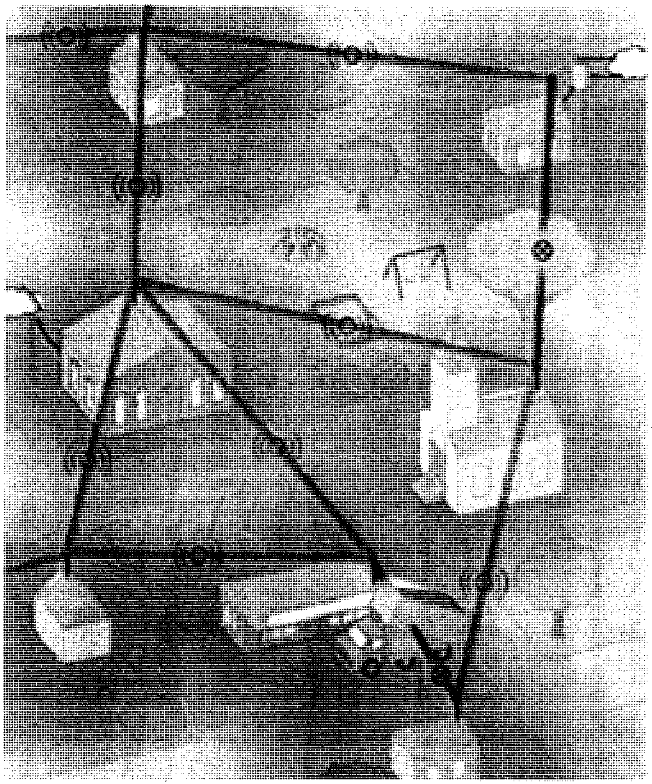


Figure 5: Dynamic Mesh network

Conclusion

The grassroots experimentation, municipal institutionalization and eventual politicization of community WiFi demonstrates how technical and social change occur together, and how dominant structures are influenced by the discourses and practices of those on the margins. Like the avant-garde of the early 20th century, the various players in community WiFi (hackers, geeks, bureaucrats, policy wonks, academics, people with laptops, or members of communities without internet connectivity) have a new set of tools, terminologies, and structures that they use to re-envision their world. This thesis presents the analysis of a process of technical, social, and policy change connected with community WiFi, arguing that symbolic, material, and organizational elements are all co-produced. It reframes community networking as democratic communication, assessing the potential of community WiFi projects to democratize communications, and to communications policy scholarship by revealing how discourses and practices from critical computerization movements can bridge into policy-making spheres. The next chapter begins by defining co-production in a communication studies context, proposing that situated, participatory research is an innovative means to explore the co-production process.

Chapter One: Co-production of Communication Technology and Society -- Key Concepts and Methods

Introduction

In keeping with Winner's assertion that "technology brings forth a world" (Winner 1993), I argue that new technical innovations are inspired by the cultures in which they develop, as well as contributing to how particular cultures consider the role of technology. New innovations rarely come out of nowhere – they are made in local cultures and are part of the evolution of these cultures, with all of the social and political complexity that this implies. In the following chapters I argue that different social contexts for the development of technologies bring forth different worlds, some of which challenge the existing politics of technologies or the social organizations in which they are established. I examine non-commercial development of technology, especially technology developed by amateur groups and municipal governments. I claim that these contexts are "alternative" to commercial research and development processes, particularly because they involve experimentation directed at solving local problems or are of interest to the developers rather than directed towards refining a product for sale. I argue that these alternative contexts for ICT development provide unique cultural and social contexts for both the development and use of these technologies that are perceived as augmenting the democratic impact of ICT development and use. Community WiFi is the latest in a series of "computerization movements" that connect progressive social and political visions with advances in ICT. In the following chapter I analyze how "computerization movements" form the historical context for community WiFi, and then

I present case studies focusing on different aspects of the co-production of WiFi technology, social organization, and policy in Chapters Three through Six. This chapter establishes the analytical background for these central questions, comprising four sections of increasing specificity.

I argue that the community WiFi phenomenon is socio-technical: its social and technical aspects are inextricably intertwined and mutually influence one another. In the first section of the chapter, I situate the analytic context for this claim by discussing how the social aspects of science and technology have been conceptualized through the social studies of science and technology (STS), particularly though its social constructivist tradition. After an historical review of trends within STS, I introduce contemporary perspectives on the co-production of technology and society. In the second section, I consider how co-production is applied in communication studies. I discuss three conceptual approaches that are particularly applicable to the example of community WiFi: 1) discourses of expertise, 2) articulations between technology and society, and 3) the role of network forums as sites of technical and discursive exchange. The third section of the chapter more specifically discusses the social forms produced in relation to ICTs, distinguishing communities from publics, arguing that both of these social forms emerge in the context of community WiFi, and that both are politicized. In the final section, I argue that the best way to approach the socio-technical phenomenon of community WiFi is to engage in situated research that constructs analytical frameworks iteratively and that draws on observation of and participation in the processes it describes. Some of the features of situated research include relationships with research partners and an understanding that every researcher participates in constructing the reality and importance of their research. I therefore review ethnographic and multi-sited methods as they have been adopted in STS, communication studies, and community networking, and reflect on the appropriateness (as well of the challenges) of using participatory, multi-sited methods in this thesis.

Social Research on Science and Technology

Thirty Years of Science and Technology Studies

Science and Technology studies emerged from the social studies of science, whose goals were to draw attention to the role of culture and social experiences in the development of "objective" science (Pinch and Bijker 1992). The sociology of science formed part of an overall movement in the social sciences that challenged positivist assumptions that categories such as race, gender, mental illness – or even scientific fact – were fixed and determined. By studying the social worlds of scientists in laboratories, social science of technology (SST) opened a formerly black-boxed world and explored how work practices and cultures influenced the creation of 'objective' science.

In the 1970s this approach was extended to the study of technology development, and science and technology studies (STS) have since continued to develop strategies to explore the social and cultural processes that shape the development and appropriation of technologies. Wacjman (2002) describes STS as a way of transcending the debates over the division or alignment of nature and society[3] and countering the determinist view that technology is autonomous and therefore separate from the social realm. She claims that

STS "rejects the notion that technology is simply the product of rational technical imperatives . . .[therefore,] technology is a socio-technical product" (p. 351).

Early STS research considered that social factors had a determining influence on the development of technology. The social construction of technology (SCOT) perspective popularized in the 1970s and 1980s concentrated entirely on the social impact of relevant social groups (or actors): the people and groups involved in designing new technologies and in defining who might use them. One sub-set of SCOT is the socio-technical study of systems development. In this tradition, political forces are analyzed as having a determining impact on the eventual shape of systems. Examining the political impact of technology from a different perspective, constructivist studies of gender and technology consider the political consequences of technology's gendered qualities. Developed as a critique of social determinism, Actor-Network Theory (ANT) proposes that technologies and human actors influence each other. A more balanced perspective has developed recently that examines co-production of social phenomena and technology as part of a broader overall trajectory in social science research examining knowledge production and power.

Social Determinism: Social Construction of Technology

The first social studies of technological development concentrated on unpacking technological "black boxes" by studying "relevant social groups" — the people involved in design and development of technologies, and their influence on the form and definition of technologies during their formative stages. Pinch and Bijker (1992) argue that early in their development, technologies are "interpretively flexible" and can have different meanings for different groups. Technological design responds to this flexibility: "there is not just one possible way or one best way of designing an artifact" (40). In Pinch and Bijker's classic example of bicycle development, relevant social groups included athletic young men cyclists, women cyclists, anti-cyclists and racing cyclists. Each of these groups had a different interpretation of how bicycles should be used, and their interpretations redefined the types of problems to which bicycle designers responded. For example, the problem of vibration due to wooden or metal wheels was redefined as a problem of speed by racing cyclists, leading to the adoption of air tires. While this made a "better" bicycle for racers, it did not necessarily improve the bicycle from the perspective of the other relevant social groups. SCOT was the first conceptual framework to address the creation of technologies as a social process involving a variety of actors and not only "famous men" inventors. The work described in this thesis has certainly been influenced by this approach of exploring all of the different actors involved in technological development. However, the SCOT tradition has limitations that make it inappropriate for my purposes here. It tends not to consider questions of use, and many questions of politics: in short SCOT does not create ways of addressing power differentials between relevant social groups, as Winner (1999) points out and Bijker (1995; 2002) echoes. In comparison, Hughes' (1987; 1983) work on the social aspects of systems design retains a focus on design, but introduces the concept of cultures of system design, as well as taking account of the impact of politics, making it more applicable here.

Political Determinism: Socio-technical Systems Development

Hughes (1987; 1983) applies a constructivist approach to describe how social and political factors influence the design and development of infrastructures and systems. Using the example of electrical power systems, he explores how cultures of systems development form around the values, ideas, and knowledge of elements that make up a system. For Hughes, political conflicts, rather than the negotiations between relevant social groups, are the primary determining factor in the development of electrical systems. Hughes sees human agency as operating through the process of making laws that govern different aspects of systems design. For example, he argues that electrical systems in Chicago, Berlin, and London were designed in different ways partly because of the political systems in each city. In London, where local councils ruled small areas, each parish or borough developed a different electrical system that did not necessarily interoperate with systems in other areas. Hughes' focus on the role of politics and systems design culture runs below this thesis' concern about how community WiFi becomes institutionalized. However, institutional politics are not the only kinds of politics bound up in technology development, and the focus on large institutions and corporations that Hughes employs does not fit with my examination of non-commercial technical development like community WiFi.

Power as Difference: Gender in Constructivism

Gender and identity politics also influence technological design. As I explain later in this thesis, technological development (even the grassroots technology production associated with WiFi and other computerization movements) is gendered. Feminist studies of technology question the relationship between gender, knowledge, and practice, using the tools of constructivism to reflect on the way that gender and technology are mutually constructed. Cockburn (1983), Wacjman (2004) and Faulkner (2000) argue that gender identity and technology are mutually constituted: relationships to technology develop within existing gendered frameworks. As Faulkner writes, "the fact that popular images of both science and technology are strongly associated with the masculine side of [gender] dualisms must be one of the reasons why, in a deeply gender divided world, most girls and women don't consider a career in engineering" (11).

However, this perspective has also been criticized as essentializing gender by aligning technological knowledge with masculinity. As Grint and Gill (1995) point out, "there is a dynamic tension between the view that technology is closely related to masculinity and a perspective which sees this apparent association as itself ideological, based upon a narrow and specific understanding of the technical and a set of exclusions which position women outside the technical realm" (p. 4). These reflections politicize constructivism by reflecting on the way that existing social constructs like gender are interpolated with the construction of technology and technical expertise. More recent work from Suchman (2005) has contextualized the gendered quality of labour, and other studies of the constructed relationships between gender and technology include Wakeford's (1999) study of gendered work in an internet cafe and Shade's (2002) discussion of gendered virtual communities. Peddle, Powell and Shade (2008) analyse how labour becomes gendered within community informatics projects, pointing out that community projects may espouse progressive politics, but this does not mean that community informatics projects are free from feminized or gendered divisions of labour. Finally, Wacjman

(2004) proposes that a study of the gendered aspects of technology is at its core a study of how power operates through socio-technical formations. In studies of social constructivism, a continuing attention to power thus requires attention to gender.

Provocative Politicization: Actor-Network Theory (ANT)

Without explicitly addressing gender, the Actor-Network Theory perspective also addresses questions of power. It attempts to redress one of the failings of SCOT and previous constructivist traditions: the fact that only humans can be actors. ANT proposes that human and non-human actors are drawn together in a set of mutual relationships that includes nature, society, and hybridized objects like technologies. Latour (1991) breaks down the distinction between technology and society, hoping to re-examine the relationship between power and domination. He introduces actors and actants as the elements in this network.

Actants, either human or non-human, are possibilities that stabilize in the guise of one type of substance or concrete element. Actors mobilize these possibilities, and attribute to them goals and borders, thus transforming them. The mobilization of possibilities is called translation. Once linked together, these translated possibilities form a network of relationships. Latour (1991) argues that in establishing such a network of relationships, technical innovations can be revealed in their complexity, thus permitting a relativist view of both technology and social relations. Latour writes, "when actors are unstable and the observers' points of view shift endlessly we are entering a highly unstable and negotiated system in which domination is not yet exerted" (129). Neither technology nor the constructed category of "the social" is determinate. Technology is one voice among many, but it does have its own voice, as evidenced by Latour's (1996) "novel" about the failure of a mass-transit system in which the train tells its own story of its development and its ultimate abandonment.

Three other key concepts emerged from ANT's close studies of technological development, particularly those conducted in laboratory settings and engineering design firms (Akrich 1992): inscription, scripting, and de-scription. From these sites came the observation that technological objects were inscribed by their developers with assumptions about technology's ideal form and desirable uses. Technologies were understood as developing along with scripts that represented the designer's expectations about how technology should be used: the scripts could be rejected (de-scripted), or accepted (in-scripted), but in all cases performed a kind of negotiation between the designer's expectations and the user's practices. For example, Akrich (1992) describes the development of a lighting kit by French engineers for use in developing countries, arguing that the designers did not expect the users of the lighting system to modify or adapt it, and thus created a closed, cumbersome system. The scripts that the designers attached to the lighting system failed and the people for whom it was designed attempted to change it. When their efforts at modifying both the technology and its scripts failed, they abandoned the system.

Criticisms of ANT

Actor-Network Theory's provocative claim that technologies themselves might provide their own kind of shaping force has been widely and usefully criticized (Law 1999; Slack and Wise 2005), particularly for failing to account for differences in social power[4], and also for its assumption that relationships between actors – whether human, non-human, or hybrid-technological – are symmetrical. This makes it difficult to align ANT with other social science research concerned with questions of power or the development of social structures. In addition, like much work in STS, ANT does not separate large-scale from small-scale relationships. One of the core principles of ANT is to use small-scale, detailed analysis to suggest broader political implications. This makes it very difficult to apply to social mobilizations, for example social movements that attempt to politicize technology like the computerization movements that interest me in this thesis. Still, post-ANT research in the STS and constructivist traditions has accepted the challenge of seeing both technology and society as fluid categories.

Balanced Perspectives on Constructivism: Co-production of Technology and Society

The previous review of the history of social constructivist approaches describes a shift in focus from social determinism, to a more nuanced focus on politics and power, taken to its extreme in the ANT claim for a radical symmetry between humans and non-humans. More recent constructivist work has developed a focus on the co-production of technologies and society through observation of how technologies operate as sites of knowledge transfer or exchange (Bowker and Star 1999) and as elements of controversies that mobilize opposing social or cultural perspectives (Callon 1981). Jasanoff (2004) defines co-production in terms of knowledge production: "[it is] shorthand for the proposition that the ways in which we know and represent the world (both nature and society) are inseparable from the ways in which we choose to live in it. Knowledge and its material embodiments are at once products of social work and constitutive of forms of social life; society cannot function without knowledge any more than knowledge can exist without appropriate social supports" (p. 2). Co-production refutes the social determinism of SCOT while taking a position that aligns STS more closely with other social sciences. As Jasanoff notes, STS is interested in four sites of co-production: "making identities, making institutions, making discourses, and making representations" (p. 13). With these broader frames, elements of STS analysis can be bridged into other social scientific fields. STS approaches have been particularly useful in communication studies. In the next section of this chapter, I describe how the "special case" of communication research integrates constructivist perspectives from science and technology studies.

Constructivism in Communication Studies: Social Shaping and Consequences

The study of communication technology (and, as the next chapter explores, computers that have become framed as communication technologies) is often considered as a special case in the study of technology and society. Carey (1989) argues that while all technological change is in some ways a social process, development of ICTs is especially important because its results are the restructuring and mediation of communication itself, which is accompanied by important ritualistic and symbolic elements. In addition, increased access to information contributes to the informed decision-making that is essential for democracy. Furthermore, developing technology is itself a process of communication -- of negotiation between different relevant social groups through which the structures underlying political life are established. For these reasons, questions about the design of and access to ICTs are fundamentally political questions, and the connection between design, governance, and appropriation of technologies particularly significant.

Compared to the design and development oriented studies of STS and ANT, media and communication studies research tends to focus on use – or appropriation – of information technologies. This is often described as a process through which material technical forms and symbolic representations join together. However, the study of technological development within communications studies has begun to focus on the entire process of the social shaping and consequences of technology (Lievrouw and Livingstone 2002). Various studies have developed conceptual tools to describe this process. For example, Mackay and Gillespie (1992), frustrated with the failure of both STS and Marxist approaches to examine technology's contexts beyond the role of structures and subjects in developing technology, drew on cultural and media studies for a more integrated approach. They examine "three conceptually distinct spheres 1) Conception, invention, development and design; 2) Marketing; and 3) Appropriation by users." (1992, p. 691). This begins a focus on technology as process, breaking down the artificial distinction between "design" and "use."

Proulx (2007) expands on the concept of appropriation, arguing that the "social appropriation of technology" takes the form of progressive steps: technical access; technical and cognitive mastery; meaningful integration into everyday practices; innovation and the creation of new practices; the mobilization of communities of practice; and finally political representation of the interests of users through the development of policies. In comparison to ANT and to previous STS work, policy development is considered part of the co-production process within communication studies. Policy-making is part of the symbolic sense-making process that occurs around the production and consumption of ICTs. Dutton's (1999; 2004) work illustrates this approach: his theory of the ecology of games accepts that actors throughout the production, distribution, and regulation phases of technology development have conflicting goals that eventually shape the governance and structure of technical innovation. These actors do not necessarily behave rationally, but instead attempt to balance several different identities, relationships, and desires: for example, acting as government officials but also as parents or homeowners. In addition, policy-makers adopt different stances depending on their professional responsibilities, for example as employees of government departments with particular mandates. Using approaches like these, policy-making also contributes to the process of appropriation.

Using STS for Policy Research: Bridging

The policy environment can also configure the social impact of ICTs. The framework of co-production, as I describe above, helps to situate policy as one of the products of socio-technical change. Star and Greisner (1989) describe "boundary objects" – such as maps – that can be interpreted differently by different groups of people. These boundary objects help people establish common ground in contexts where many different types of expertise are developed. This process is called "bridging" and I use the concept to describe how knowledge, practices, and material objects are transferred between different groups of people brought together by common cause. The non-commercial, community-based, self-organized social contexts where new ICT technology is produced and discussed create unique opportunities for bridging of all kinds. As I discuss below, my research design in this thesis has encouraged bridging of knowledge from participants. However, bridging also explains how ideas about the importance of ICTs in social life, and practices associated with them, appear in contexts different from the ones in which they were originally developed. Like the maps that Star and Greisemer describe as linking experts from different fields, ICTs can also act as boundary objects linking technical experts, social justice advocates, and policy makers. Newer or more flexible technology might inspire more bridges, as its social and political impacts are just beginning to be defined. As part of the co-production of technology and society, the concept of bridging helps to describe how ICTs are appropriated into social life and into policy discourse.

Through these analyses, communication studies has begun to integrate design and appropriation into a single framework that remains focused on the political implications of ICT development and appropriation. Lievrouw and Livingstone (2006) argue that "media and information technologies comprise the material systems themselves and their social contexts, including the artifacts or devices used to mediate, communicate, or convey information; the activities and practices in which people engage to communicate or share information; and the social arrangements or organizational forms that develop around the devices and practices" (cited in Boczkowski and Lievrouw, 2007 p. 955).

Each of these three categories of media and communication technologies influences the other: "design," "appropriation" and "regulation" are all part of the same co-production process.

Links between STS and Communication Studies

Links and bridges between different spheres of knowledge related to technology characterize co-production. Material objects like new technologies can provide links between different groups of people with otherwise diverging interests. These bridges permit actors to have influence in a variety of different spheres. Similarly, the study of technology in communication studies has developed through links with STS: Boczkowski and Lievrouw (2007) describe three bridges that link STS and media and communication studies. These bridges are, broadly speaking 1) concerns with the process, 2) consequences and 3) causality of technology. For example, a concern with process motivates both ANT laboratory studies and the analytical framework of the ecology of games. Questions of causality are implicit in the very nature of constructivism itself, which assumes that technology does not change society, but which also raises questions about the extent to which social changes contribute to technical changes.

Boczkowski and Lievrouw highlight the contrast between Eisenstein's (1983) assumption that changes in printing technology had revolutionary consequences and Johns' (2000) focus on the *processes* inherent in the culture of printing and reading. To reconcile this split between framings of technology as determinist and contingent, Lievrouw proposes conceptualizing "determination and contingency [as] interdependent and iterative and . . . this relationship can be seen at key junctures or 'moments' in . . .media development and use" (cited in Boczkowski and Lievrouw, 2007 p. 957). Second, a focus on process marks studies of both the production and the consumption of technologies, from Akrich's concept of "inscription" that draws from STS, to studies of communication technology markets and the domestication of technology in the household (Silverstone and Hadden 1996). The third bridge, a concern with consequences, encompasses an ongoing debate about whether technological changes produce discontinuities (Schement and Curtis 1995; Schement and Lievrouw 1987), or whether there is a more fundamental continuity in their uses and practices. The discontinuity perspective argues that changes in technology have contributed to the development of an "information society" distinct from other societies (Bell 1973, 1979) while the continuity perspective focuses on similarities between the political economics of media and communications at previous moments in history (Mosco 1996; Robins and Webster 1999; Schiller 1981).

The increasing "banalization" of communication technologies, as Lievrouw (2002) argues, suggests that there is more continuity between societies than discontinuity as a result of technological shifts. Indeed, the philosophical consequences of assuming that technological changes mark revolutionary watersheds has been criticized in STS by Winner (1986), who argues that its focus on the linkages between social and technical forms often undermines the potentially negative political consequences of technological developments, including the expansion of "technological society" and in media and communication studies by philosophers of technology including Barney (2004), who criticize the philosophical consequences of conceptualizing communication as operating in a network. However, perspectives of co-production can also focus the interest in consequences that emphasizes both the continuous and the discontinuous, which can include all types of social consequences, including a more refined sense of the political consequences of technology development. Particularly, a co-production perspective might claim that society promises overall continuity, but that some discontinuity can emerge at critical moments when combinations of social and technical factors may permit more flexibility, before "hardening" into more rigid structures. I believe that this may be the case for some of the social and political changes connected with community WiFi.

The constructivist perspectives bridging STS and communication studies highlight process, consequences and causality as points of departure for analyses of the social implications of the development and use of communication technology. I argue that representations through discourse, practice, and material constructions are part of this process. In the following section, I discuss three approaches that provide theoretical tools that can be applied to my analysis of the co-production of WiFi technology and new social, organizational, and policy forms. Marvin's (1988) discussion of expertise in the electrical field establishes discourse as a key means of establishing the social role of a new technology, while Slack (1997) and Slack and Wise (2005) introduce the category of assemblage to describe specific points of connection between technology, ideology, and organization. Finally, Turner (2005, 2006) identifies the network forum as a site of co-production of technology, culture, and networked organization, where bridging of discourse takes place to connect them. These concepts are applied later in the thesis, but

I present them here as a way of situating my thesis within the constructivist tradition in communication studies.

Symbolic Representations of Communication Technology

Carolyn Marvin: Discourses of Expertise

Marvin's (1988) study of electricity begins by asserting that electricity is fundamentally a communication technology. Marvin conceives of technology as a practice whose implications can be understood through the discourses produced around them: she considers how "electric literacy" connected the technology of literacy with the emerging electric technology. Not only does electricity require specific kinds of knowledge, but the practice of writing and reading about electricity also creates communities of "literates." Discourses were produced by and circulated among these groups of literates, who were also elites trying to establish themselves as experts. Marvin pays special attention to the way that power relations framed in terms of access to or expertise in electrical technology are laid over existing power structures relating to race and gender. She writes, "jokes in the electrical press were aimed mostly at those with little social power, occupying either the conditions of misery that electrical progress was supposed to alleviate or positions that would have to move aside to make room for electrical success" (p.19). In this analysis, "electrical success" implies that the community of "non-experts" (framed in many of Marvin's citations as being women, non-white, poor, and/or rural) must abandon their mechanical metaphors for understanding technologies, and their emotional responses, which are deemed unsuitable in comparison to the "social and moral superiority" (p. 22) of electrical experts.

Marvin's focus on the gendered and class identity of experts reiterates that existing structures of dominance can influence the ways in which new ICTs are contextualized: not least by influencing who become experts and to whom they speak. However, the limitation of her approach is that she looks only at discourse, not at the practices that may have undermined the elite understandings of expertise – as Fischer (1992) and Martin (1991) reveal in the case of the telephone, women developed expertise as end users and managers of the technology, despite "expert" assumptions to the contrary. What Marvin contributes to constructivist research in communications, and for this thesis in particular, is a clear conceptualization of the role of discourse in establishing emerging social imaginaries connected to technologies. For a more abstract conceptual perspective on how social life and technology are connected, I next consider articulation theory as developed by Slack and Wise.

Jennifer Daryl Slack and J. Macgregor Wise: Articulation Theory

The cultural studies approach to constructivism responds to the fact that "there are no necessary correspondences" between ideologies, practices, and social groups (Sterne, 1999, cited in Lievrouw and Livingstone 2002) by examining how these elements are connected together – articulated – by discourse and practice in particular times and locations. Hall (1983) introduces the concept of articulation theory to describe how material elements, practices, and social groups are connected; articulations are "lines of tendential force" linking political ideologies with particular cultural assumptions. These are not determined by the origins of the ideologies or assumptions – Hall elsewhere describes the contingency of articulations: "the so-called 'unity' of a discourse is really the articulation of different, distinct elements which can be rearticulated in different ways" (cited in Lievrouw and Livingstone 2002 p. 490). Articulations are a more subtle way of connecting together otherwise separate concepts – without focusing specifically on individual representations of these concepts, as is the case with studies of discourse.

Slack (1997) applies articulation theory to the connections between social forms and technology. She argues that technology is fundamentally a set of connections between material objects and ideas, which can be articulated to a variety of other social practices, organizational structures, and paradigms. In the same way that ANT considers technologies as hybrid actors connected with humans and other non-humans in a network, Slack argues that technology is best described as an articulation: "a non necessary connection of different elements that, when connected in a particular way, form a specific unity" (1989 p. 331). For example, she describes the computer as an articulation of elements (hardware, software, network) that can be connected with other elements (politics, gender, economics). These connections are not natural, necessary, or dictated by "progress" – they are instead temporary and fluid.

Slack and Wise (2005) expand upon this analysis to argue that technologies are part of assemblages that can include articulations between "actions, passions, practices, commitments, feeling, beliefs, affects, and so on" (p. 130). The concept of assemblage draws from Wise (1997) and explains how technologies can be articulated, contested, disarticulated, and then rearticulated to other concepts. Thus, technical systems are not separate from social systems, but instead should be thought of as articulated together with them. However, these assemblages change over time, so that it is possible to track the different ways that technologies are articulated to different ideologies and situated within different social forms. For example, Slack and Wise describe how the constellation known as the "Big Dipper" has, at different times and places connected together different myths and means of navigation – as well as different stars.

Unlike the depoliticized negotiations between designers and users in ANT, the contingency of different articulations and assemblages depends on where and how power circulates. Slack and Wise assert that technologies are political: their contingent connections can maintain the political interests of the powerful. To illustrate, they refer to Winner's (1986) controversial example of how engineer Robert Moses, purportedly afraid of facilitating travel by blacks and the poor, called for the construction of highway bridges too low to allow bus passage. The bridges have remained in place, as has the articulation between Moses' politics and the bridge's built form. However, re-articulations between the bridge and politics have also occurred, including Woolgar's (1991) assertion that the shaping of the bridge was more complicated than merely being an integration of Moses' politics into the built form.

Articulation theory is a particularly useful tool for constructivist analysis because it creates a way of visualizing sets of connections between particular ideologies and practices as they emerge in context and change over time. It also provides a framework for politicizing technology: articulations have their own politics, and some can be preferred to others. However, the major drawback to articulation theory is its lack of empirical applications. While Slack and Wise provide a host of examples to explain articulation theory, they do not provide any suggestions on how to identify assemblages of articulations, nor how to shift or re-articulate them. Touching on many of the same issues but working more empirically, Turner (2005; 2006) uses the concepts of the network forum and the bridging of discourse to describe the process by which people who might have articulated technology with different sets of values and assumptions are able to come together.

Fred Turner: Networked Forums and Bridging discourses

Integrating cultural studies and STS, Turner (2005; Turner) argues that articulations of technology are formed in specific contexts. One of these, the network forum, establishes venues "in which members of multiple geographically dispersed groups could communicate with one another and in doing so come to see themselves as members of a single social network" (2005 p. 489). Turner describes the network forum, which can be a type of media or a physical meeting, as providing the opportunity for an exchange of different perspectives on technology where participants develop a common working language without relinquishing their ties to existing social networks. He likens this development of a "contact language" to the shared objects with multiple definitions that scholars in STS have analyzed. In particular, he refers to material objects like those that Star and Greisemer (1989) call boundary objects. Because Turner focuses on sites of exchange where knowledge about new technology is shared, his framework is particularly applicable to social movements mobilized around technology.

Turner's network forum functions by acting as a location where discourses and practices from different social worlds[5] can be bridged. This bridging fills holes in social networks, and also shifts the way that the role of technology is discussed and understood by different communities. His analysis of the relationship between the California counterculture and the development of the internet economy focuses on the way that the Whole Earth Catalog acted as a text-based network forum bringing together countercultural 'new communalists' who pursued ideals of self-sufficiency through technology, and computer hackers who explored the potential of open access computer technologies to advance their individual freedom. These hackers often considered individual freedoms to be more important than collective rights, an ethic described as libertarian. Although this perspective contrasted with the new communalist ethic, various network forums brought people with these ideologies together in situations that established new technologies as resistant, perhaps even utopian. These also included a Hacker's Conference organized by Stewart Brand, the former editor of the Whole Earth Catalog, and the development of the Whole Earth 'Lectronic Link (WELL), an early bulletin board system/online community in San Francisco.

With the concept of the network forum, Turner explains how particular social imaginaries are mobilized through connections developed by communications technologies – often through the personalities and backgrounds of individual people who develop them. The drawback of Turner's network forum is that he describes it as primarily producing new forms of language, without considering whether technical forms might also be products of networked forums. My application of the concept of the network forum in Chapters Five and Six draws on the broader principles of co-production to argue that technologies, as well as discourses, can link together different social imaginaries.

The concepts and analytical approaches developed by Marvin, Slack and Wise, and Turner form part of the fundamental conceptual grounding of this thesis, where they are applied to the social, policy, and technical forms co-produced through the community WiFi phenomenon. Two of the social forms that I consider most important are "communities" and "publics" as they are produced in connection with media and communication technology. The following section introduces communities and publics as they are conceptualized within communication studies, as well as in studies of community networking.

Communication Technology, Publics, and Communities

The 'special case' of constructivist research on communication technologies rests on an assumption that communication media are important as a means of constituting society through the circulation of ideas, and that ideas are essentially society's symbolic products. Shared ideas create social imaginaries, or ways that people think of themselves as being together. Two social imaginaries - publics and communities- are potentially mobilized through the process of constructing and using WiFi networks as they are through other technologies and media forms. This section introduces these concepts and explains their importance to this investigation of community-based technology development.

Philosopher Charles Taylor (2002) defines "social imaginaries" as "ways in which people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations that are normally met, and the deeper normative notions and images that underlie these expectations" (p. 106). Unique social imaginaries, Taylor argues, emerge at particular moments of history when social changes occur. In contemporary society, social imaginaries are constituted or reinforced through the process of communication. I argue that, in addition to emerging in many other situations, social imaginaries are created through the development and appropriation of WiFi technology. It is possible to make a distinction between two broad social imaginaries: "publics" which have a politicized, expansive quality linked to the ideal of a democratic voting public, and "communities" which are more bounded (often by geography) and affective, as well as defined by a sense of their uniqueness from other social forms. In communications studies, these two concepts glide into and overlap one another, and some of this ambiguity extends to this thesis. While this fluidity is unavoidable when describing the shifts of contemporary social imaginaries, the following sections outline how the expansive, politicized conception of a public differs from the more contained, affective conception of community.

Publics

Beginning with Dewey's (1964) suggestion that a newspaper could contain enough information and reach enough people to inspire the development of an ideal democracy, the idea of publics draws from an assumption that being able to distribute ideas among a large group of people inspires political knowledge and participation. Every form of media has its public: for example, readers of newspapers, viewers of television, audiences for political speech, or commentators on online media. The listening or viewing public is ideally meant to encompass the decision-making public – the rational decision-makers of a democracy, whose actions take place in a public sphere that Habermas (1989) characterizes as the site of reasonable discourse and civility, separated from the private sphere of education, family, and home. Habermas argues that the lifeworld of concerns about education, child-rearing, and democratic participation always risks being colonized by the system of rationalization and institutionalization. He proposes communicative action, a form of symbolic interaction, as the means of producing productive rationalizations that structure society without producing an alienating rationality. This communicative action takes place, ideally, in a public sphere.

Habermas's bourgeois public sphere, a symbolic realm where political discourse takes place separated from the state and where an educated, rational public makes critical decisions, is often held up as the ideal communicative state. For Habermas, the publics produced and sustained through communication make communicative acts centrally important for the development of democracy. In his *Structural Transformation of the Public Sphere*, he argues that institutions including newspapers, coffee houses, novels, and magazines contribute to differentiating the public sphere from the state and from the private sphere by facilitating a structural transformation that favoured individualism and expression in public. Fraser (1992) criticizes the elitism of this concept of the public, arguing that it excludes participation by women and members of non-dominant groups.

More broadly Warner (2002) argues that publics are social spaces created by the reflexive circulation of discourse. Warner understands this exchange of discourse as the site of pure political engagement, outside of the framework of the state: "speaking, writing, and thinking involve us—actively and immediately—in a public, and thus in the being of the sovereign" (p.51–52). If speaking, writing, and thinking are the foundations of sovereignty, then the media through which they are communicated become politically important as well. Warner's insistence that publics are defined by spaces of circulation as opposed to places or institutions inspires him to develop Fraser's (1992) concept of counter-publics – "parallel discursive arenas where members of subordinated social groups invent and circulate counter-discourses to formulate oppositional interpretations of their identities, interests, and needs" (cited in Warner, 2002 p. 118). Counter-publics are ways for elements of the private to be made public: they can also be ways for people marginalized by the creation of publics in the dominant media to find a voice. Downey and Fenton (2003) argue that the development of counter-publics is facilitated by the internet and networked forms of media production and organization.

Publics (and counter-publics) coalesce around communication media, which permit them to create a shared space of exchange, which is ideally democratic. Fraser (1992) has criticized Habermas' idealized public sphere as being inaccessible to a wide variety of people including women and poor people. In response, community and alternative media can create outlets for stories and perspectives not covered by commercial or government-controlled media (Downing 2003; Kidd). Arguably, the structure of the internet itself can mobilize new types of publics and counter-publics (Papacharissi 2002). In the chapters that follow, the emergence (or failure to emerge) of WiFi publics is examined along with, and sometimes in contrast to, the emergence of locally-relevant "community WiFi."

Communities

There are similarities between conceptualizations of mediated publics and mediated communities. Anderson (1991) argues that communities do not exist except by being collectively imagined by their members. This suggests that communities develop around forms of media like newspapers, maps, or even monuments. However, compared to the broader understanding of "public," community is more bounded, even when it is imagined as transcending the geographic and cultural constraints that characterized the first social scientific definitions of community. Tönnies (1887, trans. 1955) defined community (gemeinschaft) as a "unity of will" in opposition to society (geschellschaft). This traditional sociological definition takes village and family as primary sites for development of community, and although social research now concentrates on a profusion of types of community including "geographic communities, virtual communities, communities of circumstance that grow from situations of need, and communities of interest" (Fraser 2005) there remains an understanding that identifying a community implies connectedness and commonalities, whereas a public implies broader political mobilization.

Warner (2002) argues that the difference between a community and a public is that the public is composed of strangers, or at least of people who do not organize their interactions based on deep affective knowledge of one another. In contrast, a community draws on this deeper affective bond as part of its self-definition. Etzioni defines communities as "social entities that have two elements. One, a web of affect-laden relationships among a group of individuals, relationships that often crisscross and reinforce one another, and the other, a measure of commitment to a set of shared values, norms, and meanings, and a shared history and identity – in short, a connection to a particular culture" (2004, p. 225). Day and Murdoch (1993) also evoke the bounded nature of community, arguing that when people talk about their definitions of 'community', they focus on the symbolic links between a geographic area and a shared ideological background. The bounded quality of community is meant to suggest closer affective connections than the political concept of publics. Perhaps for this reason, media and communication technologies are often leveraged to fulfil goals like building or sustaining community.

Community Networking and Community Informatics

The goal of creating and developing community has, like the creation and development of publics, been mobilized by communication technology. Two linked fields, community informatics and community networking, investigate the theory and practice of this mobilization. While it is difficult to draw strong distinctions between these two areas, community informatics, "concerned with the development, deployment and management of information systems design with and by communities to solve their own problems" (McIver 2003 p. 33) is more oriented towards design, and community networking, which investigates both on-line "virtual communities" and local place-based communities, is focused on community use of technology, sometimes with the goal of changing policy to afford a greater accessibility of information technologies. Community informatics draws from "the assumption that geographically-based communities (also known as 'physical' or 'geo-local' communities) have characteristics, requirements, and opportunities that require different strategies for ICT intervention and development from the widely accepted implied models of individual or in-home computer/internet access" (Taylor

2004 p. 4). Gurstein (2000) notes that "community informatics pays attention to physical communities and the design and implementation of technologies and applications which enhance and promote their objectives."

Stillman (2004) describes community networking as providing a "seemingly endless variety of forms [that examine] the interface between people and technology" (p.2). This variety of forms often includes assessment of ICT projects undertaken within different types of communities (mostly geo-local communities). As Stoecker (2005) notes, analysis of community networking has proceeded in two general directions: 1) assessment of ICT projects in local communities, and 2) explorations of the "virtual communities" made possible through the application of networked technologies[6]. In addition, community networking initiatives form the basis for challenges to communications policy because they provide critical alternatives to existing communication networks (Loader and Keeble 2004). Representative literature in the first category includes Marshall et al's (2004) comparative study of the regional impacts of ICT, as well as Myles' (2004) study of the role of community intermediaries in creating and sustaining local networks, Boase et al's (2006) assessment of internet use within geographic communities, and Dutta-Bergman's (2005) study concluding that internet access increases the satisfaction of residents about the communities they inhabit.

The second category includes substantial work in the field of computer-supported co-operative work, including Carroll and Rosson's (2003) analysis of the design features that permit virtual communities to produce the same social benefits as place-based communities. Explorations of virtual or on-line communities include not only Rheingold's well-known (1993) reflections on the WELL, but Wellman and Gulia's (1999) examination of connections between online and "offline" communities; Hafner's (1998) examinations of the role of the WELL in defining the virtual community, Turkle's analysis of the consequences of "life on the screen" (1995) and Shade's (2002b) analysis of the role of gender in the development of virtual communities. In an overview of this tradition Jones (1999; 1997) reflects on the transformation of internet studies from the study of virtual communities towards a greater focus on the integration of online and offline modes of interaction.

A third strain of community networking research focuses on the political contributions of local networking projects. Day and Murdoch (1993) argues that community networking ideally contributes to community development. Clement and Shade's (2000) access rainbow defines a framework for increasing community appropriation of ICT, focusing on the layers of access required, beginning with access to infrastructure and ending with governance. Shade (2002a) also describes the policy implications of supporting ICT networks that empower local communities. More broadly, Feenberg and Bakardjieva (2004) posit that community networking projects may act as a form of 'democratic rationalization' which they describe as "user interventions that challenge harmful consequences, undemocratic power structures, and barriers to communication rooted in technology" (2004, p. 186). Democratic rationalizations may not necessarily operate by creating state-level policy, but they are nonetheless political interventions because they reshape elements of technical systems perceived as unjust. Therefore community appropriation of technology can contribute either to high-level policy changes, or its political impact may be felt through interventions that alter the structure and context for technologies at a smaller scale. Democratic rationalization also suggests that communities can have a political impact, potentially in a different way than publics whose development is conceptualized as more directly linked to democratic political participation. Broadly speaking, community informatics and community networking are critical forms of "computerization movements": non-commercial organizations that promote the social benefits of computerization. As the next chapter discusses, computerization movements are one important site where the social imaginary of "community" is co-produced along with technology.

Communities and publics are social imaginaries that can develop through mediated communications. This section has summarized definitions of communities and publics, focusing particularly on assessments of the development of communities and publics through the use of media and communication technology. The following chapters examine how communities and publics form within, or are evoked by, social mobilizations connected with WiFi technologies. These mobilizations, in turn, impact technical and policy forms. This sociotechnical process unfolds on several different levels; however, the conceptual tools provided by Marvin (1988), Slack and Wise (2005), and Turner (2005; 2006) provide ways of grounding the analysis by examining discourses, articulations, and network forums. The next section describes how I have developed these concepts through empirical, participatory research in two specific case studies and within the broader CWN "movement."

Methods for Exploring Co-production

Socio-technical research in communications studies assesses the range of social, technical, and hybrid elements influencing mediated communication. The methods used by previous researchers in this area draw on a variety of data sources. For example, Marvin (1988) focuses on print media, following the discourses circulated through trade and popular publications produced for or discussing the electrical elite in the early 20th century.

Turner (2005) draws on print sources as well as face-to-face interviews and records of meetings, as well as the technical design of the WELL, to explore how the design of the WELL encouraged sociability. Hughes (1983) consults maps, plans, the design of devices, and technical schematics for the development of electrical systems. These sources of data permit an analysis of how different groups of people wrote about, talked about, schematized and designed technologies within specific social contexts. However, the historical approach of each of these projects fixes the practices of the people involved in producing these texts, discussions, and schematics in time. In contrast, my research has concentrated on changes taking place in times and spaces I myself occupied. It establishes me as a researcher-activist, and the focus on bridging, knowledge-sharing, and the policy impacts of WiFi draws from my involvement both with local WiFi projects and with broader community wireless networking mobilizations.

Ethnography

An alternative to historical approaches like those used by Hughes, Marvin, and Turner is ethnography, which focuses on the evolution of discourses and practices in lived social life, over time. In STS, ethnographic approaches have focused both on design and on use. In the ANT tradition, Akrich (1992) examines the process by which new technologies are inscribed with values and assumptions of their designers. Oudshoorn, et al (2004) provide an STS critique of the gendered aspects of inscription, especially the consequences of designers using their own experiences as a way of conceptualizing their users as "everyone."

In communication studies, ethnography is the primary means of investigating the "domestication" of technology, examining the complexity and significance of everyday practices of technology (Silverstone and Hadden 1996; and see the review by Haddon 2004). This tradition's focus on situated practice has also influenced analysis of communication technology's (and especially the internet's) intersection with gender (Shade 2002b; Wakeford 1999; Kendall 2002) place (Hampton 2001; Miller and Slater 2001; Wellman 2001) and race and ethnicity (Kolko, Nakamura, and Rodman 2000).

Within the community networking research tradition, ethnography (especially participatory ethnography) is considered a form of advocacy that contributes to the development of community networking organizations and the broader communities they serve (Taachi, Slater, and Hearn 2003). Otherwise, ethnography is used to describe the influence of community networks on life in a geographic community. In this field, representative studies include Cohill and Kavanaugh's examination of the Blacksburg Electronic Village (1997) Pinkett's, (2003) participatory ethnography of the Creating Community Connections project linking MIT researchers and a Cambridge, MA housing estate; and Clement et al's (2003) study of the everyday uses of community networks and home internet service in inner-city Toronto. Bakardjieva and Smith (2001) also use ethnography and unstructured interviews to interrogate the idea of "virtual community." Finally, ethnography has also been used to explore the qualitative experience of the digital divide (Clark and Demont-Heinrich 2004). These examples indicate how ethnography can be used to study the affective nature of community as it develops through community networking projects. As internet access and networked communication have become integral to everyday life and of research practice, virtual ethnography, involving observation of and participation in social practices online (Hine 2000) has supplemented conventional ethnographic research practices including participant observation, open or semi-structured interviews, and detailed "thick descriptions" of situated practices (Hammersly and Atkinson 1995).

Multi-sited Approaches

In this thesis, I have chosen to pursue a multi-sited research approach drawing from documents, designs for WiFi networks, and participation in and observation of discourses and practices of community WiFi developers, as well as quantitative findings that can be used to contextualize the qualitative insights. Comprising three main sites: a grassroots community WiFi group in Montreal (Île Sans Fil), a municipal WiFi project in Fredericton, New Brunswick, and the North American "Community Wireless Networking (CWN) Movement," it follows the evocation of communities and publics through the development of non-commercial WiFi networking.

This thesis grew from a two-year ethnography of Île Sans Fil, and expanded to track new contexts and discourses for WiFi. Developing the research strategy iteratively, I was inspired by the ANT approach of "following the actors" and observing how they themselves described the multiple contexts and meanings of their engagement with technology. As Latour (2005) writes,

> It is in these kinds of spots that we have to take a decision if we want to trace social connections in new and interesting ways: we must either part company with the analysts who have only one fully worked out metaphysics or "follow the actors themselves" who are getting by with more than one. Concreteness does not come from choosing some figuration over some other ones in the place of the actors, but from the increase, in the accounts, of the relative share of mediators over intermediaries (p. 58-61).

In ethnography, this pursuit of multiple actors and multiple contexts is referred to as a "multi-sited imaginary" (Marcus 1995) where the sense of the phenomenon under consideration is assembled from diverse sites and actors. Both Marcus (1995) and Saukko (1998) argue that using more than one ethnographic site expands the utility of this method: taking a similar position Marcus (1998) writes, "within a multi-sited research imaginary, tracing and describing the connections and relationships among sites previously thought incommensurate is ethnography's way of making arguments and providing its own contexts of significance" (1998 p. 14). Necessitating an iterative and reflexive research stance that changes with relation to each site, the multi-sited imaginary negotiates between describing the world as it is and abstracting the elements that connect together similar elements in different locations. In the cultural studies tradition, multi-sited studies connect places with flows, people and practices with ethnoscapes, technoscapes, and mediascapes (Appadurai 1996). Saukko (1998) argues that these methodological practices nourish interdisciplinarity and an attention to structures of power. However, multi-sited work can be limited if it only assesses one aspect of culture across many sites. Instead, the variety of sites should be used to interrogate several different aspects of culture. I find this a particularly productive approach for exploring the co-production of WiFi technologies and the new social and organizational forms associated with them.

Finding the Middle Ground

Hine (2007) argues that multi-sited research engages with a "middle ground" that comprises the terrain that emerges as a research site, as well as the researcher's own shifting position between different research sites. The multi-sited imaginary questions established expectations about what the boundaries of a "case" should be, and provides an opportunity for reflection on the nature of methodology itself. Hine also argues that multi-sited imaginaries engage with the "middle range" of studies that straddle the split between attempts at providing focused, local description and those hoping to develop a "theory of everything". In STS, the middle range connects the thick description of ethnography (originally laboratory studies) with the high theory of ANT, or with studies of the institutionalization of technical forms (Geels 2007). In communication studies, middle-range theories can bridge focused discursive and ethnographic studies of production and consumption with the more abstract articulation theory, or even bridge the cultural studies and political economy traditions (Vaidhyanathan 2006). In this project, striving towards work at the middle means applying techniques of ethnography in a way that produces insights about the socio-technical process of defining and building WiFi in connection with various types of communities and in turn connecting those insights to the socio-political consequences of the process. The middle ground is also a terrain of negotiation for my own position within the research process, encouraging me to think about the connections between institutionalized academic research and the more grassroots modes of engagement that characterize local WiFi projects and broader WiFi mobilizations.

For this reason, my multi-sited study draws on documentary evidence, interviews, and technical documents produced at each site. Primarily a qualitative research study, it also draws on quantitative data gathered through surveys and monitoring of the use of WiFi networks. This thesis contributes to a growing field of research on WiFi and its political and social impacts. It also represents a uniquely situated perspective: the cases are not comparative, not closed, and were never visited by an "objective" researcher. As a researcher, student, and activist, I am part of the stories that I tell about CWN. However, this situated perspective and multi-sited methodology have inherent shortcomings, since situated perspectives privilege some kinds of knowledge and overlook others. The content as well as the tone of this thesis illustrates the way that situated perspectives can shift. This literature review and the following historical summary are more detached, while I introduce the case study chapters with stories introducing the people, places, and ideas that I encountered. Storytelling reiterates that one of the roles that a researcher-activist can play is as a narrator, linking ideas and people together in one of many possible trajectories.

Neither my stories nor the analysis in this thesis accurately represents all of the experiences and perspectives that are part of the CWN phenomenon. However, my situated perspective also draws on rigorous qualitative (and even some quantitative) research methods. The specific techniques used in each case are described in the relevant chapters, along with further reflection on their individual limitations, but first I discuss some general issues of participatory research.

Participatory Research

Unlike the studies mentioned earlier that used historical data, my exploration of WiFi was conducted as the technology and its meanings evolved and shifted. Although constructivist research argues that the meanings of technologies are never entirely "closed," early phases of technical development introduce a proliferation of interpretations of technology. As I conducted research, I participated in constructing discourse and defining practices. My own movement through the three research sites and my engagement with each attempts to balance a necessary attention to local context and detail with an understanding of the different contexts provided at each site.

Participatory research implies a level of commitment and involvement by the researcher. For example, in community networking research, participatory methods are intended to contribute directly to evaluation and improvement of the projects they are engaged in research with, through the methodologies suggested in participatory action research (PAR) (Lennie and Hearn 2003). Practical tools and methodological techniques concentrate on the feedback loop between research, evaluation, agenda-setting and service delivery (O'Neil 2002; Stillman and Stoecker 2005). Still, the effectiveness of PAR depends, as Stillman and Stoecker (2005) point out, on the time and experience of researchers.[7] Graduate students have conducted most of the research on community wireless networking as participants in CWN initiatives[8]. The enthusiasm and time that graduate students are able to dedicate to research (as well their potential political motivations) may have assisted in creating a participatory research culture connected with CWN. My own engagement with CWN has been contextualized by participation in larger research projects emphasizing participatory research, connections between academia and advocacy, including the CRACIN and CWIRP projects, which are described in Appendix One. Being involved in policy-relevant research projects has inspired me to employ a participatory approach but also sparked my interest in pursuing public-interest and policy relevant research. The politicized nature of CWN projects also inspired other researchers, many of who have remained involved in political advocacy related to community WiFi after completing their thesis research projects.

A more refined set of conceptual tools assist in critical reflection on this aspect of co-production. For example, theoretical frameworks for new social movements (especially Touraine 2000, 1988, 1977), which I employ in Chapters Two, Five, and Six, consider that social movements (including the media reform movements that I discuss in Chapter Six) that depend upon the participation of 'movement intellectuals' who help to define the social relevance of the social movement, as well as providing legitimacy for many of the movement's outcomes. Dutton (2006) outlines the challenges for researchers participating in the media reform process, noting that stereotypes of researchers as irrelevant and apolitical can be overcome – but sometimes with difficulty. He identifies five types of actors participating in media reform: academics, activists, foundations, bridges, and specialists. Of these, academics may not necessarily make the strongest contributions to policy change, because the nuanced perspectives of research may not align with the more polarized perspectives of policy-makers. Dutton's analysis suggests that ‘movement intellectuals’ may stand to benefit more from the increased credibility of participating in grassroots activism than activists stand to benefit from academic research and suggests creating relationships of collaboration to prevent academic researchers from acting as “hired guns.” Still, researchers within social movements are situated in an awkward position, where a positive contribution to the movement may be outweighed by the personal and professional benefit they draw from participating in it.

Ideally, collaboration creates benefits for all of the people involved, although some may benefit more than others. As a means of conceptualizing the relationship between researchers and “the researched” in ethnography, Thomaselli (2003) suggests working through a “reverse ethnography.” This thought experiment traces the relationships created during ethnographic research, and calls into question the necessary authority of the researcher. A reverse ethnography allows all of the participants to see how research relationships are reciprocal and constructed: a research text abstracts the experiences of active participants, but it also provides a way for participants to see the value of their activities. Researchers can promote reciprocity by facilitating access to research findings as they develop and allowing self-reflexivity for all of the participants in the research process.

Although my research position shifted as I explored the different cases presented in this thesis, I have attempted to create reflexivity and reciprocity throughout the process. I distributed research results to the people involved in producing them, and solicited feedback on future research plans. I made public presentations to various groups of actors including government representatives and policy-makers and created educational resources related to public and community use of networked communication technologies.[9] In many ways, therefore, I have contributed to discursively framing WiFi as a "community technology."

Conclusion

In this chapter I have reviewed literature from social science traditions concerned with the relationships created between society and technology, beginning with the STS tradition and then examining key works that employ social constructivist perspectives within communication studies. I have presented three important sets of concepts useful for understanding the co-production of technology and society: discourses of technical expertise, articulations between technology and society, and network forums that assemble people, technologies, and shared forms of knowledge. I have also explained how the concept of a social imaginary can be used to describe the emergence of social forms like communities and publics that are associated with communication media and technologies, and which emerge with relation to WiFi. Finally, I have argued that ethnographic and multi-sited methods are useful tools for understanding the co-production of technical forms and social forms, which has inspired reflection about my own participation in the co-production of WiFi technology and social forms. With this chapter I have situated the study of the community WiFi movement's co-production of social forms, technology, and policy within communication studies. In the following chapter I begin to set the historical and social context for this co-production by situating community WiFi networking as a contemporary "computerization movement": a form of advocacy of computing technology by non-commercial actors. I examine the continuities and discontinuities between previous computerization movements and the community WiFi phenomenon, arguing that computerization movements offer a critique of technocracy that can also contribute to the development of new socio-technical institutions.

Chapter Two: Computerization movements – Re-mediating technology from the 1970s to the 2000s

Introduction: A History of Computerization and Community

Like electricity, the telegraph, telephones and televisions, computers and ICTs have been envisioned as potentially inspiring a more democratic society (Carey, 1989). This chapter critically examines these visions as they have unfolded over the past forty years through what Kling and Iacono (1991) call "computerization movements." In keeping with the overall focus in this thesis on the co-production of technologies and social forms, my interpretation of computerization movements focuses on ways that democratic imaginations of computer technology establish alternatives to the dominant institutional frameworks for computers – even while they contribute to them. At important historical moments, computers are associated with disruptive and oppositional political positions that promise social improvements through alternative applications of technology. However, at the same time computerization and the promotion of computers as a goal in itself supports the status quo of post-industrial, informational capitalism. In a dialectical process, the critical re-mediations of computer technology that are meant to be politically and socially progressive are integrated into institutional structures, some of which are not as progressive as originally envisioned.

This constructivist approach draws heavily on existing work in the history of computing. There are two broad traditions of constructivist computer histories: one concentrates on the shape of systems, connecting technological developments with social structures to describe how and why computer systems were materialized in particular forms (Abbate

1999; Ceruzzi 2003). These histories challenge more determinist accounts written by systems theorists that discuss advances in hardware or software without consideration of the social context (for example Goldberg 1988) and also challenge the technological determinism so often associated with computer histories. However, these more conventional computer histories contrast with a second genre of social histories concentrating on the personalities of computer developers and describing flamboyant iconoclasts and troubled geniuses. This history hinges on narratives that describe hackers building their own computers or looking for flaws in existing networks, creating software outside of institutional channels, and tales of activists creating community-based networks for socially innovative applications. This second type of history focuses on the visions and social or political goals of the people involved in these experiments, and it is also more likely to discuss these practices and goals in terms of community and to describe how these innovators make up different types of communities. Some examples of these histories include "hacker histories" describing the hacker cultures of the 1950s and 1960s by Levy (1984) and Markoff (2005), descriptions of the technical cultures of radio tinkerers in postwar America (Haring 2006), close histories of cybernetic researchers in California in the 1960s (Bardini 2000) and their relationships to members of the counterculture (Turner 2005). Also in this tradition is the cultural and social history of open source software developers from the 1990s onward as exemplified by Moody (2002).

One limitation of the first type of history is that it implies a kind of inevitability – the present computing context, with its small, powerful computers linked together in local networks with connections to a global internet emerges as the obvious outcome of generations of discussions. Even if they are not necessarily deterministic, such stories lay out a rational landscape of ICT diffusion that focuses on how industries and practices develop (see Rogers 1995). In contrast, the second type of history can be too focused on goals, dreams, and visions associated with technology or on the personalities of the visionaries who are often men, especially when their goals are in opposition to the dominant understandings of computing – for example, in the development of community-based computer systems. Often, this focus on the individual genius reinforces masculinist conceits in computer development by celebrating the figure of the brilliant, solitary "lone hacker." In fact, in the past forty years, the transformation of computer technologies has been connected with transformations of organizational forms, including the increasing importance of ideals of community, which appear and reappear as symbolically important in discussions of technological change. Discussing a desirable form for "community" may be one way of evoking the myths of technological transcendence of existing space, time, history, and politics that Mosco (2004) claims underlie contemporary society.

In this chapter I use the concept of computerization movements to link together the two types of computer histories described above and capture some of the social, political and symbolic transformations that have taken place. I describe how computers and ICTs are envisioned as helping to achieve public interest goals, and what social and institutional changes result from the development of these visions. After introducing the concept of computerization movements as it might be understood from the perspective of new social movements (Touraine 1977, 1988, 1992), I argue that computerization movements perpetuate a paradoxical dialectic between visions of computers as providing greater liberty, social justice, and economic transformation, and the maintenance of a potentially oppressive technical culture through existing economic and social institutions. I provide thematic examples drawn from computerization movements of the early 1970s onward, focusing on how these computerization movements mobilize visions of the democratic potential of computing, which may or may not be reflected in the institutional realities they help to shape. At some critical junctures, notably in the 1970s and at the current time, computerization movements contribute to broader social critiques that link technological changes, media regimes, and political shifts. I conclude by situating community wireless networking as a contemporary example of computerization movements, arguing that it creates its own critique of the existing ownership and institutionalization of communications infrastructure.

Computerization Movements

Kling and Iacono (1995; 1988) describe how intellectuals, professional associations, and civil society advocates helped to integrate computing into mass culture in the United States, arguing that "the spread of these technologies is not simply the byproduct of ambitious marketing departments in high-tech companies. The government, media, grass-roots organizations and coalitions of organizations all communicate favorable links between computerization and a transformed social order which help legitimate relatively high levels of computing investment for many potential adopters" (1995). In other words, visions of positive social transformation help to motivate increased investment in computing. Not surprisingly, Kling and Iacono note that actors in computerization movements often use the rhetoric of technological utopianism to describe the social benefits that they believed computerization could produce. They reiterate that participants in computerization movements do not consider that they are engaged in marketing: they are instead participating in collective organizations and activities that may have social or political value; for example, early computer hobbyists created social networks and exchanged information to facilitate discussions about common passions.

While Kling and Iacono argue that computerization movements can be compared to other social movements such as labour movements, they are still critical of the technological utopianism of movements that aim primarily to introduce more machines in order to improve society. They conclude that even though the rhetoric of technological utopianism allows people without much experience with computers to sympathize with the goals of computerization movements, the movements themselves often pay little attention to the human cost or impact of computerization. Thus, computerization movements can often serve to advance the interests of elite groups, while justifying the continued existence of networked, technologized society.

I would argue that for the most technically expert members of society, who could also be considered as making up the technocracy – the group of technical experts placed in positions of power based on their knowledge and skills – computerization movements act as a legitimating force. Still, despite their legitimizing tendencies, computerization movements also provide the potential to radically re-envision technology. Kling and Iacono (1995) describe "counter-computerization movements" as mobilizations critical of some of the outcomes of computerization: for example, the non-profit organization Computer Professionals for Social Responsibility, whose members include professional computer scientists in academia and industry, has lobbied against the use of computers in the service of the military-industrial complex. However, despite their critical stance, these attempts at re-visioning and restructuring technology are connected with the same activities that legitimate computer technology's high social profile. While Kling and Iacono argue that computerization movements are distinct from counter-computerization movements, I believe that the social critique that often develops as a result of computerization and the promotion of computers form part of the same process.

Computerization Movement Dialectics

Based on Kling and Iacono's conceptualizations, I argue that computerization movements present socially critical visions of computing that both criticize and legitimate the current social role of computing and information technology. In particular, the understanding of computerization movements can benefit from conceptual insights provided by Alain Touraine's New Social Movement theory.

New Social Movement Theory

Touraine (1977) presumes that industrial technology has created a rupture between post-industrial society and pre-industrial society. Drawing from this assumption, he claims that the social movements of post-industrial society focus not on control of labour, but instead on influence over the symbolic meanings circulating in society. His New Social Movement theory claims that contemporary social movements work in discontinuity with previous social movements. The theory argues that contemporary social movements operate at the communicative level and in terms of the production of symbolic meaning, giving cultural orientations a social form (1988, p. 42). A central point of struggle in Touraine's new social movements is what he calls historicity – the set of ethical, cognitive, and economic structures that characterize a society at any point in its existence. New social movements challenge how these structures will be established and represented: in other words, they primarily debate who will define or influence the tenor of the times. Therefore, some of the struggles of new social movements concern ownership of data and the control of the production of symbolic goods.

New social movements have influence at the level of everyday lived society, rather than at the level of the state. Touraine (1988) distinguishes between what he calls diachronic and synchronic social changes. At the diachronic level, radical changes occur as eras end and others begin. At this level, the state's regulations can influence which types of changes occur, for example, favouring one type of economic system over another. New social movements operate instead at the synchronic level, where smaller and more symbolic changes alter social experience, including the experience of historicity. As Canel (2004) writes,

> Touraine's action theory attempts to rescue the subject from all forms of reductionism and seeks to achieve a balance between structure and actor. Post-industrial society, with new technology and increased reflexivity, gives rise to new conflicts and actors. His emphasis on the functioning of society (the synchronic dimension) and on normative contestation highlights the significance of the new movements. The emergence of new actors struggling over non-economic, non-political themes demonstrates the increased reflexivity of post-industrial society regarding the social construction of reality (2004, n.p.).

Touraine insists that the great struggle of post-industrial times is the struggle with historicity. Unfortunately, this insistence fails to describe how these symbolic struggles influence the broader structures formed diachronically by the state. Even though new social movements establish that symbolic aspects of the world are sites for struggle, Touraine's theories risk leaving social movements without any political dimension. He focuses on historicity at the exclusion of institutionalization, which may be a result of his focus on the discontinuities between post-industrial society and other phases of society. Despite this, his theories are usefully applicable to STS research. In particular, Touraine's concern for the synchronic sphere of life resonates with my interest in the co-production of symbolic, organizational, and material aspects of communication technology. Even more importantly, Touraine's identification of the control of data flows as one of the most important elements of post-industrial historicity anticipates computerization movements, where struggles over the shape and importance of computers are also struggles over who should have access to information and how it should be distributed. Empirical application of Touraine's ideas of new social movements to cases like computerization movements provides a conceptual framework that helps to explain why discussions of the social role of computers are important to contemporary society.

Applying New Social Movement Theory to Computerization Movements

Promoting computers and computing as a solution to social problems both supports and challenges the technological imperative that some scholars see as underlying assumptions about progress (Nye 2006; Slack and Wise 2005), as well as linking together the continuity and discontinuity perspectives on socio-technical change. In one way, the enduring association between technology and progress challenges Touraine's (1988) insistence that postindustrial society is far different than industrial society. In another way, the focus on computers as emancipatory is essentially post-industrial, because it focuses the symbolic adoption of ideas about computerization. Computerization movements are partly struggles over how computers should fit into society, and whether and how they might make it more just and fair.

Still, computerization movements hint at one of the terrible paradoxes of contemporary society: on one hand they promise a rethinking of computing and a critique of dominant or oppressive representations of computers and technology, but on the other hand, they are part of a "technological society" oriented towards mechanization and consumption. Ellul (1964) argues that organizing society around technology creates a logic of technological dominance. Because they focus on developing and promoting computerization, computerization movements do little to undermine this logic.
I argue that criticism of and implicit support for a technological society are both present in computerization movements, together creating a dialectic that influences both progressive visions of computing and the sometimes more banal realities resulting from these visions. Assessing this tension within computerization movements allows us to see how discussions about the social impact of computers are essential for engaging with historicity: they are part of how the values of contemporary society are defined. More importantly, an historical summary of computerization movements can potentially indicate how the synchronic – affective, symbolic – elements of new social movements impact the diachronic – economic, political – elements of broader social change. This

chapter concentrates on the symbolic influence of computerization movements. Because computerization is itself part of the logic of capitalism, advocates for computerization are on one hand supporting the dominant economic and political system, while on the other hand they are providing alternatives to it by proposing critical symbolic and organizational contexts for computerization. This is especially true of the "grassroots" non-commercial, self-organized forms of many computerization movements that struggle to define the symbolic importance of computing.

Linking Constructivist Communication Studies and New Social Movements: Re-mediations

The concept of re-mediation helps to frame this symbolic importance. Lievrouw (2007) draws from Touraine to argue that new social movements centered on technology engage in a "re-mediation" of media content within the scope of their historicity. While Lievrouw argues that re-mediation of content and forms of media is separate from reconfiguration of technical systems themselves, I see computerization movements as re-mediating both communication systems and their content: they provide re-mediations of technology that resist the logic of capitalism by creating alternative understandings of or frameworks for computer and network technologies. Re-mediations take the logic of a technology as it is understood in one social context, and shift it to resonate with a new context. For example, while computers in the 1940s were associated with defense research, centralization, and expert planning, as Light (2003) and Turner (2006) point out, they were re-mediated by members of the 1960's counterculture as tools for individual freedom and decentralization. Computers have since been re-mediated numerous times in ways that highlight their association with visions of community, freedom, and democracy. Eventually, the re-mediations themselves become less radical, sometimes developing into more permanent social, economic, or political institutions.

Lievrouw's concept of re-mediations is similar to Bolter and Grusin's (1999) understanding of how media forms are re-mediated: newer media forms like digital media absorb the logic of older forms like film or television. This re-mediation of aesthetic forms and functions is part of a broader logical of re-mediation that I argue includes social structures and organization. Computerization movements create new ways of envisioning computer technologies, establishing re-mediations that include new social contexts and institutional forms.

Computerization Movements Since the 1970s

The concept of re-mediations explains how computers and ICTs can repeatedly be envisioned as inspiring freedom and democracy while simultaneously becoming integrated into the very systems criticized for being undemocratic. I argue that computerization movements both support and criticize technocracy, creating a dialectic that has been repeated over the last forty years, sometimes contributing to social mobilizations at critical junctures in media and politics (McChesney, 2007). For example, in the 1970s, more easily accessible personal computers promised a challenge to the centralized mainframes of the day, and also connected with countercultural goals like providing community-based information and establishing small-scale communalistic societies. The critical juncture of the 1970s, where new computer technology challenged the existing media and computing landscape, established computerization movements as part of an overall social critique, especially since computers promised alternatives to existing devices, organizations, and institutions. The potential for computers to inspire community or democratic participation emerged out of this critical juncture.

Later, the community computer networks of the 1980s provided services that were not always available elsewhere, or that were alternative to commercial services. However, by the 1990s, the success of the World Wide Web made some of these services less useful, and computerization movements focused the potential for networked computers to facilitate online "virtual" communities. A proposed "community" model for the internet was perceived as disrupting both consumer capitalism and the linkages between computers and the military-industrial complex. 1990s computerization movements promised to extend connectivity and the liberatory potential of computers to an even broader group of people: ideally, everyone. In many ways, this vision has influenced the West's current reality of ubiquitous, always-on computer networking. In the 2000s, computerization movements like community WiFi establish local organization as one of the contexts for computerization in the interests of community. Therefore, over the past forty years, the vision of "community computing" has inspired criticism of established computer structures through the development of alternative socio-technical forms, while at the same time influencing the development of computer technology and institutions. The following sections explore this dialectic by providing examples of computerization movements from the 1970s onwards.

Improving Office Work and Expanding Minds: Computing in the 1970s

Two opposing visions of computing emerged in the 1970s and early 1980s. In the business world, computing technology supported rationalized bureaucratic processes, while in the California counterculture epitomized by Stewart Brand and the 'new communalist' movement (described by Turner (2006)), computing was associated with the reversal of bureaucracies and the development of individual intellectual freedom. The tension between control and freedom is one aspect of the dialectic that underlies the promotion of computing, and has accompanied the commodification of computing and information technology.

Office Bureaucratization, Workplace Democratization

Kling and Iacono (1988) describe how computing systems have been associated with social improvements, in particular with greater autonomy and democracy of access to information, but also with an ease of use and streamlining of work. They describe the Office Automation movement that advocated computerizing offices as a way of making secretarial jobs easier, as portraying "social relations as cheerful, cooperative, relaxed, and efficient – better jobs in better environments" (p.233). The push for computerization, even in offices, was not coming from managers pursuing greater control, but also from advocates who imagined in computers the potential to make work – and life – easier. This meant that advocates for Office Automation, even as they acknowledged the potential for computers to promote 'deskilling' and increased work pressure (especially for women working in administrative positions), framed their promotion of computers around the idea that computerization could make office jobs easier. Still, the importance of control through computing systems was never very far from the discourse of institutional computerization movements.

The Counter-culture's Mind-expanding Machines

As computers in the 1970s became smaller and more powerful, voices besides those in industry began to represent the progressive social potential of different elements of computing, specifically the mind-expanding, personally-empowering and anti-bureaucratic potential of computing technology. Turner (2006) traces the connections between this strand of computerization advocacy and "systems-oriented ecological theory and cybernetics" (121). Influential members of the counterculture, especially Stewart Brand, became deeply involved in computerization research and advocacy from the 1970s onwards. Initially drawn together by research centres including Douglas Englebart's Augmentation Research Centre (ARC) at the Stanford Research Institute (SRI) as well as hobbyists associated with the loosely organized People's Computer Company and the Homebrew Computer club, computer researchers, hobbyists and advocates were inspired by the idea of computers as means of expanding individual intellectual capacity while encouraging "elements and emblems of a collaborative system designed to amplify . . . individual skills" (Turner, 2006 p.108). Englebart, in whose laboratory the first on-line, distributed computing system (the NLS) was developed in the late 1960's and early 1970's, advanced the idea of a 'co-evolution' of computer systems and their users. Based on experiments with the NLS, his vision rigorously involved "the coevolution of user and machine and the concomitant requirement that the user undergo the rigors of a learning process" (Bardini, 2000 p. 154). Englebart implied that through use of a computer system, an individual could become part of a system of collective intelligence. Ideally, a distributed, worldwide group of users would be drawn together through networked computers.

This idea resonated with the countercultural ideals of collective knowledge, mind expansion, and communal living and working. Stewart Brand's *Whole Earth Catalogue* and subsequent *CoEvolution Quarterly* magazine picked up these ideas and distributed them to a broad reading public that included back to the land advocates as well as counterculturalists and computer hackers. The Whole Earth Catalog and Brand's other work connected the discourses of what Turner (2006) calls "new communalism" an ethic associated with a return to rural, communal living, and which also associated this rural simplicity with the use of particular tools introduced to readers of Brand's *Catalog*, with the practices of computer experimentation and design like those that Englebart's team undertook. Turner describes how when SRI lab members moved to the newly founded research and development laboratories of Xerox PARC in Palo Alto in 1972, the Xerox PARC library was outfitted from the Whole Earth Truck Store, and also how PARC designers drew from layout elements in the Catalog in their design of new technologies. Later, Brand interviewed PARC engineers for an article in *Rolling Stone* magazine, at the time a countercultural magazine known as much for being anti-establishment as for its eclectic music criticism. In turn, the researchers and experts within PARC became advocates for the transformational potential of computing by building small-scale technologies for communication and collectivity. This constellation of Californian influences provided an imagination of the computer as a mind-expanding machine, linked into the expansion of consciousness. The key to the computer's mind-expanding potential – especially its potential for co-evolution – was that it, like the mind itself, could be modified[10].

This iteration of 1970s computerization movements contrasts directly with visions of the computer as a tool for control and bureaucratization. It presents the computer as one element in a project of radical emancipation through the encounter between human and machine. This computerization movement presents a new set of actors – not the para-professional organizations that Kling and Iacono describe, but instead loose networks of individuals with expert understandings of computers, who were not necessarily part of the counterculture, but in some ways allied with it. These people – hackers – had the skills to transform computers into mind-expanding machines that promoted and developed community.

Hackers

Hackers appear frequently in computer histories. Sometimes identified as computer hobbyists and sometimes as experts, hackers combine a deep understanding of computer languages with a playful problem-solving approach. The hacker's quasi-mythical cultural origins are as MIT computer science students of the 1950's and 1960s who reprogrammed mainframe computers for fun (Levy, 1984). The early hacker narratives describe late-night pranks, hackers sleeping in their offices, and other tales of devotion to machines. As a cultural category, hackers – with similar qualities to the WiFi geeks I introduce in the next chapter – suggest that modification of machines might be a way of engaging in the struggles of a computerized world. Levy's (1984) description of a 'hacker ethic' evokes some of the radical, oppositional character of hacker cultural identity. He argues that a hacker ethic includes the following values, that:

> 1) Access to computers – and anything that might teach you something about the way the world works – should be unlimited and total;
> 2) All information should be free;
> 3) Mistrust Authority – Promote Decentralization;

> 4) Hackers should be judged by their hacking, not bogus criteria such as degrees, age, race, or position;
> 5) You can create art and beauty on a computer;
> 6) Computers can change your life for the better. (p. 79)

The hacker personifies a connection between resistant ideals of computer systems design and resistant or oppositional social ideas. Hackers provide a counterpoint to associations between computing and the bureaucratic military-industrial complex. Their engagement with computers is intimate and playful; they break down established conventions. Revealing system weaknesses, sharing software, promoting "freedom" and playing with technology, hackers from the 1970s to the 2000s seem to promise a kind of resistance to the status quos of computing – a cheeky call-up of the parts of computerization movements that promised consumer electronics as solutions to social ills. Hackers assume computers can change lives for the better – and they attempt to do this by of routing around authority they perceive as bogus.

Turner describes how hacking connected the California counterculture with computerization movements. In the 1970s many "old guard" hackers who had learned computing on large centralized mainframes were working on ways to decentralize these systems and make computers more accessible. In California, this led to community-based computing initiatives, including the People's Computer Company, which published a playfully-decorated newsletter and opened a storefront where people could buy computer parts, and Resource One, a project that established public computing terminals around Berkeley. Resource One hosted the Community Memory project, a peer-to-peer community network that allowed Berkeley residents to post, share, and access local information. Ken Colstad described the project in the People's Computer Company newsletter:

> Such a horizontal system would allow the public to take advantage of the huge and largely untapped reservoir of skills and resources that resides with the people . . . [it would] counteract the tendencies towards fragmentation and isolation so visible in today's society (cited in Turner, 2006 p. 115).

Resource One and the Community Memory project were developed by people who had been active in anti-war protests, and they act as a technological critiques of isolated, rationalized society and the military-industrial complex. The people who founded Resource One were computer experts who had learned how to hack at MIT. They were also, as Markoff (2007) argues, entwined into anti-war, anti-establishment counterculture. In 1970s California, hacking and computing became integrated into discourses and practices of community building. The dialectic negotiation between the computer as rationalizing tool and computer as mind-expanding democratic medium characterizes the process by which the culture of computer advocates influenced the design of computing tools, which then again became integrated into new visions of computing. In this way, the structural paradigm of the computer as an organizational tool synthesizes with the paradigm of the computer as a mind-expanding media for collective consciousness.

The connection between cognitive expansion and freedom of mind, communal living and democratic access to local information contributed to the framing of the social critiques offered by 1970s computerization movements. Yet this critical juncture, shaped as it was by the social unrest of the late 1960s, eventually passed, and personal computers instead became associated with the promise of neo-liberal capitalism. As the Apple Macintosh personal computer emerged as a heavily marketed consumer product in 1984, these symbolic elements had combined to produce a new cultural structure or context, that of personalization, which would in turn engage dialectically with a new perspective on the computer (and, increasingly, the network) as a site for community development.

The 1980's – Democracy through Personalization, Freedom through Free Software, and Community through the Network

Personalization

Computer histories including the one presented by Ceruzzi (1999), frame the launch of the Apple Macintosh personal computer in the United States as the triumph of the "computer as a personal machine." These histories suggest that personalization is the end point of computer history. In 1984, an extraordinarily expensive commercial aired during the Superbowl portrayed the Apple computer as preventing society's descent into an Orwellian dystopia. This mass-media representation of technological utopianism evoked the personal, individual transformation that was to come as a result of new computing technology. The revolution was explicitly a consumer one as the Apple was a completely closed system: unlike earlier PC's that could be modified by their owners, there was no encouragement to open up the box and add, subtract, or modify components like hobbyists had done with the first personal computers.

In this context of personalization and commodification of computers, the association between personal computing and democracy persisted. Despite his earlier interest in communalism, in the 1980s Stewart Brand advocated that personalization of computers was a key part of their liberatory potential, and one that could be revealed with the help of hackers. In 1984 he invited 150 hackers to a conference outside of San Francisco, with the goal of defining the social impact of hacking and developing a cohesive community of hackers. Turner argues that the conference represented an important moment of defining hackers (who otherwise played a variety of different social roles) as a cohesive community of cultural rebels who could liberate computing (and thus society) from the control of technocracy. However, this liberation was achieved partly through the process of personalization: Turner (2005) quotes Brand as saying that "in reorganizing the Information Age around the individual, via personal computers, the hackers may well have saved the American economy. High tech is now something that mass consumers do, rather than just have done to them" (p. 138). Therefore, by purchasing computers, mass consumers were reasserting their social influence.

Free Software

At the same time as black-boxed personal computers were being sold to a new generation of consumers, and personalization of computers was seen as a way to route around the control of centralized information systems, Richard Stallman and other former MIT hackers focused on opening up access to computer software, continuing the tradition of sharing source code that had been part of early hacking. Stallman was convinced that the MIT lab's culture of sharing was essential to developing good software, and thus promoting freedom. He founded the Free Software Foundation, dedicated to maintaining totally free and modifiable software. Stallman's libertarian political stance (which also became associated with free software in general) focused on personal freedom made possible through increased access to and control over source code. He developed an operating system called GNU (a recursive acronym for GNU's Not Unix) that was completely free – not only free of charge, but built upon freely accessible source code. Stallman designed a special software license, the General Public License (GPL) to require that the source code of any modification to his freely available GNU operating system would also be free to consult and use. Moody writes, "Stallman created in the GNU GPL a kind of written constitution for the hacker world that enshrined assumptions about how their community should function" (2004, p. 27). This license codified in words and law the idea that software distribution might be connected to social values, for example, the values of freedom and democracy collectively held by the hacker community.

As computerization movement actors, hackers like Stallman defined software as a site where openness, freedom and sharing opposed enclosure, control, and individual ownership. Moody writes, "Stallman's work is significant not only because it engendered many of the key elements and pioneered many of the processes that made the success of what came to be the combined GNU/Linux operating system possible but because it provides an ethical backdrop against which the entire free software and open source story is unfolding" (p. 29). Free software established access to source code as a corollary to access to other means of production like printing. However, free software licenses guarantee the freedom of the software code, rather than the products derived from it. Free software thus creates individual freedom for software programmers. Throughout the 1980s business models developed that capitalized on this individual freedom. Free software's first licenses laid the groundwork for new forms of software production based on the re-use of common elements of source code. Called "open source" this method of working depends on freely available source code but establishes ownership and profit models for the finished software products. What had begun as a radical claim that "information wants to be free" eventually facilitated a new business model for software development[11]. The expansion of free software and open source modes of work expanded their influence partly through distributed computer networks, developed through the 1980s not only facilitated the hacker community's distributed work on computer code, but also captured the imagination of other computerization advocates.

Networking and Community

The individual PC, even when it is interpreted as a symbol of freedom to consume, has its limits. The possibility of building networks of computers transforms individual products into nodes in communication networks. The first computer networks were developed through the 1960s and 1970s and for the most part remained experimental and connected small groups of terminals linked to a central mainframe computer, but the ARPANET – built by researchers associated with the Advanced Research Projects Agency, a United States Department of Defense-funded research project – created a network that spanned the continental United States. The network was meant to facilitate shared use of computer resources, but researchers mostly used it to communicate using electronic mail. In the early 1980s, people who had worked on the packet-switching technology of the ARPANET created commercial packet-switching services that provided the possibility for people outside of ARPA-funded institutions to also use this form of communication. Abbate (1999) writes, "The ARPANET had publicized the benefits of computer networking in the early 1970s. Later in that decade, a number of individuals and organizations began to experiment with providing these benefits to computer users who were excluded from the ARPA community and could not afford commercial network services. These grassroots networks, designed to be inexpensive, were usually run as cooperatives, with a minimum of central coordination. They were user-driven efforts" (p. 200). Some examples of these on-line services, as they were called, were newsgroups like USENET or non-ARPANET university links like CSNET and BITNET. The swift proliferation of these networks was eased along by the accessibility of small personal computers and local area networks that connected them.

As Abbate describes, one surprise in the development of the ARPANET was the role of the system's users in finding interesting and constructive applications. E-mail use grew along with computer networks: as other systems paralleled ARPANET, mail switching technologies made it possible to send e-mail to anyone with a connection to any computer network. The ability to communicate asynchronously with one of potentially millions of other people was a clear indication of the shift from computing systems to communication systems (Abbate, 1999 p.111) – or, away from the paradigm of the business organizer and towards the paradigm of the mind-expanding machine. This shift continued throughout the 1980s with the expansion and commercialization of online systems that had their roots in previous computerization movements. For example, Douglas Englebart's NLS was considered a curiosity when it was first presented in 1966, but eventually inspired the development in the mid-1980s of commercial bulletin board systems (BBS) that complemented the local and grassroots systems.

To cater to the increasing numbers of personal computer owners, commercial services like CompuServe and Prodigy charged subscribers monthly fees for access to these communication and information tools. Many of these produced what Rheingold (1993) called "virtual communities" where people "use words on screens to exchange pleasantries and argue, engage in intellectual discourse, conduct commerce, exchange knowledge . . .create a little high art and a lot of idle talk" (p. xvii).

Defining "Virtual Community"

Rheingold's main point of reference for his idea of virtual communities was the WELL, the "Whole Earth 'Lectronic Link" on-line system founded by Stewart Brand as a new home for the San Francisco counterculture. Regardless of the fact that the WELL's first participants already shared a local community and culture, the idea of "virtual communities" and "electronic frontiers" became, as Turner argues, "key frames through which Americans would seek to understand the nature of the emerging public Internet" (p. 142). The WELL's success stemmed not only from the fact that it served people who already shared a similar geographic location, but also because it provided ways for these people (many of whom had already explored new technologies and sites of exchange through the *Whole Earth Catalog* and *Co-evolution Quarterly* to create and exchange information that was worth paying for. The WELL, in essence, sold its community members to themselves, by creating an open structure to which people could add topics, posts, or responses. This model was adopted by other on-line services that developed around the same time.

On-line services like the WELL and the other community networks introduced North Americans to socializing using a keyboard, computer, and modem. In the context of what some advocates (especially Schuler 1996) perceived as a decline in "traditional community," online networks that could make access to information and communication more democratic were envisioned as pillars supporting a "new community" of deep, collective engagement and reinvigoration of local democracy. The WELL provides a strong example of how the notion of "grassroots" local engagement becomes connected with networked computer technology. These re-mediations of computer technology have drawn on the popularity of the personal computer, which had been the focus of computerization movements of the 1970s. They also established computer networks as networks of communication – and inspired the hope of creating community by expanding access to these networks.

The 1990s: Community or Commercial Networks?

In the 1990s, computers became framed as communication tools, amid rhetoric of an "information revolution" or "knowledge-based economy" that circulated visions of computers and networks as tools for democracy and liberation. In particular, this rhetoric accompanied the expansion of the internet from a primarily university-based network to a hyperlinked, multimedia platform for information, education, and commerce. The dialectic of the 1990s computerization movements contrasts the expansion of access to computer networks, especially the internet, with questions about whether this access fulfils community aims rather than becoming a commercial marketplace. Some of the literature pursuing this questioning includes Feenberg (1995), Shade (2002b; 1999), and a review by Feenberg and Barney (2004).

Feenberg and Bakardjieva (2004) identify two models for virtual or online community: the "consumption model" and the "community model." The opposition between these models describes the dialectic of 1990s computerization movements. The "consumption model" establishes the internet as a platform for consumption of goods and media, while the "community model" is anchored in hopes that the internet will support "relatively stable, long-term . . . associations" (p. 2). The "community model" draws from the experiences of people who participate in "virtual communities" like the WELL and other BBSs, as well as the developing local community networks. They argue that community building using new technologies can act as a 'democratic rationalization' that "challenges harmful consequences, undemocratic power structures, and barriers to communication rooted in technological design" (p. 16). They ask: "will the Internet become the ultimate entertainment and/or information medium, a seamless environment for business transactions of all kinds? Or will the Internet emerge as a community technology, enlarging human contact both globally and locally in accordance with the early visions and the subsequent practice of community building?" (2004 p. 24). These questions lay out the dialectic between the internet as mass medium and marketplace and the internet as platform for global and local community building.

This dialectic has motivated the development of studies in community networking. During the 1990s, concern about the impact of computer networks on community motivated theoretical and practical work following two interpretations and re-mediations of computing in the context of community: one a continued focus on virtual communities as communities of interest replacing or transcending other types of community and the other the examination of how existing forms of community occupy the digital sphere – for example, the idea of reinforcing local communities by providing them with electronic tools (Stoecker 2005). Virtual communities were perceived as providing both new sites for democratic engagement in an age of transformed mobility, and as facilitating novel types of communication and work. The following two sections analyze these re-mediations before I move on to discuss networking in local communities.

Virtual communities and the Space of Flows

The re-mediations of computer networking in the 1990s engaged with the political potential of virtual communities not necessarily fixed in geographic space or place, inspiring theorists and practitioners to find a way of situating community and civic action in this new global context. Virtual communities promised a global reach of communities, linked through the web. This inspired Etzioni (2004) to envision that community and civic life would take place not in cities and towns and civic institutions, but in the "parallel universe" of cyberspace (Benedikt 1991) "layered on top of, within and between the fabric of traditional geographical space" (Batty, 1993 cited in Graham 1998). This drew out what Wellman and Gulia (1999) perceived as a "polemical" split between a perception that cyberspace would "re-enchant" community eroded by a loss of social capital and a perception that online community would destroy real community. The polemic was further embedded in a context of increasing globalization that was also facilitated by the expansion of the internet and networked technologies. Geographers like Harvey (1996) laid aside absolute definitions of the concepts of space and time, describing instead how "multiple processes flow together to construct a single, consistent, coherent, though multi-faceted time-space system" (p. 260-261). This purported shift in the way that community and society are organized inspired Wellman's (2001) argument that networked communication and globalization mark the age of a "networked individualism" where social engagement becomes shallower, less grounded in place, and anchored in the individual. Proponents and theorists envisioned the network model as inspiring the development of different social imaginaries.

Castells (2001) assembles empirical evidence for the existence of a network society characterized by two kinds of social spaces: the space of flows that operates within the network, and the space of places. The space of flows is made up of small personal networks that feed into wider networks. However, even though the logic of flows and capital operate at a global level, people still live in places. Castells is unclear about whether or not valuable political engagement can take place within the space of places: he argues that power is located in the space of flows, so resistance should also be located there. He responds by proposing the concept of "networked resistance", which moves democratic engagement from a local to a global activity situated in the space of flows. This conceptualization of networked resistance is supported by empirical research on social movements and their use of information technology (for a review see Surman and Reilly 2003). It presents a clear example of how computer networks are re-mediated as potential sites of distributed, participatory democracy that extends farther than the democratization of personal computers by virtue of their commercial promotion.

Distributed Communication and Hacking

Free software hackers and open source developers also became better organized and active during the 1990s. In 1991, Linus Torvalds, a Finnish student, created the first version of a free software kernel, the core of a computer operating system. He announced this development to a newsgroup, calling it a project "for hackers, by a hacker" (cited in Moody, 2004 p. 46). Colleagues worldwide began contributing to the software, which combined with Stallman's GNU became a complete operating system, freely available. By the height of the dotcom boom in 1997 this operating system was competing with major software projects, with thousands of people contributing to its development. Hacking and free software still acted as a critique of centralization, control, and private ownership, but through the 1990s hackers and geeks benefited from the huge investment in new technology and internet companies, making large amounts of money from initial public offerings of software, as well as gaining cultural credibility (Hafner and Lyon 1998).

In 1990's academic literature, hackers were described as the probable inhabitants of the new social space envisioned as taking shape on the internet. In response to the dotcom boom's hyperbolic commercialization of the internet, theorists looked for evidence of non-commercialized, community activity on the network. Because hackers interfered with and reconfigured the network, hacking became imagined as a radical practice that demonstrated the potential of virtual community. Alternative media advocate Hakim Bey (1991), described hacking as creating "temporary autonomous zones" of radical unregulated action around the edges of the network while the Critical Art Ensemble's (1994) direct-action art projects used hacking as "electronic civil disobedience" against sources of institutional command and control that could no longer be centrally located and targeted. Hackers, whether benign or disruptive, demonstrated that networked politics could include anarchy and resistance. Mosco (2004) describes how the hacker 'trickster' enlivens the positive potential of computer networking: "the hacker makes trouble for everyone, but this modern-day trickster has a powerful purpose: the realization of a mythic utopia locked up by our stagnating tendencies to freeze revolutionary technologies in the ice of outdated social patterns" (p. 48). Because hacking modifies the structures that underpin online space, it seems to propose the network as a space that can be modified and re-envisioned, much like the space of community. This remediation of networks as sites of struggle also reinforced visions of new virtual communities evolving on computer networks.

Politics, Publics, and the Network

Throughout the 1990s community networking projects developed and distributed networking tools to local communities. Some of these specifically engaged with the possibilities for creating a local space on a network. For example, the Amsterdam Digital City (DDS), active from 1994 to 1997 (Rustema 2001), tried to reproduce a city online as a way of developing interest in local city council elections. Scholars considered the DDS innovative because it allowed free access to its citizens to do anything they would do in a 'real' city: including meeting in bars and visiting the red light district. Similarly, Schuler (1996) describes how many community networks use navigation elements drawn from the geography of American small towns featuring the town square, post office, health centre, and school (Chapter 2, n.p.) Thousands of other cities and communities also created online systems during the 1990s, sometimes giving them explicitly geographical or 'local' names like the Blacksburg Electronic Village (BEV) in Blacksburg, VA.

These community networks, or Free-Nets, usually provided some combination of local information, e-mail service, web hosting, and later internet service provision. They proliferated in the United States and Canada: Moll and Shade (2001) estimated that there were 35 networks in Canada in 1995-1996, with between 250,000 and 600,000 members. Many were founded or supported by people within universities, who had earlier access to computing and networking equipment. The BEV was founded as a partnership between Bell Atlantic, Virginia Technical University, and the town of Blacksburg, to act as a testing ground for online learning services. Ottawa's National Capital FreeNet (NCF) was founded by people associated with Carleton University, but run by volunteers as "a free, computer-based information-sharing network, linking the people and organizations of the region, providing useful information, and enabling an open exchange of ideas with the world" (Patrick 1997). Free-Nets provided an alternative vision of how computing should support community. Rather than situating community in the space of flows, their design and content augmented the local spaces of places. The BEV's success, for example, was framed in terms of how it created a local market for information services (Cohill and Kavanaugh 1997).

Many Free-Nets were founded before the widespread diffusion of Web-based graphical interfaces, and provided text-based information services organized into menus, similar to the Gopher menu-based search interface. These online services were accessible via modem or public access terminal. Patrick described the NCF, for example, as providing "two types of services: access to an electronic network and content provided by the community and its members" (1997, p. 77), and found that most people using NCF in 1995 responded that they were only "slightly" or "not at all" motivated to contribute to their local community. Even though local information and communication with shared interest groups was rated as the third-most important service, this local communication channel disappeared from the FreeNet as graphically-based Web access became available. As Chapter One indicates, community networks emerged out of many different contexts in North America, and have had a lasting impact on how community and technology are connected.

As of 2005, the NCF had become a broadband service provider, using revenues from high-speed subscriptions to subsidize dial-up Internet access. The NCF is in many ways an exception: although some Free-Nets have become internet service providers, many have disappeared entirely, leaving a vacuum where local, community-based communication and information services had been provided. Through the FreeNets and community networks of the 1990s, internet access became available to a wider group of people. FreeNets also created a means to access local information and a venue for local discussions. While internet services provided some of the same kinds of applications, the local variation in how community networks were designed created more possibilities for democratic rationalization. As Feenberg and Bakardjieva write, "the various conditions of community we have identified can be found fulfilled in many of these experiments" (p. 23). However, one enduring impact of the FreeNets was the creation of networks of researchers and advocates who continued to advocate for universal access to communication technologies especially the internet, within their own communities (Clement, Moll, and Shade 1998; Clement and Shade 2000; Gurstein 2003). These relationships between researchers, advocates, and developers of community networks have established working relationships and perspectives on public interest communication that continue to develop. As Chapter Six explores, the development of community WiFi has contributed to similar networks of activists, advocates and researchers.

As the global internet expanded through the 1990s, advocates focused less on the local impact of networking projects, possibly because of the unprecedented expansion of the internet and its commercial applications. Throughout the 1990s, the potential for networking to permit community development and democratic engagement in the "space of flows" encouraged re-mediations of computer technology that concentrated on the promise of online community. While this more distributed and network-supported vision of community has become highly commodified (Moll and Shade, 2004), I argue that it also establishes the conditions for 2000s computerization movements, which concentrate on re-establishing the importance of local community and real-life democratic engagement.

The 2000s: Mobility, Flexibility, and Computer-mediated Everyday Life

The 1990s re-mediations of computers and networks foregrounded the idea of democratic and community engagement online, in a sphere separate from that of the local community. They also included the transformation of free software's critique of capitalism into the flexible labour and distributed production of open-source software development (Weber 2004). The increasingly global network was envisioned as providing an alternative to local spaces where some theorists felt democratic engagement was declining (Putnam 2000). As Web services began to replace the local online services of community networks, "virtual communities" joined geographic communities as sites for social and political engagement. For example, Bakardjieva and Smith (2001) found that participation in so-called "virtual communities" as a form of everyday collective practice permitted "immobile socialization" within the private sphere, establishing online communications sites for collective deliberation and action. This example of "being and acting together," along with the examples of networked politics, established global, mediated networking as a key context for personal computing going into the 2000s.

The assumption in the 2000s, in Western countries at least, is that computer networking should be pervasive, powerful, and extensive. Forlano (2008) argues that this assumption of "anytime, anywhere" networking and connectivity "has been predominantly linked to the convenience, freedom and ubiquity of mobile and wireless technologies. Therefore, such language plays an important role in framing debates about these technologies by emphasizing mobility, globalization and the totalizing of physical space rather than the importance of local, bounded communities" (n.p.). Ubiquity and pervasiveness are envisioned as the most valuable qualities of networking. This shifts the perceived link between community and technology. What was once called "online community" is now referred to as "social networking," (see boyd and Ellison 2007 for a summary) and communication tools like e-mail and social networking are now the internet's "killer applications" (Middleton, 2003). Daily life for people in the West (and increasingly elsewhere) involves regular use of mediating technologies. Visions of democracy, community and ubiquity of access become ever more important as more of daily life can be mediated by technology, but these visions are also concerned with community ownership of communication technology, suggesting a renewed importance of more material concerns.

The Return of the Local, the Development of the Public

As Chapter One also discusses, the increased use of computers as communication and media platforms has had political impact. The "network society" no longer presents a flow of space and time apart from the spaces of everyday life, and consequently, the private rhythms of everyday life combine with the public exercise of democracy. This commingling of public and private demands different metaphors to describe it than the "online public sphere" (Calhoun 1998) or "networked democratic space" (Castells 1996) of 1990s computerization movements. This more nimble, mobile, and increasingly mediated experience of life creates new sites for democratic imaginations of computing, and new theorizations, such as Scheller's (2004) notion of public and private commingling.

Scheller argues that "taken-for-granted geographical understandings of public spheres as spaces and networks continue to limit the ways in which we might imagine the dynamics of public formation" (p. 39). She further argues that private and public spheres are increasingly commingled by mobile technologies. Instead of a public space or a networked public, she proposes a viscous gel in which mobile communications technologies help people move in and out of contact with one another creating "flexible constellations of identities-on-the-move" (p. 49). Scheller's gel is not a consistent medium. Publics form in some places, for some periods of time, using some network resources, only to dissolve later. While Scheller's conceptualization explicitly theorizes mobility, her concept of the momentary "gelling" of publics helps to explain one of the key ways that 2000s computerization movements re-mediate technology. Concerns similar to those of previous generations of computerization remain, such as an interest in extending knowledge about and access to computers and information networks to a broad and diverse citizenry, and inspiring participation in democracy. Mobility and fluidity have shifted social as well as technical paradigms.

Community wireless networks (CWNs) play a part in changing expectations about how communication systems should be designed, and also change the way that publics are mobilized around and through these systems. CWNs mobilize local technical experts to apply their interest and expertise to developing non-commercial local broadband systems. As I explore in Chapter Three, this can inspire the gelling of a WiFi public engaged with the idea of developing community communications infrastructure. As software hacking becomes more common and more young programmers learn open-source software, community WiFi networks offer a way of building skills and contributing to "WiFi publics." These temporary publics re-envision and reconstruct connections between computer networks and local democracy by developing systems that are locally scaled, using organizational structures drawn from open-source software development.

The Expansion of Open-source Production

Like other computer hobbyists, WiFi geeks experiment with hardware and software that is simple and interoperable: all WiFi antennas and receivers use the data protocols and are built to a common standard. More importantly from the perspective of computerization movements, hackers experimenting with early WiFi modems discovered that the small processors inside them were running the Linux operating system developed by Linus Torvalds and the standard open-source operating systems. The accessibility of the operating system's source code made it possible (and challenging) to modify the modems. One of the important elements of the 2000s computerization movement context is the expansion and application of open source practices, not just within the computer hacking community but also within other areas of life. A generation of computer geeks learned programming by downloading and experimenting with free software, and through CWN projects, geeks frame hacking as a form of citizen engagement. In addition to using technical hacking to create WiFi communities, CWN geeks also contribute to extending the discourse and practice of hacking beyond the technical community. Chapters Three, Four and Six explore this in more detail.

Mobility and Flexibility

Community WiFi organizations have re-mediated WiFi, transforming it from an unstable new gadget to an infrastructure for connectivity. More generalized social shifts have accompanied this re-mediation: for example, Forlano (2008) notes that community-based WiFi has contributed to the development of a mobile public of freelance workers who use WiFi cafes in New York City as office spaces. NYCWireless, the local CWN, introduced free WiFi into some cafes and public spaces in New York City, which resonated with the increasingly flexible work practices of many freelancers and professionals, many of who no longer work in conventional office spaces. As Forlano notes, WiFi hotspots develop their own communities and cultures that have as much to do with the other advantages of the location as with the availability of internet connectivity.

The disconnect between the media presentation of WiFi as a technology for ubiquity, and the situated local practices Forlano observes, suggests that one of the sites for CWN re-mediations of computer networking may be questions of local and global scale. CWN groups are resolutely local, attracting people with similar technical interests to face-to-face meetings. Yet they are also global and virtual, with practitioners around the world exchanging information online and at national and international meetings, with the goal of providing better WiFi connectivity to their local areas. The re-mediation of WiFi as a technology for local development rather than global connectivity fits into a broader context in which local information services like the ones that FreeNets provided were replaced with connections to the global Internet. At the current critical juncture, when conventional media is undergoing a crisis in ownership and credibility, the possibility of community-based media to develop through community-based WiFi projects is a key aspect of its politicization.

The expansion of open-source software development also contributes to this re-mediation, as greater numbers of geeks learn about software development, and participate in community WiFi projects. This aspect of the community WiFi movement is examined in the next chapter. Together, these elements impact the current visions of how computerization can be invoked in progressive social change. The contemporary context, where the promise of ubiquitous connectivity is held out as an ideal and where hacking is again positioned as contributing to the public good, sets out opportunities to envision the progressive contributions of computing for local communities, but also creates opportunities to politicize community WiFi as part of broader goals for media reform.

Conclusion

From the 1970s to the 2000s, computerization movements have dialectically engaged with dominant imaginations of computing, putting forth alternatives to military-industrial computing and mass media at some critical junctures, but also legitimating the social role of computers and ICTs. Computerization movements can be thought of as similar to new social movements, because they frame computing in terms of its potential to transform democratic social life. On the other hand, forming a social movement primarily to advocate for advances in technology inspires a technocentrism that can reinforce technocratic control. The history of the visions and realities of computerization movements from the past forty years highlights what Lievrouw calls the "re-mediations" that computerization movements experience in different social contexts. The rest of the thesis focuses on the role of community WiFi networks in the current context of mobility, ubiquitous connectivity, and mutable publics.

CWNs are a contemporary form of computerization movement: they draw on elements of the computerization context that surrounds them, and re-mediate these elements by envisioning new forms and uses for WiFi networking technologies. The realities that develop from these visions include local community WiFi networks and the promise of engagement of CWN actors – as communities and "gelling" publics – in democratic life. At the same time, like other computerization movements CWN projects play a role in institutionalizing computing technology. Experiments with WiFi establish technical standards and social frameworks that help the technology become established and accepted. Furthermore, CWN plays another kind of institutionalizing role, by changing expectations about how communication systems should be established, and by whom. This institutionalizing role may, at best, underline the importance of public or citizen involvement in telecommunications.

CWN critiques existing ICTs and media technologies by establishing alternatives to them. At the same time, these alternatives contribute to the development of new institutions. Hackers and geeks are involved in developing community WiFi, but so are bureaucrats, policy-makers, equipment manufacturers, and marketing agents – not to mention laptop computers, WiFi routers, and antennas. The history of the CWN movement establishes how these actors situate the connection between community and computer networks at a critical juncture in media and communications development and policy making, and how this contributes to the dialectic inherent in computerization movements between critique and institutionalization. The next chapter explores this dialectic, and the creation of WiFi communities and publics, in the case of Montreal's Île Sans Fil.

Chapter Three: Île Sans Fil and WiFi Publics

Introduction

On a steamy evening in August 2004, I walked up some rickety stairs into an organic vegetarian co-op bar to meet the members of Île Sans Fil (ISF). Over pitchers of beer, they told me about their volunteer technology project: they were setting up free wireless connections to the internet in parks and cafés, funded by a small arts grant in partnership with an arts organization. The young men and women I met that night talked about covering the city with WiFi to create an alternative communications infrastructure that anyone could use to access the internet; one that would also provide a platform for new media art projects. They felt that this infrastructure could connect local community organizations to one another, allowing them to exchange information without having to pay for expensive, commercialized internet services. With intelligence and passion, they described how the technical flexibility of WiFi would make it possible to create such a community-based infrastructure. They debated ways to organize themselves to solve the technical and political challenges of this project as a "community" rather than a large hierarchical organization. They showed me the Linksys WiFi routers that they "flashed" with open-source software, transforming the routers into nodes on the ISF network that would display a special "portal page" unique to that router – and thus to that hotspot.

I was at the bar that night because Michael Lenczner, at the time an undergraduate student and one of the founding members of ISF, had wanted to recruit an "academic researcher" to provide more credibility to his community wireless networking project.

After doing community work building technological infrastructures in West Africa through the federal government's Netcorps program, he had decided to create a community technology group to develop social software applications. At the same time, he wanted to have better access to the internet in public places, so he partnered with David Vincelli, an engineering student, to create a community organization that could deploy WiFi while also developing social software applications that could bring people together in local places. He was charming, well-spoken, confident but self-effacing. Convinced that technology "had values," he was determined to put these values (community empowerment, social engagement) into his WiFi design. He wanted to motivate people to participate in their community by building technology that would itself encourage participation. He could not have imagined that a few years later, ISF's network would be the largest in the city, and considered to be one of the most successful community WiFi networks in the world. The transformation of ISF provides an example of how the community WiFi phenomenon acts like a new social movement by establishing a locally relevant WiFi project for Montreal.

Between 2004 and 2007, ISF created a network of over 150 WiFi hotspots; with backhaul bandwidth donated by local businesses or community organizations that provided free WiFi to people using laptops in publicly-accessible areas. Without hiring any paid staff, the ISF volunteers developed software that assisted in maintaining this network, as well as forging partnerships with arts and cultural organizations to use each of the hotspots as a potential site for the distribution of community media and civic information using the "portal" page that all WiFi users saw when logging in. Representatives of ISF were invited to discuss their approach at international meetings of community networking practitioners in the United States and overseas[12]. They also spoke to representatives of municipalities interested in wireless networking in Florence, Italy and Toronto. Media coverage of ISF focused on the usefulness of the free WiFi project in a city without much public WiFi connectivity, as well as the unique "community" aspect of the project. An article in the Globe and Mail, for example, described ISF as a "Montreal WiFi collective" (Patriquin 2004). In late 2007 the Economic Development Commission of greater Montreal (la Commission de l'agglomeration de Montréal sur le développement économique) proposed a partnership with ISF to fund the expansion of the network to 400 hotspots including 150 on city property, but requiring the constitution of a more formal organization, including a full-time, paid manager. As of July 2008 the partnership was awaiting approval. The activities of ISF over the three years, as well as the partnerships it formed – especially with arts organizations – illuminate the process of first contextualizing and institutionalizing community WiFi.

When I walked into the bar in 2004, theorists and proponents of WiFi networking had been describing it as a disruptive technology associated with decentralized, small-scale local projects: neighbourhoods, community organizations, and municipal governments (Bar and Galpernin 2004b, 2005, 2004a). This interpretation of WiFi focused on its flexibility and interoperability. The first assessments of these projects (Auray, Charbit, and Fernandez 2003) focused primarily on the technological choices that characterized community WiFi projects, and argued that WiFi was a particularly appropriate technology for small-scale, local networking, but that these networks would not necessarily provide substantial challenges to larger policy or organizational structures. More recent work has begun to examine the connections between social and technical choices (Powell and Shade, 2006), and the impact of community WiFi on innovation and social capital building (Cho, 2006).

In the intervening years, WiFi and other wireless technologies have sometimes been described as infrastructure for a more democratic digital media landscape (Meinrath 2005), but are more often represented as means of providing internet connectivity cheaply to broad areas (Lehr, Sirbu, and Gillett 2006). Through 2006 and 2007 over five hundred municipal WiFi projects launched in North America (Tapia and Oritz, 2006), many of them defining WiFi as essential local communications infrastructure (Daggett 2006; Middleton, Longford, and Clement 2006; Clement and Potter 2007). These broad projects would seem to contradict the grassroots, "do-it-yourself" ethos of community groups like ISF. The transformation of Île Sans Fil from a grassroots project spearheaded by a loose volunteer community to a municipal "public WiFi" project highlights how WiFi projects reestablish the local community as a site for political and social action, but also how they contribute to establishing institutions around new communication technologies.

ISF's evolution between 2004 and 2007 provides a fascinating example of the development of a computerization movement creating innovation from the ground up. This chapter describes how ISF's volunteer members built the network of hotspots, developed a popular open-source software package, and partnered with arts and cultural organizations. I argue that ISF inspires the development of different social categories: both "WiFi geeks" who share a common interest in hacking and reformulating WiFi technology, but also local residents. The category of "public" describes how these groups establish shared discourses and practices that can inspire what Feenberg and Bakardjieva (2004) refer to as "democratic rationalizations . . . user interventions that challenge harmful consequences, undemocratic power structures, and barriers to communication rooted in technology" (p. 186). The political nature of democratic rationalizations suggests that local WiFi projects produce not just "WiFi communities" but "WiFi publics" as well. I argue that these WiFi publics establish shared commitments to social and political ideas through speech, writing, and technology development. Many different publics might be created, but two are discussed here: a geek-public created through discussing and creating WiFi technology, and a community-public constituted through shared participation in a local community that is perceived as being augmented by WiFi connectivity.

Geeks, Communities, and Publics

This chapter introduces the ISF project as a means to assess this slippage, concentrating on three elements: first, the way that many of the people who were centrally involved in ISF defined themselves with relationship to the category of "geek", where an idealized "geek" is a technically skilled person who mobilizes their skills in order to participate in the community; second, the contribution of activities – software production, network building and maintenance, and artistic collaborations – to the creation of geek-publics and community-publics; third, the tensions that emerge between these two publics, both within ISF and for the broader public using the network. I also consider how WiFi technology provides the potential for a public to develop *recursively*: to create its own means of engagement. The chapter's examination of the consequences of Île Sans Fil's project for its volunteers using the concepts of communities and publics clarifies the dialectic of computerization movements: volunteers become technical experts at the same time as their project disrupts existing forms of computerization and media in Montreal.

The chapter is divided into four sections. In the first section I introduce the ISF project and its geek volunteers, describing how ISF fosters their expertise, and also how they perceive their work with WiFi as contributing to the broader Montreal community. The second section outlines ISF's main activities and then introduces "geek-publics" and "community-publics" as specific social forms leveraged through these activities. The third section addresses some of the limitations of "geek-public" enthusiasm about mobilizing "community-publics." Fourth, I consider the use of ISF's WiFi networks, examining the extent to which the imagined "community-public" communicates using the media platform developed at WiFi hotspots. In the concluding section I reflect on how the tensions between the geek-public and the community-public reproduce the dialectic inherent in computerization movements, as well as how various forms of institutionalization, especially the forthcoming partnership with the city of Montreal, reinforce the less disruptive, more conventional aspects of ISF's organization and technical innovation.

Methods

This chapter draws from a long-term participant observation conducted between 2004 and 2007. As part of this research I participated in regular volunteer meetings, attended board meetings, supervised a student intern, and contributed to the group mailing list. Throughout the observation period, I identified both as an Île Sans Fil member and as a researcher. The participatory nature of this portion of the fieldwork necessarily drew from my own subjective experience of participation, and thus reflects all the benefits and shortcomings of such a necessary subjectivity.

In addition to these observations, I conduced two sets of in-depth, semi-structured interviews with ten core members of Île Sans Fil, one in 2004 and one in 2007. To gain a broader Canadian context, I conducted structured, hour-long interviews with leaders of four Canadian Community WiFi networks in June 2006. I also conducted two surveys of the users of the ISF network in 2004 and in 2006.[13] The 2004 survey was conducted by hand-distributing printed questionnaires to hotspots. It received 56 responses, primarily from ISF members themselves. The 2006 survey was conducted online, advertised on and linked to the "portal page," the opening page visible on every device accessing the ISF network. It ran from January to April 2006 and received 370 responses, providing a better general description of the wider community that uses ISF hotspots. To explore more subjective aspects of the use of the ISF service I conducted 15 minute structured interviews with users of the ISF system: eight in 2005 and, as part of a larger research project, twelve in 2007[14] when I also interviewed three members of community organizations and research groups who collaborated with Île Sans Fil, including some of the architects of the municipal partnership. When possible, I recorded interviews and transcribed them. Otherwise I made notes and immediately transcribed them afterwards. Many of the interviews were conducted in French. My translations appear in the text and the original speech as I transcribed it appears in the endnotes.

ISF volunteers: "A Somewhat Geeky Group"

This section describes the volunteers at ISF, and their relationship to the idea of being "geeks." Volunteers at ISF are students, professionals, or retired. They come from different cultural backgrounds, and most speak both French and English fluently. Since 2003, over 100 people have participated in ISF, some for months, others for years. ISF volunteers expressed interest in three overlapping themes: engagement with emerging technology – especially developing software for WiFi routers, leverage of new technology for community development, and the investigation of the potential of WiFi to explore the nature of local places through location-based art and media. Three of the volunteers I met in 2004 – Benoit Gregoire, Michelle Kasprzak, and Daniel Lemay, became, along with Michael Lenczner, important players in negotiating these diverse interests.

Benoit Gregoire, a software engineer who ran his own company, joined ISF because he wanted to work with his laptop somewhere more interesting than at home. Gregoire developed the WiFiDog software that managed the ISF network and permitted it to be used as a community media. He was one of the first 'techy' ISF volunteers to work with artists as part of a collaboration with a Canadian Heritage funded arts project called the Mobile Digital Commons Network (MDCN) which remained one of ISF's main collaborator until 2006.[15] He maintains that this was the most fulfilling part of his involvement with ISF. When I first met Benoit I was struck by the unrelenting logic and sense of justice with which he approached any problem, whether it be technical or social. Benoit was the "technical" or "Research and Development" director of ISF from 2004 to 2006. He developed WiFiDog, the captive portal system that allowed each ISF WiFi hotspot to distribute its own media content to people in the immediate local area. Three years after its deployment, the software is widely used by community and commercial WiFi companies globally. Its main features are that it allows for location-based information to be delivered to WiFi users, and it facilitates the management of WiFi networks.

In early 2005, Daniel Lemay was in the midst of a career change; taking a break after managing the IT program for a labour union, he opened an open-source software consultancy, dedicated to bringing the low cost and flexibility of open-source to community organizations in Montreal. By late 2007, he had taken a position as a director of information technology for the city of Montreal. Calm, diplomatic, and truly dedicated to introducing technology to the community sector (he single-handedly installed almost all of ISF's hotspots in 2004 and 2005) he saw ISF as a bridge between the open-source software development community and the established community sector in Montreal that consisted of community-based organizations and non-profits.

When I met Michelle Kasprzak in 2004, she was beginning a Master's degree at the Université du Québec à Montréal after having worked as a curator and coordinator of new media art projects at the Habitat New Media Lab in Toronto. She joined ISF because she was interested in exploring the potential for the local coverage of WiFi hotspots to be used as community media or art project platforms. Outspoken, opinionated and persuasive, she was instrumental in securing almost all of ISF's funding by convincing other arts organizations to partner with the group, and writing ISF into arts grants. In 2006, Michelle became Programmes Director for New Media Scotland and relocated to Edinburgh. She curated her last ISF-related project in 2007.

These three volunteers – not to mention Lenczner – described their interest in WiFi as stemming from its integration of technical innovation, community service, and interventions in art and cultures. Yet they and many other ISF volunteers typically described their involvement in ISF with reference to the term "geek", with the exception of Michelle Kasprzak, who described herself almost apologetically as "lacking any geeky skills" (Interview Feb. 12, 2005). Although she was reluctant to call herself a "geek" Michelle used software development in her own art practice and her collaboration and consultation with multimedia artists. Another volunteer described ISF as "primarily a social club for geeks . . . a club of passionate workers" (Interview with Laurent Maisonnave, December 8, 2007) [16]. Most ISF members I interviewed said that one of their main reasons to participate in ISF was to contribute to their community. Many meetings finished with members introducing themselves and chatting, saying things like "we are really a nice bunch of people – we are the good guys[17]" (Field Notes, March 21, 2006). The volunteer I interviewed above said that groups like ISF were important because "they provide access to something that's important, like water, electricity [smiles] . . . well it's not more important, but it lets you get informed[18]" (Interview with Laurent Maisonnave, December 8, 2007).

Creating Social Capital and Expertise

For many ISF volunteers, meeting every two weeks and discussing WiFi technology and its social impact created ISF's most significant outcome. One ISF group member wrote on the group's mailing list, "I'm very happy at how Wireless internet has taken me away from my indoor computer to the outside world. Today I meet many people, discuss how this technology can help communities, develop new potentials for people" (Robert Crecco, posting to ISF-vol list, 24 November 2004). For this volunteer, "wireless internet" itself impacted his life, by introducing him to new people. For him and others, being close to wireless internet, and understanding its complexities at a time when few others could make sense of its technological "kludges" (Mackenzie 2003) made WiFi geeks into experts. A "kludge" is a system whose component parts do not necessarily fit together perfectly but that is made to work anyway. As their network expanded across Montreal, ISF members became viewed as experts within their field. Many of the volunteers I spoke to worked in the IT industry, and felt that they developed indispensable skills through their work with ISF that was not available in their paid work.

ISF has created a place to "play" with technology, and through that play, to gain social status and power, creating a gathering place where members could share thoughts and information and build their expertise. Writing about engineering studies, Downey and Lucena note that "engineers routinely feel powerless themselves but are viewed as highly empowered by outsiders" (1995 p. 187). At ISF, engineers as well as technicians and hobbyists occupy the same social space where the hierarchies of the business world are laid aside for the pleasure of sharing a common interest. Outside of institutions of work, the pleasure of working with technology reinforces the status of ISF members as "experts" even if they do not hold expert positions professionally.

This process of legitimization of WiFi and WiFi experts through experiment and experience can be compared to the process of legitimizing "electricians" (Marvin, 1988) or "ham radio operators" (Haring, 2007). Social capital building helps to explain one aspect of participation in ISF, since participants benefit from getting to know people with similar interests, as well as building their technical skills. However, the WiFi geeks in Montreal are proud of the fact that they are "do-ers, not talkers." The next section describes what the "do-ers" were doing to establish an interest in community WiFi in Montreal.

ISF's Activities

Building a Network

As I described in the last chapter, the perception that existing forms of computer-mediated communication could close down or limit access to communication has motivated not only hackers and geeks, but also artists interested in locative media[19], and social justice advocates committed to expanding access to communications. As a cultural practice, WiFi hacking envisions a potential space of non-commercial control, grassroots restructuring, and citizen participation in communications. As Mackenzie (2005) writes,

> The constant appearance of new gadgets, devices, and practices that modify, alter, or hybridize WiFi suggests that hopes for other forms of sociality and openness associated with communication technology still persist. That hopefulness is conditioned by the recent history of new media, particularly by a consciousness of the almost total commercial ownership and control of Internet and communications infrastructure. (207)

The geeks at Île Sans Fil acted on this hopefulness. Their 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, Île Sans Fil uses it's [sic] free public access points to promote interaction between users, show new media art, and provide geographically- and community-relevant information" (Ile Sans Fil 2007). In pursuit of this vision, ISF's network of over 150 WiFi hotspots provides WiFi in locations that are open to the public (though not, strictly speaking, public) including parks, cafés, bars, restaurants, artist and community centres, and the public areas of some hospitals and academic institutions. The idea of using WiFi as an electronic "third space" away from work and home (Oldenburg 1989) has been central to ISF's vision.

Many volunteers I interviewed said that one goal of ISF should be to "get people out of their basements" (Field Notes, 2004; 2005; 2006) – in other words, it should establish WiFi connectivity as a way of encouraging geeks – and other people who might be working alone – to gather in public space. Some social research argues that the decline of third spaces in North America is linked to a wider decline in democratic participation

(Putnam 2000) and from this perspective ISF's rethinking of WiFi is a political intervention. Creating WiFi hotspots accomplished this intervention in two ways: it provided WiFi geeks with a reason to meet one another, as well as the opportunity to collaborate with artists, academics, and community workers who were interested in the social and cultural alternatives of a community WiFi network. In addition, the hotspot network suggests an alternative to commercial systems, and a way to more fully explore the potential of WiFi as an emerging technology.

ISF members created a non-profit business model for WiFi hotspots, offering businesses and community organizations a WiFi system at wholesale cost, plus a fifty-dollar annual donation. In exchange, the organizations signed a "social contract" guaranteeing that they would not charge end users for the WiFi connection. Since Montreal had not been well served by commercial WiFi providers, this offer was compelling for many independent cafes, bars, and community organizations who wanted to offer WiFi to their visitors, or who wished to cut costs by sharing internet connections wirelessly. Over time, the sponsors of ISF hotspots came to include not only bars, restaurants and community organizations, but also two downtown Business Improvement Areas, one on the portion of the St-Laurent Boulevard between Sherbrooke St. and Mont-Royal Avenue, lined with restaurants and trendy cafes and popular with tourists and hip young Montrealers, and the other in the Village, a predominantly gay inner-city area with a thriving commercial strip lined with cafés and restaurants. Both of these organizations considered that WiFi coverage was a relatively inexpensive way of providing a competitive advantage to their business members. The importance of these partnerships is visible through the expansion of the number and distribution of the group's hotspots.

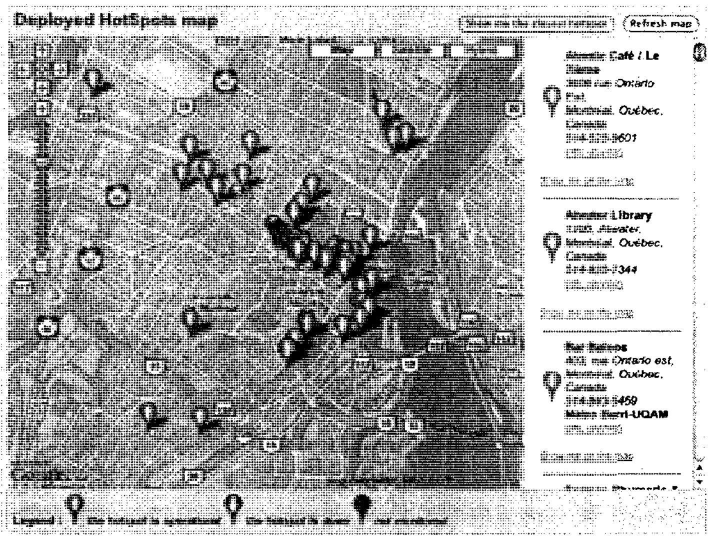


Figure 6: ISF Deployed Hotspots October 2006

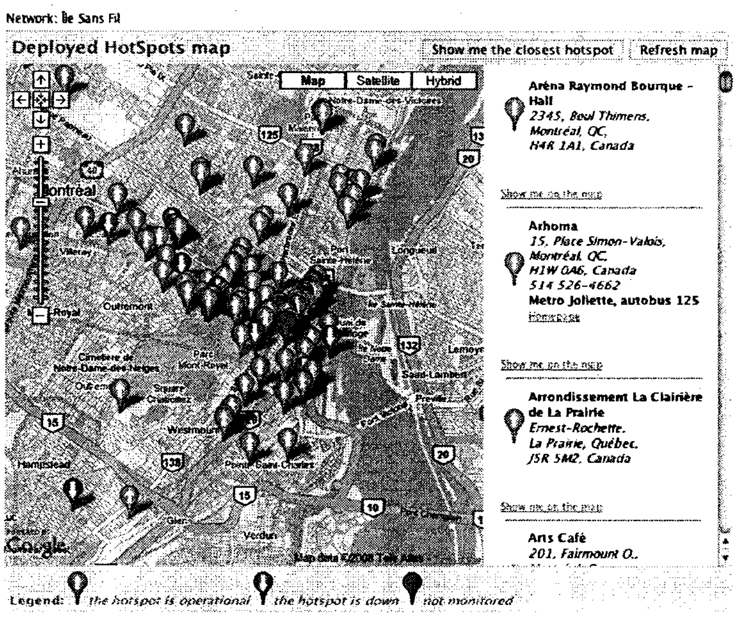


Figure 7: ISF Deployed Hotspots May 2008

However, although these large projects provided technical challenges for ISF's geeks, the original vision for the network proposed designing hotspots to act as local media hubs.

Software Development

This broader vision shaped ISF's software project. "WiFiDog" is open-source software that transforms off-the-shelf WiFi modems into nodes in the group's network that display a unique opening page ("the portal page"). Members of ISF instigated this project in 2003. The software is meant to provide a unique media environment for each of the group's hotspots. Each modem equipped with this software connects users to a central server where their access is authenticated, and displays a portal page containing specific content related to the location. WiFiDog's first version, completed in 2004, displayed a unique opening page at each hotspot that included the name of the hotspot and a list of users who were online. Over the following years, ISF members modified the page by adding additional news feeds, changing the visual layout, and attempting to develop a social software application.

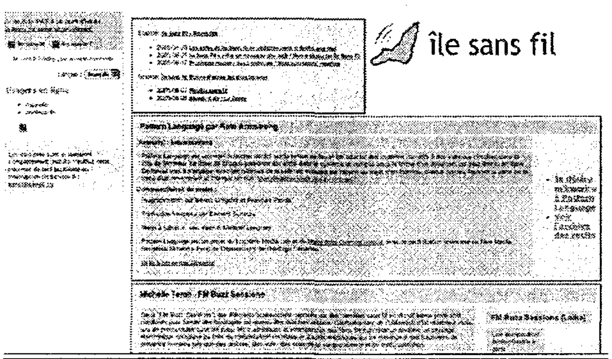


Figure 8: ISF Portal Page May 2005, including Pattern Language Art Project

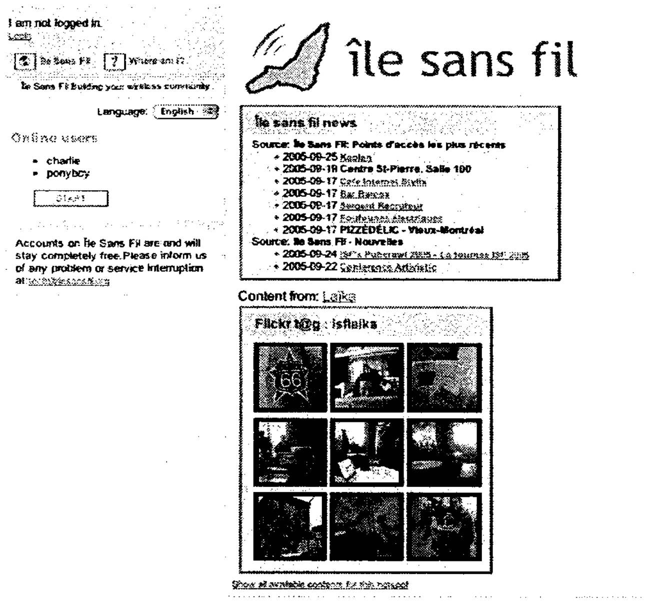


Figure 9: Île Sans Fil Portal Page October 2007 including Flickr photo aggregator

In 2006, a new portal page launched, including not only the names of users online, but optional links to profiles showing their website, name, or other information. The portal pages also acted as a platform for a series of interventions: first, a series of curated location-specific art projects, then a distribution of emerging Canadian artists funded by Heritage Canada's Terminus1525 program[20], and finally an aggregation of political information in the weeks leading up to the 2007 Quebec provincial election. The WiFiDog portal page also hosted a "local radio" multimedia distribution project at five ISF hotspots[21]. These projects, which I discuss in more detail below, were viewed as explicit interventions that established WiFi hotspots as unique social and cultural spaces, but also as applications that expanded the functionality of WiFiDog, providing its programmers with greater technical challenges.

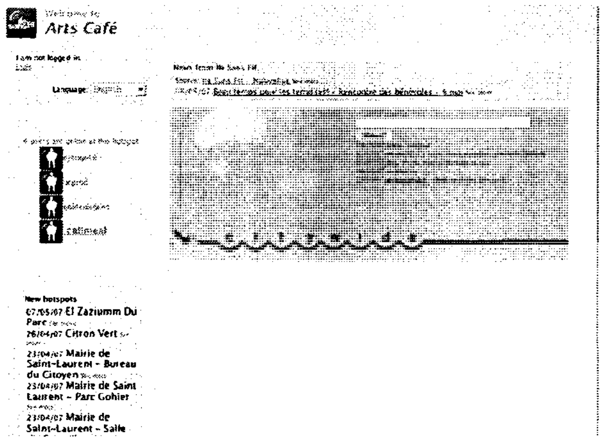


Figure 10: Île Sans Fil Portal Page May 2007

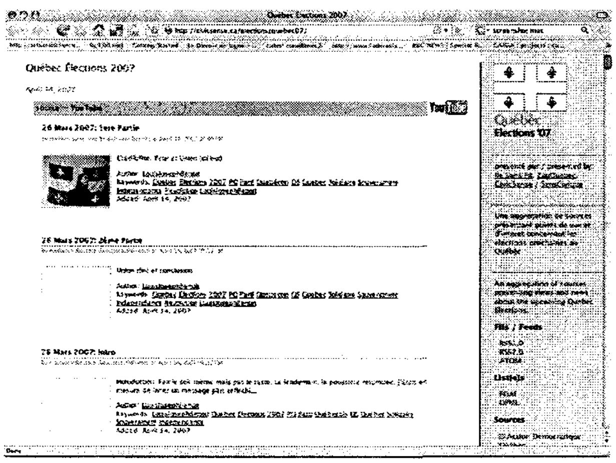


Figure 11: Quebec Elections '07 Site Linked from Portal Page

The WiFiDog software included the functionalities that supported the portal page, but also acted as a network management software tool that authenticated ISF's users, providing a way to both centrally manage the network by monitoring which nodes were functioning, and to shape network traffic by permitting or denying access to particular devices connected to the network. These functionalities helped to build a community of software developers around the world. Since WiFiDog was itself a piece of open source software, it was adapted for a variety of purposes by developers all around the world, including private or corporate WiFi networks.

Partnerships

Many technically inclined members of ISF joined the group in order to participate in challenging software development projects. Many of the projects that geeks considered challenging were created out of partnerships with universities, research groups, and other community organizations. ISF's first institutional collaborators were artist organizations like the MDCN project, and one of the first uses of the portal page was to deliver artistic content, especially locative media that explored the nomadic practices of Montreal's laptop users; for example Kate Armstrong's "Pattern Language" presented one paragraph of a novella at each of five hotspots, visible in Figure 6. The novella's plot unfolded as WiFi users moved between different hotspots. In 2006 Michelle Kasprzak curated In-Site Montreal, supported by the Canada Council for the Arts, which presented location-specific artwork at five different ISF hotspots (see http://www.year01.com/insite). Also in 2006 ISF, along with community wireless networks in Toronto and Ottawa, received funding from Heritage Canada to distribute artistic content curated by Terminus1525, a project promoting the work of young Canadian artists. The works (mostly images) were displayed on hotspots across the networks in Toronto, Montreal and Ottawa.

Through my involvement, ISF became a partner with the SSHRC-funded Canadian Research Alliance for Community Innovation and Networking (CRACIN) project, explained in Appendix Two. However, this partnership, although it financially supported my research, did not provide any funding to ISF as per the terms of SSHRC. Another academic partnership, the Infrastructure Canada-funded CWIRP project, compensated ISF for time spent assisting researchers. This funding required someone to assist the CWIRP researchers, a task which most often fell to Michael Lenczner, since few other volunteers were interested.

Unlike its relationships with federally funded research programs, relationships between ISF and community organizations were more tenuous. In 2005 ISF proposed to install a connectivity project using recycled computers in a low-income housing project, but the partnership with the housing association never took off because the housing development managers did not see the utility of the proposal. The development of a community infrastructure in Montreal initially attracted interest from Communautique, a Quebec umbrella organization dedicated to supporting the collective appropriation of information technology by community organizations (Proulx and Couture 2006). Although ISF was recognized as a winner of the Prix d'Innovation Sociale (social innovation prize) in 2005, its official partnerships with Communautique have been few: ISF provides WiFi in Communautique's offices, and their director general now holds a seat on ISF's board of directors. In exchange for providing WiFi coverage in boardrooms and public areas, ISF received office space at the Centre St-Pierre, which provides offices for religious and community organizations. While ISF's partnerships have connected it with the community sector in Montreal, as an organization it has combined a "community" image with influences drawn from open-source organizations more focused on technology development than on social change.

Open-source Organization

A sense of being an "open-source project" was important to ISF. In 2004, it presented itself as an organization inspired by open-source values. Rejecting structures like meeting protocols for running meetings, the group held open meetings in bars where all decisions were made based on consensus. Anyone attending three or more meetings was considered a member and encouraged to find some way of contributing, as there was no formal structure for involving volunteers. The innovation structure was open: any new idea was accepted if it was presented as a convincing improvement on another idea. This open structure attracted highly skilled volunteers from many different backgrounds whose various positions and demands were initially organized horizontally, in a set of competing goals that is sometimes described as a heterarchy (Stark 2001). Some volunteers wanted a more robust network. Others wanted to use WiFi hotspots to create network art. Still others wanted to build software. The result of these very different reasons for involvement and different understandings of why WiFi might be important or interesting created what Daniel Lemay called an "improvisational, spontaneous" (Interview December 7, 2007) organizational culture. This improvisational culture was created out of a shared interpretation of open-source culture and the "geek" identity, but also contributed to the development of a "geek-public."

ISF's Communities and Publics

As I outlined in Chapter 1, the concepts of communities and publics are important in the study of computerization movements like community WiFi where progressive visions of technology are mobilized. ISF attempts to engage in community development by creating a network of hotspots that provide an alternative to WiFi commercial media and communication systems while at the same time bringing together new publics, including WiFi geeks. I argue that two publics are envisioned and then form through the development of community WiFi in Montreal: one a "geek-public" that volunteers aspire to become part of, and another a "community-public" composed of people living in the same area who might use WiFi networks as means of discussing locally significant issues. Each is created through discourses and practices that define shared identities such as "geek," neighborhood resident, student, parent, or citizen. Both publics can be created through different types of community WiFi activities: the geek-public is brought together by organizing a "geek group" and talking about the importance of geeky activities, and the community-public is mobilized by greater access to media that communicates local issues. Building a WiFi network is often perceived as a means to augment or improve local communities by expanding access to the internet, through the development of a new community media source built and managed by the community itself. As Scheller (2005) explains, these publics crystallize around the potential provided by various types of mobile media, including WiFi.

The rest of this section describes how ISF created a "geek-public" of participants who created community WiFi networks, as well as a vision of a "community-public" using WiFi to socialize in public places. The notion of "geek-public is drawn from Kelty (2005), who argues that the internet has permitted the development of a specific public composed of "geeks": "technically competent individuals concerned with and engaged in defining, developing, and debating the technical and legal structures of the Internet and other computer networks" (p. 185). Although community networking literature might describe geeks as a community of practice, Kelty instead argues that they are a public because their interest in discussing the structure and standards of the internet has political importance. Using the internet to discuss and modify the functioning of the internet creates a *recursive public*: "a particular form of social imaginary through which this group imagines in common the means of their own association, the material forms this imagination takes, and what place it has in the contemporary development of the Internet" (p. 186). Kelty's recursive geek public communicates using the internet while also constructing the communicative space of the internet, extending "the activities of 'speaking writing, and thinking' which have defined [publics] classically, to include building, coding, compiling, patching, hacking, redistributing, and sharing" (2005p. 203). These activities make "argument-by-technology" that supplements the "argument-by-talk" that characterizes other mediated public speech. Through these activities, geeks are potentially engaged in a democratic rationalization of the internet, using their own debates and coding practices to retain the spaces in which they can relate to one another.

Geek-publics and community-publics

Escobar writes (1994)., "any technology represents a cultural invention, in the sense that it brings forth a world; it emerges out of particular cultural conditions and in turn helps to create new ones" (p. 14). The social, economic and cultural world of Montreal provides the site for the emergence of ISF's "world" and the social forms that are part of it. This world influences what kind of "community-public" designers envision as using their network. For example, ISF's focus on developing WiFi "third spaces" in public locations may be influenced by the city's "café culture": a product of long winters and one of North America's largest student populations, and by the success of other novel forms of media distribution in public places[22]. ISF's promotion of new media art may also fill a gap in new media art distribution: the province of Quebec has good funding for new media production, but does not support distribution of new media art (Michelle Kasprzak, Interview March 5, 2005). The local culture may have inspired ISF's social goals: Montreal has had a long tradition of grassroots organizing and mutual aid, extending back to the organizing efforts of the Catholic religious colonists. More recently, decades of Quebec leftist governments have solidified in citizens the concept of a "shared good" and a connection between radical politics and community media (Raboy 1984), a commitment exemplified by Communautique's work. Since 1995, the non-profit group Communautique has facilitated the integration of ICTs into community organizations. Communautique is now a large umbrella organization that assists with the integration of ICTs into the entire community sector. Through their work they have established community-based ICT provision as integral to local values. Therefore, ISF's contribution to the community public resonates with Montreal's local history and culture. At the same time, by being oriented around action, it applies an "argument-by technology" that makes a claim for including technological development in efforts to create social change. The way that ISF's volunteers envision "community WiFi" reveals the relationship between a community-public and a geek-public.

Responses to the question "Who is community WiFi for?" indicate how ISF members think about types of WiFi publics. Some thought that WiFi was mainly for geeks – "for us, for people like us", and others described it as useful for the group's partners – "for community organizations," "for artists", while others claimed that community WiFi was "for everyone" (Interviews with Philippe April, Francois Proulx, Michael Lenczner, and Daniel Lemay, February and November 2005). Each of these respondents envisioned their "building, coding, and compiling" (Kelty, 2005) as being not only for the benefit of a recursive public composed of WiFi geeks interested in talking about and experimenting with WiFi technology, but also for a greater internet-enabled public in Montreal. Striking a real balance between these how these two publics are envisioned has fuelled ISF's project throughout its development. As the following sections explore, the balance between vision and reality reveals the difficulty of mobilizing both geek-publics and community-publics.

Table 1 summarizes how WiFi networking projects engage with ideas of community and public. Although it focuses on ISF, it also draws on interviews with other Canadian community WiFi projects, detailing the differences between the "geek-public" and the "community-public." Each is created through discourses and practices that define shared identities, some of which overlap. A list of these different identities might include "geek," neighborhood resident, student, parent, or citizen. Each has a slightly different connection with WiFi: a geek-public might form around the project of constructing a WiFi network, while a local community might be mobilized by the expanded access to the internet that a WiFi network could provide, or by the innovation that having such a network might symbolize. In fact, the City of Montreal's proposal for a partnership with ISF suggests that a WiFi network can help the community to better connected, and also acknowledge that such a "geeky project" is a good example of innovative local culture. Geek-publics and community-publics suggest that there may be some relationship between the shared identity of geeks, and the media reality of a broad, community-public.

Table 1: Geek-publics and Community Publics

Geek-public – geekiness is a global category of identity	**Community-public –sense of belonging to a (geo-local) community**
Constituted through discussions about being a geek, discussions about technology, and technology-oriented activities: "[People volunteer] because it's a good opportunity for them to flex their geek muscle and at the same time create strong relationships with community leaders" (Gabe Sawnhey, founder of WirelessToronto CWN, interviewed in wirelessNorth, January 16, 2008)	Constituted through speech and writing that allows discussion about local issues and a sense of shared belonging. Access to information through internet or network access is perceived as developing the community: "The goal [of the WiFi project] is to position Montreal as a welcoming, connected city, and a leader in wireless communications" (Service de la mise en valeur du territoire et du patrimoine, Ville de Montréal, 2007)

WiFi geeks building local networks are part of their local community and create networks they hope will be useful to their community. One way of assessing the distinctions between community-publics and geek-publics is to consider how each uses WiFi recursively. A recursive public develops when a public's speaking, writing, or coding produces the means by which that public's engagement is made possible. For geek-publics, this occurs when the public discusses and creates the technologies that help geeks define themselves as such. Kelty (2005) demonstrates how internet geeks create the internet's rules and standards, and then use these rules and standards as topics for online discussion. WiFi geeks also recursively create their own means of engagement by debating and creating modifications to WiFi standards and to WiFi hardware and software, or what is more frequently referred to as WiFi hacking. More fundamentally, though, both internet and WiFi geeks create recursive publics by using arguments about (and by) technology as means of making social links. WiFi hacking – of software, hardware, and discourse – enables more robust WiFi tools to better connect geeks, but the process of hacking can be applied to other areas.

A recursive community-public can develop a shared sense of belonging to a local space by contributing to the new media and communications platforms. Ideally, ISF's WiFi hotspots play this role by providing local information and displaying artistic projects that take advantage of the local reach of WiFi. This draws on a community-based vision of WiFi where hotspots deliver extremely targeted local information: for example displaying the results of recent local council votes and filtering information based on the location of the hotspot and the interests of its visitors. A platform like this can provide a way for the community-public to develop in the spaces of WiFi hotspots, drawing on the capacity for WiFi to operate as a form of community media.

Table 2 presents the recursive elements of ISF's publics. As the following section explores, the geek application of "argument-by-technology" to the community-public does not necessarily mean that community members will use WiFi tools in the same way as the geeks imagine.

Table 2: Recursive elements of publics mobilized by community WiFi

Recursive Geek-public	**Recursive Community-public**
Created through speech, writing and hacking that themselves establish platforms for subsequent social engagement. Hacking WiFi, and debates about WiFi technical structures help create more WiFi equipped areas where geeks can meet: "Some people play the guitar, or they paint. This is what their life is about . . .what some people like to do is code" (Île Sans Fil volunteer, interview Feb. 14, 2005) "We just wanted to create the Swiss Army knife of authentication servers . . . something really good and really cool" (François Proulx, Île Sans Fil volunteer software developer, interview Nov. 5, 2005)	Created through discourse or technology that presents the public to itself and allows the public to create a platform for its own engagement: for example, a participatory community media where the public defines its own issues of interest. Idealized and imagined as being created through the development of a community media portal provided using WiFi: "We want to create an intervention, and question people's private use of the internet" (Michael Lenczner, founder of Île Sans Fil, interview Aug. 20, 2006)

The next section of the chapter discusses the contributions of this geek-public to the community sector in Montreal, assessing the outcomes of ISF's network building, software development, and creation of partnerships. It argues that the most successful of these activities has been the establishment of the hotspot network, followed by the development of the WiFiDog software. However, within the software development project, the functionalities that facilitated network management were developed more thoroughly than the functionalities that allowed for the development of WiFi hotspots as community media sites. The least successful activity was the establishment of partnerships to create locative media content, even though this activity garnered ISF the majority of its funding and attention from media and academic researchers. All of these activities, ISF members felt, were ways of creating an alternative to the existing forms of communication.

Applying "Argument by Technology" in the Community – Hacking the City

Members of ISF were inspired by the idea of making a positive contribution to Montreal's culture by using their technical skills to develop new tools. Michael Lenczner described ISF's geek contribution to Montreal's cultural life as "hacking the city." In a widely distributed blog post, he wrote:

> We are hacking the built city. This statement is based on the idea that as wireless devices and services proliferate and ubiquitous computing becomes a reality, the physical environment (especially the built city) is rapidly becoming enhanced space or mixed-reality. The supposedly separate existences of off-line and on-line are intersecting and overlapping - most rapidly in cities . . . Where this get's (sic) exciting is that by citizens, artists and non-profit groups developing and adapting these technologies (portable devices, wireless connectivity, mobile- and location-based applications) and their model (who is supposed to use them and for what purpose) we are able to impact and change this enhanced space and through that have an actual impact on how the built city is experienced.(Lenczner 2005)

Lenczner goes on to equate community WiFi deployment with building soccer fields: it offers the potential for people who share the same local community to build their skills and expertise, and to share information and ideas that encourage self-organization. He concludes:

> With basically no money and only the intellectual and time resources of it's (sic) volunteers, ISF is trying to convert our 55 hotspots into great big soccer stadiums all around Montreal -hopefully complete with locker-rooms, art galleries, chalkboards, swingsets, libraries, booths to tell your city councillor what you think she should be doing, recording studios, and massage booths. It's a grand vision, and I don't know if we'll succeed, but I guess that's why we're all a part of this - because it's audacious and exciting and it's supposed to be beyond us.

Lenczner's evocation of hacking WiFi as being equivalent to creating community centres with art galleries and playing fields establishes ISF's activities as contributions to broader local social goals (including, presumably, the psychological well-being of its volunteers, who may need "massage booths" to relax . . .). Other members of the group also envisioned ways that the WiFi 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 neighbourhoods better: "it could be very simple: in each neighbourhood, 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. Other volunteers saw the media content delivered on the portal pages as means of inspiring a broad public of WiFi users to think about their local area differently.

Benoit Gregoire described the purpose of delivering artistic content on the portal as being: "to get people to look at content they are not initially interested in or did not previously know exists. Toward that end, how much can/should or can't/shouldn't [we] control what people see. Not from a layout or even from a content organisation (sic) perspective, but the context in which it is displayed, what is chosen, and why" (Île Sans Fil volunteers list posting 25 Sept 2005). The portal page would encourage people using the ISF service to explore their neighbourhood, its residents, and shift the way they experienced internet-based media, perhaps contributing to creative, collaborative uses of media that had not been previously possible. Through locative media content, the community-public would develop a deeper understanding of their city culture, and even a new experience of the local spaces of cafes and bars. ISF's contribution to this new experience of WiFi would be to develop the functionality of the portal pages through WiFiDog, and to build partnerships and strategies to develop the potential for WiFi to serve the local community as a type of media to augment their experience of place, ideally provoking them to socialize or to discuss political issues.

Experimenting with Locative and Community media: The Portal Page

The development of WiFiDog and the portal page allowed ISF's geek-public to debate, both through talk and through technology, how its members envisioned the community-public would use its WiFi hotspots. Debates concerned what kind of information should be provided on the portal page, and whether or not the owner or manager of the hotspot should be able to control it. From 2005 to 2007 some of these suggestions were integrated into a series of different portal page designs (See Appendix Three). Many of these designs were tested on the portal page for Cafe Laika, a trendy café in the Plateau district of Montreal where mobile workers (and many members of ISF) worked daily. The Café Laika portal page included automatic updating of photos from photo-sharing site Flickr that had been tagged with "ISF-Laika." However, many ISF members disliked this content aggregation, finding it too similar to existing corporate portals like Yahoo! and MSN. Other ISF members disliked the fact that the personal profiles that made up the "social software" section of the portal page did not permit users to opt out. In many ways, the development of the portal page challenged ISF geeks without facilitating participation by hotspot owners or end users.

A major drawback of the portal page was that modifying it was extremely difficult. Hotspot hosts could not modify their own portal page, although they could inform ISF members if they had a blog they wished to syndicate on the portal page. Giving many people the ability to modify portal pages was perceived as a management problem requiring volunteers to act as intermediaries between hotspot owners and the portal page interface (Field notes, Jan 14, 2005), but at the same time, making too many small modifications was time consuming for volunteers, so portal pages were not often updated. Some hotspot owners did not even realize that they could request modifications to the pages belonging to their cafés. To prevent volunteers from getting frustrated by making modifications for individual owners, it was easier to inform owners that customization of portal pages was limited to syndicating news feeds from other sources and aggregating these on the portal pages.

Over time, developing the portal page as a locative media became secondary to expanding the ISF network. In 2006, a partnership with the Village Société du developpement commercial (SDC, or in English, Business Development Area: an organization similar to a local Chamber of Commerce) called for ISF to cover two kilometres of St-Catherine Street, a major commercial artery at the heart of the Village, with WiFi. To meet this demand, ISF established hotspots inside any businesses willing to host them, regardless of whether they created "third spaces." The SDC, which paid for internet access at participating businesses, displayed its logo on every portal page associated with the project (see below).

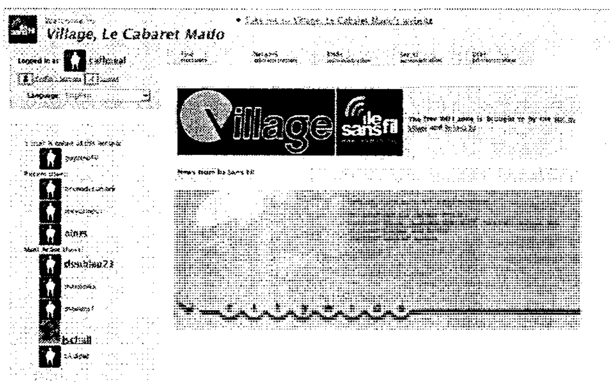


Figure 12: Village Portal Page

Accessing a hotspot in the Village neighbourhood thus introduced an ISF user to the SDC brand, rather than to content connected to a specific place and culture. The SDC project, a large and complex installation, marked a turning point at ISF. New volunteers with skills and interest in network management arrived, while many of the people interested in arts and content drifted away. At this turning point in the project, geek experiments with expanding and managing the network became more important than locative media development for the community-public.

Points of Tension

Balancing Geek Interests and Community Development

As the interests and practices of volunteers shifted towards expanding the network and developing a group of experts, ISF's technology development shifted away from locative media, and tensions within the group became more pronounced, including tensions related to gender. This section discusses these tensions, first though a description of how the shifting interests of ISF members reshaped which types of labour were associated with the geek-public.

Since argument-by technology was part of ISF's culture, one way of convincing someone of the utility of an idea was to build it: preferably, by developing software or hacking hardware. Initially, setting up hotspots was time-consuming and not considered very interesting. Volunteers in charge of setting up hotspots and performing network maintenance had difficulty motivating people to contribute to this less valuable "dogwork" (Michelle Kasprzak, Interview 2005). This changed when volunteer Alexis Cornellier was elected as "operations" representative to the ISF administrative council in 2006. He renamed the operations volunteers the "ninjas" and provided stickers, prizes, and public recognition for "Feats of Ten-Ninjas" – extraordinary efforts made by volunteers setting up hotspots, especially in the Village project. Cornellier also convinced software developers to design an easier interface to facilitate hotspot installation so that the Village project could be completed on time. Instead of improving the interface for modifying the portal page, which was a low priority, volunteers spent time programming this administrative interface. With the "ninjas" now receiving more attention at meetings, and social events like an ISF "pub crawl" usurping discussion of modifications to the portal page (Field Notes October 12, 2005), volunteers interested in the social and artistic potential of ISF withdrew from active involvement. Daniel Lemay reflects, "It's as if we reproduced a production line [for the deployment of WiFi hotspots] – we reproduced an industrial model . . .. But it could have been a noble project . . . In this there was a problem of governance, the problem was that the people with the artistic projects were always outsiders"[23] (Daniel Lemay, interview Dec. 6, 2007).

More significantly, ISF's "do it yourself" ethos conflicted with an art project created as part of the MDCN. That project created a location-specific chat for each hotspot; with the most recent chat messages displayed on the portal page. After months of collaboration with ISF, including payment of an ISF volunteer for time spent developing software to integrate the chat, the project launched at the same time as a chat client developed by other members of ISF, who had not been in touch with the developer or with Michael Lenczner, who was managing the collaboration. The artist's chat client remained as the only chat interface, but the collaboration proceeded delicately afterwards. One participant reflects:

> It's a bit challenging because it's [a], purposefully distributed control structure out there which is . . . great for some things and sort of difficult if you are on a production timeline and you are not sort of really within the inner circle. So you don't . . . know all the people and you don't know who you have to go to get what done. (Anonymous, interview July 17, 2007)

In this case, the geek public's argument-by-technology derailed a collaboration, and demonstrated how ISF's fluid organization made technology development easier and collaboration more complex. Relying on argument-by-technology also contributed to a gendering of labour within ISF, which further limited the diversity of the geek-public.

A Gendered Geek-public?

Many social and cultural practices have marked ISF's culture as predominantly masculine. Members meet in a bar to drink beer and talk about technology. They use jargon and technical language to communicate, and often spend their time together gazing at their computer screens. They like to make things work well or better, and are fascinated with new technological developments. From 2004 to 2007 around ten per cent of the volunteers were women, and many of them made significant contributions to ISF's projects by raising grant money, curating art projects, proposing usability studies of the portal page, coordinating media relationships, and creating marketing packages. Yet no female members of ISF were programmers or software developers – nor identified as "ninjas" – although all of the women I encountered at ISF could competently flash WiFi routers and install them. A subtle gendering of work activities seemed to be occurring, with women's "non-technical" contributions to technical development not recognized as "actual work" (Suchman 2005).

Similarly, the modes of relation between ISF were also gendered, with direct and assertive communication styles prioritized – in the "talk louder and faster" mode of relationship that has been observed in engineering schools (see Hacker 1990). Male ISF members were concerned about the lack of diversity of their group, but considered it primarily as a problem of "how to get more girls to be geeks," presuming that "girls" in ISF would behave, conceive of, and communicate in the same manner as the "boys" who made up most of its membership. Faulkner (2000) refers to this essentializing of male and female qualities as the "women in technology" perspective, arguing that it focuses on a lack of women in science and technology, rather than on the culture of science and technology work. In terms of creating a geek-public, this perspective situates girls as "non-geeks" and therefore already outside of the public. To counter this essentialist perspective, Suchman (2005) calls for an inclusion of feminist frameworks in technology to provide a wider interpretation of work roles in technical development. She writes:

> Feminist research displaces traditional preoccupations with abstracted and decontexualized forms of knowledge in favour of particular, specifically situated practices of knowing in action . . . it directs attention always to the labours (particularly those previously ignored) that are an essential and ongoing aspect of sociotechnical assemblages (p. 6).

Sexism, Difference, and Barriers to Participation in Geek-publics

Sometimes the gendered nature of ISF seemed sexist. In June 2005, a well-respected member[24] of ISF distributed a message on the listserv implying that the women members might be willing to perform sexual favours to promote ISF. It was a joke, of course, but the women members (affectionately called 'les filles sans-fil' or 'wireless girls') were not amused. Responses ranged from quiet shock to a questioning of one's implication in ISF. The member who originally posted the message apologized in due course, and several 'filles sans fil' continued to work with ISF, but the email underlined the difficulty of working for progressive gender politics at ISF.

In all-male spheres, sexual humour is often tolerated and considered to be the norm; likely the author of the e-mail considered us as being part of the "ISF gang." Still, the difference presented by integrating women into an environment marked as masculine made this assumption difficult to support. In short, the "wireless girls" were not men, and our troubled response to the e-mail reiterated that our presence required a different kind of social code than the "natural" sexual humour of an all-male social group. The tension that this difference created, and the sense that ISF remained, despite apologies and attempts at inclusion, a masculine space, reveals the deeply complex cultural engagements between gender and technology. The environment created at ISF provoked in its female members "extraordinary juxtapositions of positive and negative feelings about technologies" (Faulkner, 2000). This "othering" of the female members of ISF recalls Fraser's (1992) description of how the Habermasian democratic public sphere excludes women and other people who do not conform to expectations about who should comprise a public. The geek-public at ISF solidifies around the potential for social transformation imagined in WiFi. Like the ideal public sphere, the geek-public suggests openness to participation, but still creates barriers to that participation.

The Imagined "Community-public" – Uses of the ISF Network

Could the same barriers emerge in the community-public? The visions and goals of ISF hinged in many ways on the way that geeks expected people would use their WiFi hotspots. The network has experienced unprecedented use, especially considering that it was built for free, but it remains to be seen whether the community-public has used it in the way the geeks expected. Warner (2002) argues that a public must continually extend its discourse to "indefinite strangers" outside of the centre of its discourse production if it is to be sustained: otherwise, the would-be public remains a closed group. ISF attempts to extend its discourse as well as its WiFi networks by maintaining partnerships with artists and community organizations to develop content for the portal page, and by appealing to the people who use WiFi hotspots, the "indefinite strangers" (Warner, 2002 p. 120) or community-public, envisioned as accessing media and social software through the portal pages.

This section presents results from surveys and interviews with people using the ISF network from 2005 to 2007. Over 40,000 people were registered as users of the ISF network as of January 2008. Survey data from 2006 suggests that the "users" are not much different from the "geeks": forty-eight per cent are aged twenty-five to thirty-four, and sixty-seven per cent have at least a bachelor's degree, and higher proportions work in education, media, and telecommunications than in other fields. Sixty-eight per cent said that they used WiFi hotspots "to get out of my home or office." Although the presence of WiFi was a determinant of where survey respondents said they would visit, users of the ISF network also indicated that they used free WiFi wherever it was available, not necessarily only at ISF hotspots.

Observations and interviews conducted in November 2005 and May 2007 with people using ISF hotspots support these insights from the survey. They indicate that while the discourse of "community" is important to users, some practices oppose ISF's social goals. ISF users primarily want to gain access to the internet freely – one user described himself as "opportunistic – but aren't we all?" (Male Île Sans Fil user, interview Nov 5, 2005). These opportunistic users were more interested in connectivity to the internet than in socializing with people sitting nearby in a café. In addition, many of the people I interviewed preferred accessing the WiFi network anonymously, and were annoyed with ISF's authentication procedures. The fact that the service was "free" – as in, free of charge – was considered more important than the fact that ISF's technical and social structure were open to participation: while everyone I interviewed knew that ISF was a community organization, no one had thought of attending meetings, although one respondent said that he had "given them [ISF] my opinion on a couple of things, but they always ignored me" (Male Île Sans Fil user, interview Nov 5, 2005). For the broader community of users, the geek projects are "a good idea that should be replicated elsewhere" (Female Île Sans Fil user, interview November 10, 2005) but not something that inspired profound connection. This suggests that members of the non-geek community-public in Montreal are not necessarily interested in using technology as a means of creating social links – or at least not in the recursive manner that ISF's geeks expected.

The use of the ISF portal page suggests that there is an important difference between the recursive geek-public brought together by designing and using the WiFiDog software and the recursive community-public that has so far failed to use the portal page as a platform for social interactions. According to interviewees, viewing local content on the portal pages is perceived as a necessary impediment to connecting in order to send e-mail or surf the web. Most users interviewed said that they did not use profiles, and some were opposed to the idea of putting personal information online where it would be visible to people in the same location. One person explained that he used the number of user names appearing on a hotspot's page as a gauge for the amount of bandwidth available, avoiding locations with too many people online (Male Île Sans Fil user, 2005). Many ISF users seemed more interested in getting free WiFi than in participating in a mediated version of café society. Like Habermas' (1989) bourgeois public sphere comprised of men encountering one another in cafés, the recursive geek public in Montreal reinforces its own social connections in public spaces: Cafe Laika (now closed: technical issues caused interference and the owner established his own free WiFi) was not only a popular hangout for ISFers, but also the most-used hotspot between 2004 and 2007. While the geeks are in the cafes, the users may be elsewhere: Crow, Powell, and Miller (2007) suggest that a significant number of Île Sans Fil users are accessing the internet from adjacent office buildings, restaurants, or homes rather than the publicly accessible hotspots. This is even more frequently the case in the hotspots sponsored by the SDC Village. This means that ISF's plans to use WiFi to augment an experience of physical space have been undermined by the slippery nature WiFi's technical qualities: it passes easily through walls and windows.

Despite hopes that ISF's delivery of free WiFi could help Montreal's community-public to develop tools to recursively reinforce local social connections while providing access to the internet; the development of the geek-public may be this project's most significant social impact. Economically, ISF has virtually eliminated the market for pay-for-use WiFi in public spaces in Montreal: "we have done a great job of domesticating free WiFi in Montreal" (Michael Lenczner, personal communication November 17 2007). From the perspective of new social movements (Hackett and Carroll 2006), ISF symbolically recast WiFi as a community technology. However, despite the symbolic connection between WiFi and community in Montreal, the convenience and ubiquity of free WiFi hotspots remained more important for users of the service than the symbolic association with community.

While ISF may have inspired its geek members to participate in the civic life of the Montreal community, it has also helped them to build their own expertise. As WiFi technology diffuses more widely, the geeks who first explored and developed the technology begin to emerge as experts. This process can be compared to the development of previous groups of experts from groups of amateurs, a process that Douglas (1987) noted occurred with the "radio boys" in the early 20th century, that Marvin (1988) observed in the electrical profession, and that Haring (2007) described in the context of ham radio operators. Haring notes that United States radio hams embraced the government's regulation of their hobby because it provided more value to the skill and knowledge required to operate a radio. Similarly, geeks may be legitimating their own expertise in WiFi networking through the development of recursive geek-publics. As Cho's (2006) research highlights, CWNs may also primarily build social capital for their members The relative homogeneity of ISF's geek-public also suggests that grassroots innovations may not create as radical a social interventions as initially envisioned. As Lovink and Rossiter (2007) point out, "free projects can be more exclusive than 'non-free' structures in terms of gender, race, qualification, class. You need institutions to be inclusive . . .as soon as you want gender equality in your network, as soon as you start to practice gender mainstreaming, as soon as you enable gender autonomy . . . you're building institutions" (p. 87). As new institutions begin to build out of the innovations developed by ISF, perhaps the exclusivity of the geek-public will eventually be transcended.

Questioning Municipal-community Partnerships

The City of Montreal's partnership with ISF provides one possible way of institutionalizing the expertise developed by WiFi geek-publics, as well as reframing the symbolic associations between WiFi and innovation. In Touraine's (1977) terms, the partnership between ISF and the city of Montreal links the synchronic contribution of ISF's geeks to the symbolic interpretation of WiFi with diachronic changes that take place at the level of governance and regulation. The partnership straddles these two types of changes and perhaps suggests a unique means of reconciling the contributions of grassroots social movements with institutional and policy changes. Despite the limitations of the community media envisioned by ISF members, this institutionalization suggests that a broader community-public could be served through an expansion of WiFi networks, even though this has not yet occurred in Montreal.

In November 2007 I spoke with one of the members of the city of Montreal's municipal Economic Development office about their proposed partnership with ISF. In our conversation, he referred to ISF as "a group of geeks" – and 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 Nov. 18, 2007). The interest in supporting the expansion of ISF emerged as a response to the substantial coverage of the project by the local mass media, particularly the dominant French-language media[25]. Supporting the further development of this innovative group would thus reinforce this positive image of the Montreal community. 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. By attempting to gently institutionalize, rather than replace the ISF network, the city of Montreal is primarily reinforcing the development of the geek-public.

The partnership with the City of Montreal will replace the "open" non-hierarchical structure of ISF with a more conventional organizational form. In March 2008, ISF reorganized its administrative council, appointing two external board members, one from a community organization and another from a new media organization, to work with four volunteers. This committee will complete the negotiations with the municipal government and hire the full-time project manager who will subsequently manage the municipally sponsored network. This more conventional structure may mitigate some of the inward orientation of the geek-public, but it may also establish a more conventional organization of ISF's goals, where the expansion and management of the network of hotspots becomes the group's primary goal. The project focuses primarily on increasing the number of hotspots rather than employing WiFi as a new type of community media – suggesting that creating a community-public is not a main priority.

As this partnership was being debated by the city council, I spoke to some ISF members about their views on the partnership. They were less enthusiastic than I had expected. Benoit Gregoire focused on the volunteer fatigue overcoming ISF, and the unlikely chance that funding would improve this situation: "The city will only help with the resources, but someone will still have to do something; it is always the same people at the meetings, people are not active or they don't feel they have time to really contribute. As a worst case the project will just justify its own existence and the work will be done by the paid people and there won't be any real community" (Interview November 24, 2007). Daniel Lemay worried about the new partnership because he feels that the open, innovative approach that made ISF so interesting and so much a part of Montreal's culture has already been lost, because the spirit of experimentation has been replaced by an industrial model of developing and deploying hotspots that work well, but is no different from what a commercial WiFi company would do. He says, "I really feel like we may be a victim of our own success. We don't have to try very hard to do this work" (Interview December 7, 2007).

Assessing ISF's Impact

ISF's vision of mobilizing new technology in the service of community has resulted, paradoxically, in the creation of a large-scale network. This has been its greatest success, along with the WiFiDog software, now developed into a robust software suite now used around the world. However, its most important contribution, culturally and socially, has been ISF's role in helping a restrained community of practice envision a way of contributing to a broader community. The relationship between the visions that ISF members developed for their network as a community media and social networking site and the realities resulting from the success of their free WiFi hotspot network reiterate the ongoing dialectic of computerization movements. Unfortunately the ISF geek-public, like the idealized public sphere, presented barriers to participation, partly because of its focus on argument-by-technology, and partly because of the gendered nature of geek identity. The community-public never mobilized in quite the manner envisioned by the ISF geeks. Finally, as the geek-public adopted a more inward focus, the goals of ISF volunteers shifted towards expanding its network and fitting into a new institutional structure through its partnership with the City of Montreal.

ISF's innovation drew from the tension between vision and pragmatism, between an interest in transforming the structure of WiFi technology by hacking code, and in turn transforming WiFi's function by positioning WiFi hotspots as new kinds of community media. However, as WiFi became better-understood and volunteer interests changed, the group's working partnerships moved from arts projects to CWIRP's study of community WiFi as infrastructure. These shifts reflect the increasing institutionalization of WiFi technology beyond local grassroots experimentation. This institutionalization has shifted the focus away from the social goals that were originally intertwined with ISF's technical development. Daniel Lemay remarks, "The problem is that there are really no noble goals here. These projects could have been put forward by people with noble goals in mind, but it's not noble to put free WiFi in cafés. It's just cool" [26] (Daniel Lemay, interview Dec. 6, 2007).

In Spring 2008, most of ISF's committed volunteers are network administrators (ninjas) motivated to keep the network up and running. None of the four volunteers introduced at the beginning of this chapter participate actively. No new artistic collaborations have been pursued, and although one of the new board members is a new media specialist, volunteers do not coordinate production of artistic or community content. There is one woman volunteer: in 2007 readers of Montreal's La Presse newspaper voted her "Montreal's sexiest geek"[27]. This suggests that ISF's gender culture has not shifted very far – and neither has its has its "geek culture."

Conclusion

The energy I felt in 2004 upon first meeting Montréal's WiFi geeks convinced me that this group could potentially redefine local culture and communications and make them more democratic. However, the tension that emerged at ISF between a geek-public who built social capital and skills through their engagement with each other, and a community-public solidified through access to robust communications infrastructure, suggested purposes at odds with each other. Initially, participation of a diverse group of volunteers balanced these purposes by discussing and building new forms of WiFi networks. ISF provided an alternative configuration for communications infrastructure through its WiFi network, but it also reinforced a technocracy by developing WiFi geeks as experts. Because argument-by-technology was linked with expertise and masculinity, geek-publics created barriers to participation, despite the fact that they were produced through non-institutional, non-hierarchical volunteer participation.

Computerization movements including community WiFi suggest potential democratic rationalizations of technology, but the social transformations they promised have been limited by the insularity of various WiFi publics. While geek-publics may mobilize new forms of civic participation by suggesting that technical development can contribute to the civic life of a community, the broader "community-public" did not use WiFi to develop the political dialogue that could have made ISF's hotspots sites of democratic engagement. This marks the limits of WiFi publics: in Warner's (2002) terms, ISF's public is not expanding but turning inwards to form a "group"; the gendered nature of the geek-public illustrates one aspect of this. Community wireless networks are part of a new generation of projects that envision ways to politicize and democratize communication technology. However, if this democratic rationalization is to fulfill its promise, WiFi publics must create and distribute discourses and practices that mobilize not just geek-publics but also community-publics. They must also create different kinds of collaborations to prevent new kinds of divides from forming between educated, professional users of WiFi and other people in the local community. These could be collaborations between local governments and geeks, like the one beginning in Montreal. In turn, these collaborations could inspire new institutional structures that might possibly leverage the unique contributions of self-organized WiFi geeks.

As the next chapter indicates, WiFi's institutional structures depend on local context. The planned partnership with the city of Montreal suggests an institutional framework that could maintain ISF's innovative qualities by retaining the participation of geek volunteers in building the network, although it does not specifically address the broader community-public. In comparison, municipal networks create different kinds of institutional forms around WiFi, offering another interpretation of its influence on communities and publics. Chapter Four examines how community – municipal – WiFi in Fredericton, New Brunswick, is transformed into a public service. The case describes how city government officials envisioned a WiFi network as contributing to their existing government-owned telecommunications network, but more importantly, how they leveraged the symbolic connection between WiFi and innovation.

Chapter Four: The Fred-eZone, "intellectual infrastructure" and the public service model for WiFi

After two hours on the tiny Dash 8 plane, watching the propellers spin over a wintry forest criss-crossed by logging roads and highways, I landed in Fredericton. I ran across the snowy tarmac to the terminal. Just inside the door, on the wall facing the single baggage claim carousel was a poster showing a middle-aged professional woman sitting on a park bench with a laptop. "Connect to the Fred-eZone," it read, above instructions on how to find a WiFi signal, identify the eZone network, and connect to it. The poster next to it advertised the next game of the local minor hockey team. While I waited for my bags, I wondered how much these two posters told me about the city I was going to explore.

The cab ride into town took fifteen minutes, winding along the river. Fredericton itself was a small and bustling city of 50,000. Downtown on a winter morning sidewalks were full, skaters turned circles on the rink, and people used laptops in cafes. I stayed for three weeks, exploring a city marketed as one of the "world's most intelligent communities." I visited the National Research Council's offices and stayed on-campus at the University of New Brunswick, which instituted the first computer science program in Canada. I cross-country skied on tidily groomed trails, took inexpensive, reliable public transportation, attended film nights and dance performances, went to the farmer's market on Saturday and Superbowl Sunday at the pub. I interviewed friendly, well-educated employees of small companies who traded worldwide, and many members of the municipal government. I wanted to find out why and how this city, surrounded by forest, came to create North America's first free WiFi network, and what – if anything – it had meant to the Fredericton community[28].

Introduction

As I discovered, the people who designed Fredericton's WiFi network enshrined it as part of their city's innovative disruption of existing telecommunications systems, and a means of making their city appear "smart" or "connected" through ubiquitous communication services. These perspectives align with two diverging interpretations of WiFi's impact. The first evokes the *disruptive* quality of WiFi technology and its potential to create new social and technical configurations that challenge existing structures. The second channels the excitement about the possibility of using WiFi to provide more *ubiquitous* access to the internet and other networks. As we saw in the previous chapters, the *disruptive* interpretation of WiFi can be linked to the development of a geek-public of experts. This interpretation contrasts with a focus on the potential of WiFi to facilitate ubiquitous connectivity and inspire a community-public to develop.

In Fredericton, it was a group of elected officials and managers working in the city's technology department who developed one of the first municipal WiFi networks in North America – and one of the most successful in terms of its scale and longevity. The "community WiFi network" is a free public network provided on city-owned property and in publicly-accessible spaces. In its own particular context, Fredericton's Fred-eZone project represents WiFi as both disruptive and ubiquitous. In 1999, the city created its own utility telecommunications company and built a substantial fibre network operated as a co-operative with other local partners. The excess bandwidth from this network provisions the free WiFi network.

The Fred-eZone fits into a larger strategy that the municipal government has developed, which leverages the symbolic association between WiFi networks and innovation to brand Fredericton as a "smart" or "connected" city despite its small size and relative isolation from major cities in Canada and the Eastern United States. The Fred-eZone project primarily defines WiFi as a ubiquitous "intellectual infrastructure" according to the city's Chief Information Officer (Gallant 2004) that provides connectivity across the city. However, the design of the network and its use by Fredericton residents and visitors suggest that this ubiquity has not been fully developed in the network's structure. Instead, the eZone has drawn on the disruptive representation of WiFi as an emerging technology to develop the city's branding strategy.

Compared to the distributed, hotspot-based distribution model that ISF used, the Fredericton model integrates WiFi technology into an existing communications infrastructure, and creates a cultural context where the city's economic development goals are tied to its provision of internet connectivity. The success of the Fred-eZone WiFi network depends on the fact that the city purchases trunk line connections to the main internet traffic routes (also referred to as "backhaul") at wholesale cost, using the bandwidth not devoted to connecting its offices as a free "gift" to its citizens. Like the ISF project, the Fred-eZone's success levers the integration of WiFi technology into a specific local cultural, social, and political-economic culture. The key difference is that

Fredericton has integrated "community WiFi" into municipal government and economic development institutions: organizationally, the network is run by city employees, and symbolically, the WiFi network helps to represent Fredericton's innovative character within its economic development strategy.

Institutionalizing "Community WiFi" – the Municipal Case

This chapter uses the Fred-eZone case to explain how 'community WiFi' becomes more institutionalized, and how expertise, network structure and connections to other infrastructures, as well as to local culture, influence the development of institutions. The chapter also examines how ideas about WiFi's potential to disrupt existing organizational and technical structures influence the development of the Fred-eZone. A brief discussion of literature on communication infrastructure development opens the chapter. Insights from infrastructure development literature illustrate this institutionalizing process, describing how disruptive technologies like WiFi become framed as infrastructures. I argue that the way Fredericton city officials describe Fred-eZone as an "intellectual infrastructure" is an important indication of the social and cultural impact of the network.

Following this brief discussion of infrastructure development literature, the three main sections in this chapter discuss how the eZone was developed and built. Once again, the relationship between visions of WiFi's impact and the reality of its social impact form the basis of the analysis. The first section of this chapter describes how the eZone's developers envisioned this network contributing to their city based on what they perceived as its existing technological and cultural capacity. The second section focuses on how these visions of the network accorded with real experience, both in terms of managing uses of the network that were "disruptive" – unexpected or threatening to pre-existing expectations – and in encountering the limits of the network's ubiquity. The third section considers the process of institutionalization in more detail, summarizing how both disruptive and ubiquitous elements of WiFi were represented in Fredericton, and situating this negotiation as continuing the dialectic of computerization movements as they become more institutionalized. The conclusion points to some of the paradoxes inherent in the Fred-eZone's evocation of WiFi as disruptive and ubiquitous – in particular, the ambivalent status of a "connected community" that remains geographically isolated from larger business and knowledge centres. Fredericton must maintain a symbolic connection to a globalized world while developing its own local identity. As in Montreal, the Fredericton community WiFi project co-constructs ideal forms of community and public. Fredericton thus defines a city as a community, and WiFi as public infrastructure.

Methods: Shifting Perspectives from the Grassroots to the Elite

In researching this chapter I continued to pursue a situated perspective on the social and technical development of a WiFi system. I interviewed the people involved in designing and building the system, as well as decision-makers who worked at integrating connectivity issues into local policy[29]. Over a three week period in February, 2007 I visited Fredericton and conducted twelve in-depth interviews with elected officials, municipal managers, business people and university researchers and administrators, which I transcribed and analyzed. The process of transcription and analysis investigated similar themes to those developed in the ISF chapter. The key themes for analysis included the ideas of community and public, as well as perceptions of WiFi as disruptive or ubiquitous. To balance this elite perspective I conducted informal, in situ interviews with ten people I observed using the eZone in public places. An online survey of users similar to the one distributed to Île Sans Fil users was conducted in March 2008.[30] To participate in the local culture, I attended theatre, dance, and cinema, participated in local sports, spent time at the mall and in cafes where the eZone was available, and chatted with locals in pubs and bars. For a period of a few days I worked from the offices of the City of Fredericton IT department. I also conducted a review of technology and innovation coverage in the local media, as well as a network survey of the number of wireless networks active in downtown Fredericton. I obtained network management data of the use of the eZone for 24 hours on February 9, 2007, and aggregate measurements from November 2006 to September 2007.

The limitations of this approach, which was constrained by the relatively short period of time I spent in Fredericton, and the fact that I visited during the coldest part of the winter, are evident in the bias towards elite informants from large institutions. Several interviewees reiterated that the eZone was used more often during the summer months when tourism increased, and when more local residents used outdoor spaces. The cold winter weather I experienced during my fieldwork meant that fewer people were outdoors or in public places in Fredericton. My perspective of the Fredericton community is therefore shaped by my contacts and experience. Still, within the trajectory of the socio-technical construction of WiFi, this perspective provides insight into how decision-makers discuss and understand new technology. It also testifies to the openness of individuals and institutions in Fredericton. As one of the people I interviewed said, "Because it's a small province it's relatively easy to go to the president of the university, to the Premier" (Greg Sprague, Project Manager, National Research Council, Interview Feb 10, 2007). This element of Fredericton's culture shaped my fieldwork, but perhaps it also influenced the city's innovation by facilitating collaborations and favouring the development of close working relationships.

Sites of Innovation in Infrastructure Development

Fredericton's WiFi innovations are configured by the city's identity as a relatively small, isolated community with a wealthy, educated workforce and a desire to retain citizens and businesses in the face of global competitiveness. The Atlantic region of Canada has historically struggled to retain and expand its workforce, and Fredericton's innovative branding has thus responded to the challenges of attracting and retaining young workers to the region. The city government's autonomy in establishing its own telecommunications operations resonates with the actions of previous non-commercial actors in establishing communications infrastructure – including the grassroots actions of Île Sans Fil. The difference between the ISF project and the Fred-eZone is not so much a difference of scale, but one of institutionalization. One way of institutionalizing technology is by thinking about it as infrastructure. Bowker and Star (1999) claim that infrastructure is embedded within other structures and technologies and that it only becomes visible when it breaks down. Furthermore, they note that infrastructure can be learned: for example, classification systems are taught and learned within communities of practice. Studies of infrastructure building describe how new technologies transform from exceptional phenomena to practice, becoming nearly invisible in the process. This process is not smooth, as not all infrastructural technologies develop into embedded infrastructures – and certainly not in the same ways.

In North America, communications infrastructures have grown sporadically and organically. In the United States context, Sandvig (2006) notes that the establishment of a nationwide telephone infrastructure was disorderly in its beginnings, with local, often rural, co-operatives creating a patchwork of different systems, some of which required participants to provide their own pole and wire. He argues that the role of local governments in the first stages of development of technologies like WiFi is to:

> [S]erve the forgotten and the dispossessed, to experiment and pioneer systems that meet overlooked local needs, to partner with enthusiasts in ways that push the technology forward, to apply pressure to legacy carriers by investing in alternative networks, and to foster competition by insisting on widespread service, reasonable rates, compatibility, and interconnection on reasonable terms. (p. 505-506)

In the Canadian context, Martin (1991) details how in the early 20th century, several alternative possibilities for telephones were negotiated through the gendered conflict between telephone designers and telephone operators and users. Telephone companies had not expected to see demand for telephones grow outside of business districts in major cities, since the telephone was imagined as a technology for businessmen. Instead, social use of the telephone expanded its potential market to women – and eventually Canadians in all parts of the country. As these examples demonstrate, the early and nascent development of infrastructures can permit social and political negotiations.

Sandvig's argument draws from studies of the railroad (Hughes 1983) and the telephone system (Fischer 1992) that indicate that infrastructures are built on a small scale, often in a disorderly manner, before they are built out to larger scales and made available to more people. This suggests that a perception of new technologies as disruptive persists until technologies can be institutionalized. Often this institutionalization defines the infrastructure as a public good. For example, after the period of proliferating local telephone infrastructures resulted in large telephone companies offering reliable service, the Canadian government mandated universal basic telephone connectivity. Hughes (1987) also argues that cultural and political-economic variables influence the form of large infrastructures like electrical systems: technical and political-economic contexts meant that electrical power systems in the United States, Great Britain, and Germany developed differently. However, the scale of the researcher's analysis, as well as the scale of the infrastructure, may impact how messily contextual or systematically smooth these infrastructures appear to be as they develop. As Edwards (2002) notes, studying infrastructure development on different scales can provide different insights into the nature of changes: while meso-scale studies of institutions like regulatory bodies or governments can describe infrastructures as transcending individual control, and macro-scale studies abstract infrastructure into broad roles (for example, studies of airline travel infrastructure or shipping), small scale studies can instead reveal active appropriation of infrastructure and the evolving design of emerging technologies by the people who design and build them.

Fredericton's broadband and WiFi projects provide an example of community-based innovation that is more institutionalized than the grassroots actions of ISF. In this thesis, the Fred-eZone case acts as a bridge between my discussion of oppositional technology development cultures like ISF and the focus in the following chapters on how actions connected with community WiFi bridge towards policy advocacy. Because Fredericton is a small community, it cannot provide an example of what Edwards would call meso-level changes or what Touraine (1988) calls diachronic or state-level change, but a close investigation can provide insights into community WiFi's institutionalization, as well as the factors that characterize successful municipal networking projects. The project reveals that municipal explorations of emerging technology like WiFi do not necessarily "serve the forgotten and the dispossessed" (Sandvig, 2002 p. 505). Instead, the new technology can be integrated into a new set of visions that help Fredericton to brand itself as a city that is "smart" and "connected."

Preconditions for developing a WiFi network: The Knowledge Community and 'Knowledge Infrastructure'

For three hundred years Fredericton's main employers were the provincial government, and its two universities: the University of New Brunswick, with approximately 7,500 students and St. Thomas University, with approximately 3,000 students, as well as the local military base. University graduates could expect to walk down the hill from the campus to take up offices in the government buildings by the river. A prosperous community developed; when I visited in 2007 the average household income was $70,000 per year (Team Fredericton 2008), compared to Montreal's average household income of $48,000 (Statistics Canada, 2007). In the late 1990s the provincial government began to downsize and the municipal government began to explore how to prevent a collapse of its economic base. In 2000 it developed an economic development strategy that focused on knowledge work and knowledge industries. The mayor says, "We didn't want to have to be dependent on government, or so dependent on universities, which had served us well, but we wanted to diversify, and we had decided that information technology was the way to go" (Brad Woodside, Mayor of Fredericton, Interview Feb 3, 2007). At the same time, an economic development coalition was created that made municipal government and business leaders part of "Team Fredericton." Drawing from the tight connections between municipal and business leaders who wanted to shift the economic base away from reliance on universities and governments, this cross-cutting strategy focused on branding Fredericton as an innovative 'knowledge-based community' to distinguish it from other cities in the Atlantic Canada region, all of whom were competing to retain young workers, increase immigration, and build strong economies (Atlantic Canada Opportunities Agency 2006).

However, delivering on the promise of being a knowledge-based community meant improving internet connectivity. Until 2001 only one internet service provider (ISP) – Aliant, owned by Bell Canada – served the city. Broadband connectivity was only available in certain areas. The cost of bandwidth was at least twice as expensive as in major centres: 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. After realizing that the incumbents were unwilling to provide broadband coverage over the entire city, the city technology department, which had been laying fibre 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 non-profit, city owned company called E-Novations. E-novations obtained a license as a non-dominant telecommunications operator[31] and the company began operating as an ISP. City staff explain that prior to the city's investment in this fibre infrastructure, some businesses paid up to $3000 a month for a T1 backhaul internet line. Currently, the average price is $250. The fibre "Community Network", allowed the municipal government and other local businesses to aggregate their demand for bandwidth. E-Novations bought bulk bandwidth from wholesale providers, and resold it at 1:1, meaning that service was always as fast as promised. 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, either offered by e-Novations, Aliant, or by other providers at market price.

In 2003, the director of Team Fredericton submitted a plan for a small demonstration WiFi network to the municipal government. The same plan had already been submitted to the federal "Smart Communities" program, but had been rejected. The federal program, begun in 1998, defined a Smart Community as "a community with a vision of the future that involves the use of information and communication technologies in new and innovative ways to empower its residents, institutions, and regions as a whole" (Industry Canada 2004). Although Fredericton's application to host New Brunswick's official project was rejected, the city council backed the project anyway. Fredericton's broad tax base, balanced budget, and interest in carving out a niche as a well-connected knowledge hub made a WiFi network an attractive investment. The presence of the existing fibre Community Network cut the costs for the project significantly, since the

WiFi network could draw from the internet connectivity provided through the fibre ring. The development of a city WiFi network was presented as a kind of inevitability: "Look, we provide tennis courts, all other kinds of infrastructure, so this makes sense. At the same time as we were doing this the Team Fredericton infrastructure was also being developed. It's a way of distinguishing us from all the other little cities in the middle of nowhere . . . If you had the opportunity to do this, why wouldn't you?" (Jane Blakely, Director of Corporate Services, City of Fredericton, Interview Feb 10, 2007).

Visions of Community

That Fredericton is in many ways as Blakely describes – a "little city in the middle of nowhere" – may hold a key to its self-definition as a community. Compared to the more fluid conceptions of community and public explored through the ISF case study, this specific geographic location for community holds more in common with traditional sociological definitions of community (Burt 1992; Tönnies 1887, trans. 1955). According to 2006 census data Fredericton has a growing but not particularly mobile population: a large majority has not moved from their homes in the past two years. Of the population of 49,980, fewer than 1,500 are recent immigrants within the past five years or non-permanent residents. Compared to the Canadian average, Fredericton residents are slightly younger, and 30 per cent have post-secondary degrees – the third-highest rate in the country after Ottawa and Toronto. Sales and service, business and finance, and management are the most popular occupations. Compared to the New Brunswick overall unemployment rate of ten per cent, Fredericton's 6.6 per cent unemployment rate is very low. The vast majority of Fredericton residents speak English at home (Statistics Canada 2007). These statistics present a picture of a stable, well-educated community of service workers and professionals: relatively homogenous, but thriving.

Fredericton's tightly-knit community develops through close social and professional relationships as well as a sense of common character. Fredericton's network builders envisioned their network as contributing to a community defined both by its geographic location as well as its local culture. In terms of the definitions of community presented in Chapter 1, Fredericton's community combines symbolic and personal elements (Day and Murdoch 1993) that Fred-eZone developers build through technology. The city's economic development officer reflected on the scale and nature of community as it influenced the eZone project:

> I found it interesting that the first hotels or motels to deliver WiFi were the "Country Inn and Suites" and "Comfort Inns" of the world . . . the smaller, more flexible, more nimble places to stay. Not the Sheraton Inn in Toronto, who still want me to plug in a cable and pay $4.95 a day. So is it any wonder that Fredericton was way ahead of Toronto when the Country Inn and Suites was way in front of the Sheraton Inn in Toronto. I think the bigger you are, the more trouble you have wrapping your head around this" (Don Fitzgerald, Interview Feb 3, 2007).

The head of the city's corporate services felt that a smaller city encouraged elected officials to consider the entire community as opposed to their local electorate: "It's small enough that council members can't be parochial. They have to think in terms of the benefit of the whole city and not limit themselves to twelve square blocks" (Jane Blakely, Interview Feb 10, 2007).

Civil Servants, Not Geeks

The Fred-eZone's developers, colleagues and friends including the city's chief information officer, the manager of the city IT department and the director of Team

Fredericton, felt strongly about using technology to promote their city. They knew each other well and had previous interest and expertise in high-tech. It is unlikely that any of them would describe themselves as geeks, although all of them said that they learned about networking technology "on the ground," "through trial and error," and "by doing." Of the three none trained as engineers. Mike Richard, the Vice President of Operations at E-Novations and a manager in the information and communication technology division of the Fredericton municipal government, was a police officer for 15 years in Fredericton's municipal police force. Maurice Gallant, the city's Chief Information Officer, worked for the Conference Board of Canada in Ottawa, before returning to Fredericton, and Don Fitzgerald, the executive director of Team Fredericton, the city's economic development agency, ran an internet service provider before joining the public sector. All of them had worked together for at least five years by the time the Fred-eZone project began. Their approach to connecting community and WiFi was much more pragmatic than the grassroots explorations at ISF. These examples illustrate well what Bar and Galpernin (2005) point out, which is that following the explosion of geek-produced WiFi projects follows the age of the bureaucrats, who may have different visions of how to use WiFi.

Developer's Visions of Community Networks

The composition of the fibre "Community Network" that supported the WiFi network illustrates how network developers and advocates envisioned technology as contributing to their community. The Community Network is owned and operated by the municipality, and delivers high bandwidth to businesses at reasonable wholesale cost. Building the network was an act of resistance by the municipal government to the incumbent telecommunications company's disinterest in the city's small market, and its local development was a point of pride. Maurice Gallant explains how the incumbent ISFP resisted the city's construction of the fibre network:

> This was not something they wanted us to do. They tried to dissuade our councilors, our managers, that we shouldn't be doing this ... that this was unfairly competitive, that there was a commercial offering out there, that we should be using that. But we had done our research, we knew what the price points were, we knew what the price points could be. (Maurice Gallant, CIO City of Fredericton, Interview Feb 14, 2007)

The success in developing the fibre network autonomously instead of depending on incumbent providers reinforced the idea that Fredericton's civic character was resourceful, innovative, entrepreneurial, and self-sufficient. The description of the development of the eZone reiterated these values as characteristic of the Fredericton community:

> It tells a lot about our council and about our community. We went and said, we'd like to do this, here's what it would cost, here's the area it would cover. And I guess we got a no. . . . [Then] council said can you come back. And we were back at the very next meeting. Okay, we like this idea, but the area that you are going to cover is too small. And the delivery time is too long. And you didn't ask for enough money. So here's more money than you asked for, so go do much more than you planned for and by the way do it in less time. So, collectively at this time we are the dog that caught the parked car. Because we had mapped out a small, relatively easy to do project that wouldn't interrupt what let's call our day jobs. But our council saw the correctness of this kind of tool in this kind of community. (Don Fitzgerald, Interview February 3, 2007)

The development of the eZone evoked a particular vision of the Fredericton community as resourceful, business-minded innovators who could develop a free WiFi network without increasing residential tax rates. The mayor describes the competitive nature of this innovation: "it was like we were in a race with a lot of other people but we got a really good start. And of course money is part of that. To be able to do this, and not to have taxes go up because this is part of the basic tax package. And I think now people are starting to see the benefits. People are doing business downtown on our system." (Brad Woodside, Mayor of Fredericton, Interview February 3, 2007).

For the mayor, as well as for other municipal departments including the tourism department, the WiFi network is a way of branding Fredericton as high-tech and innovative, linking this innovation with the city's government, education, technology and geomatics industries: "We use it as a kind of mind flip – to get away from the perception of Atlantic Canada, backwards, welfare bums, to say that the whole city is under a WiFi umbrella but that you could still sit down by the river and get some of what you associate with Atlantic Canada. It changes your perspective. [We show] hiking trails and then right away the smart city message" (David Seabrook, Manager, Fredericton Tourism, Interview Feb 13, 2007). This "mind flip" is part of an overall communications and branding message that attempts to position Fredericton competitively with relation to other cities. Lovink and Rossiter (2007) argue that cities are agents within a "communicational economy" of creative industries. Each city attempts to communicate its own status as a locus of creativity. Furthermore, "creative industries has an ambition to hardwire its concepts into infrastructure. Policy leads to urban development, employment conditions, flows of economic investment, border movements, and so on" (p. 18). Fredericton attempts to institutionalize the creative, innovative symbolism of the WiFi network while streamlining images of WiFi-linked creativity and innovation into its marketing and tourism material.

Fredericton's vision of WiFi differs from that of ISF. The WiFi network initially formed a natural extension to the fibre Community Network, which had lowered business costs and creating competition in the residential broadband market. Instead of being seen as a community media platform, the Fred-eZone's developers thought of it as a municipal public service for mobile knowledge workers, business people, and visitors. Having a WiFi network was envisioned as easily branding Fredericton as a community of innovators who would support increased connectivity and choose to live in a place with established "intellectual infrastructure."

Intellectual Infrastructure

With the development of the economic development strategy focusing on knowledge industries, Fredericton's decision-makers have invested in intellectual infrastructure including network hardware and software, but also institutions. In 2003, Fredericton put in a bid to act as the home for the National Research Council's Institute for Information Technology (NRC IIT[32]), a federally-funded research institution that conducts research, develops technology, and incubates technology-focused businesses. The NRC IIT is now located on the campus of the University of New Brunswick. The Fredericton city council's bid specifically referred to the innovative connectivity infrastructure developed by the municipal government, but also to the fact that the city had an educated workforce and was open to research. In a way, the NRC IIT is itself a form of intellectual infrastructure.

Greg Sprague, a project manager at the NRC IIT and the former CIO of the University of New Brunswick said: "in a province like New Brunswick we have to go find people, get them to come here and get them to stay. Networks are an important piece of the economy. We do try and sell NB as a test bed. Distributed, educated, bilingual population. Perfect place to do a pilot project" (Interview February 13, 2007). A representative of a successful local software development business selling on the global market describes the business advantages of Fredericton beginning with, "the broadband; the ability to connect to the world from here" (Sandi MacKinnon, Interview Feb 11, 2007). Broadening the definition of infrastructure to include network connectivity infrastructure extends the definition of public infrastructure. The director of Fredericton's economic development organization comments: "normally if you talk to someone about the definition of infrastructure it's going to be roads and streets, water and sewer. But cities are about a whole lot more than that now. They're about parks, cultural institutions. They are about the different levels of infrastructure. Council sees this as intellectual infrastructure, something that will allow the people and the firms that live here to succeed and prosper here" (Don Fitzgerald, Interview February 2, 2007). In order to inspire local success and prosperity, the municipal government envisioned the WiFi network as symbolizing a vibrant community that could retain young people and attract new immigrants.

As an infrastructure for connectivity and connection, the WiFi network also meant to compensate for weaknesses in previous generations of infrastructures. For example, the city's director of information technology described how a WiFi hotspot provided a symbolic link between the transcontinental highway, which had bypassed the central city, and the downtown core:

> When the four-lane highway came through here a few years ago it was going to bypass the whole city, and there was a lot of concern about that. The old highway there were 4 or 5 exits off the road, directly to downtown. Now we have the Big Stop, the truck stop that is the major point on the highway, and so we covered that with wireless. (Mike Richard, interview Feb 03, 2007)

Discussing the city's assets as "intellectual infrastructure" suggests that Fredericton possesses greater infrastructural resources than similarly sized or located cities, a claim that underpins its branding strategy as a "smart" knowledge centre. This claim also gestures at how the WiFi network was built on existing city-owned infrastructure like street signs, lampposts, and water towers. However, the Fred-eZone was not built based entirely on public investment. When the city technical office began developing the eZone in 2003, WiFi technology was still relatively unstable and had only recently begun to be used to cover wide areas. The city agreed to act as a demonstration project for Cisco Systems in exchange for in-kind equipment donations and shared expertise. The demonstration project cut the costs for the original deployment of the network, since Cisco donated much of the backhaul equipment. In turn, Fredericton appeared in Cisco promotional material[33].

Like ISF, the Fred-eZone concentrated on providing connectivity in places away from work or home. The Zone was supposed to appeal to visitors and to "knowledge workers" who would want to be connected when at other locations besides work and home. This meant covering the entire downtown core, with a focus on places like bars or cafes that these workers and visitors might visit. Other public areas were also included, like the boardroom of the local electrical utility, whose executives wanted shareholders and members of the public to be able to access the internet without going through the company's internal network, and all of the city's parks, arenas, and sports centres. The network design focused on the integration of WiFi as one public service among others, linking it to the municipal institutions and infrastructures already in place. Also, because the WiFi network was meant to illustrate the innovative character of the Fredericton community, its design evolved as the network expanded. Its coverage has remained concentrated on city-owned property, in the downtown business core and other commercial corridors including the Knowledge Park industrial estate and a suburban commercial strip (see Appendix Eight for coverage maps). Wade Kierstad, the Fred-eZone's network architect noted: "WiFi was never meant to replace home or business connections but to work in-between these areas. The initial vision was not to replace the providers of home or business service" (February 3, 2007). One of the city councilors who voted to support the construction of the eZone reiterated that the network had grown out of the need for municipal employees to be linked together, and had never been planned to operate separately from the municipal government.

Managing Disruptive Technology

The symbolic link between WiFi and innovation draws on the representation of WiFi as a disruptive technology. In Fredericton, aspects of the network also disrupted the expectations of the network's developers. The first disruption was the fact that the WiFi technology did not work reliably when the network development began. Changes in the network design during the design and deployment process indicate how designers' visions of how the network should be used contributed to the technical and architectural choices they made. Even after the Fred-eZone received sustainable funding to expand past the state of a demonstration project, the network was still designed to provide "best effort" service rather than reliable connectivity. The expectations of the project's designers were always tempered by the fact that they were working with new, untested, and unstable technology that they were attempting to manage and integrate into their existing ICT infrastructure.

The evolution of the network architecture reflects how the eZone's designers integrated their visions for WiFi into their existing networking structures. At the time of writing, the Fred-eZone network consists of three virtual networks (VLANS), each of which is connected to the city's fibre backbone and to the city's server where a firewall and network management software are also located. The three virtual networks prevent interference from too many radios operating on the same network. Wireless backhaul is used to connect tower sites with connections to the fibre network to the individual WiFi access points. The access points are equipped with radios that link to the main tower sites wirelessly, broadcasting WiFi signals to receivers in the area. Unlike the ISF network, there is no e-mail authentication process for using the Fred-eZone. Instead, a splash page shows the terms and conditions for use of the network, which users must accept before connecting to the network. The MAC addresses (unique addresses identifying a single physical computer) are logged, and MAC addresses associated with abuse are blocked. During the day, the bandwidth allocated to the eZone is limited; at night, it is unlimited. Peer-to-peer network traffic is throttled (that is to say, the amount of traffic it is allowed to use is severely restricted), and sending of e-mails is limited.

This architecture was the result of modifications made in the first two years of the Fred-eZone's development, and addressed both technical malfunctions and the behaviour of the people using the network. The nature of these modifications indicates how the eZone was integrated with other municipal infrastructures as a public service, but also the influence of the network builders' conceptions of community. The initial design for the eZone was as a series of point-to-multipoint WiFi transmitters (or antennas) mounted on locations with backhaul connectivity to the internet. All network traffic was routed to the city's central authorization server, which managed the radio connections and authenticated the people using the network. The network was "pretty well completely open" (Mike Richard, Interview Feb 06 2008). The uses of this "open" network included some practices that disrupted the network developers' initial visions, inciting them to restructure the network based on this experience.

Aligning Visions and Experience

Disruptive Uses

The eZone is designed to permit free WiFi access using the excess bandwidth purchased, but not used by, the members of the fibre Community Network. Initially, network planners felt that there was sufficient bandwidth to have the eZone provide high-speed WiFi to anyone who wanted to use it, at any time. However, this bandwidth was not sufficient for providing unlimited peer-to-peer transfers, or ways of transferring large files by distributing them across a network. Peer-to-peer traffic often uses different protocols than other internet traffic like web browsing. In 2004 BitTorrent peer-to-peer transfers accounted for so much network traffic that the eZone was beginning to encroach on bandwidth allocated to other Community Network members. The network designers responded by shaping the network traffic. They limited the speed of transfer of peer-to-peer traffic and prioritized web-based HTTP traffic. This move thus makes it difficult to use the eZone for purposes other than visiting web pages and checking e-mail.

Shortly after this incident, the network managers received a notification from anti-spam service SpamAssassin that messages originating from their network had been blacklisted because so much spam was being sent from the Fred-eZone. The managers responded by blocking known virus ports, and by installing a mail proxy server that intercepts e-mail messages and runs them through an anti-virus program. Computers connected to the eZone are permitted to send only 10 e-mail messages using SMTP (Simple Mail Transfer Protocol -the standard message delivery protocol) per connection. These measures have configured the eZone into a network that is difficult to use for purposes other than the occasional web searching and e-mailing that its designers imagined. In fact, survey data from March 2008, which is discussed in more detail below, indicates that the Fred-eZone is used most often for occasional access to e-mail, web searching, and instant messaging. These uses are very close to the uses anticipated by the Fred-eZone's developers, who eventually created a closed, tightly managed network that is accessible free of charge and without authentication. Even though the network is highly managed and many uses (like voice over internet protocol or VOIP) are discouraged, the designers feel that this increased control is justified because access is offered free of charge.

Designing a network to favour the uses imagined by its designers is an example of what Akrich (1992) refers to as "configuring the user" where designers of technologies imagine potential users as being similar to themselves. Designers configure the eventual users based on how they envision their products contributing to the world. These visions are often based in designers' own experiences. In many ways, the Fred-eZone's designers envision their ideal users as being like themselves: professionals who find it useful to be connected to the internet for work and pleasure. The homes of several city technology employees also host eZone nodes, one of which is among the ten most frequently used hotspots. However, this could be an overly simplistic view. It is not so much that the eZone developers design for users they believe are like them, as it is that they are developing for an ideal Fredericton inhabited by mobile professionals drawing on the city's intellectual infrastructure and contributing to its purported innovative culture. This process of configuration is more similar to that of the Amsterdam Digital City, where designers imagined the future users of their technology in terms of their own experiences (Oudshoorn, Rommes, and Stienstra 2004).[34] Managing the network by responding to unexpected uses of it reinforces a specific vision of community, in which the community using the eZone shares a common identity with the designers. At the same time, the modified network's structure configures the possibilities of use to more closely align with the designer's visions.

Managing the structure of the eZone to configure more desirable types of use is a means by which the network's designers attempt to capitalize on their vision of how the network should represent their community. Sandvig (2002) notes that visions are ways of thinking about the use of communication technology when no deep thinking has occurred: visions are a partial narrative conceptualizing who should use technology, in what circumstances, in what way, what such use of the technology should mean, and what consequences this use is intended to have. The visions of the eZone as potentially improving the quality of life in the city are sustained through the way the network has been structured and modified by its developers.

What kind of Ubiquity?

Digital Divides

The modifications of the eZone and the choices made about how to frame its builders' visions of an appropriate WiFi network and its most desirable uses demonstrate how specific interpretations of technology highlight some social concerns and leave aside others. For example, Fredericton's high-tech development is never discussed in terms of bridging internal digital divides within the community itself: only in terms of competitively positioning Fredericton with relation to other cities as a site for business development and immigration. The fibre network provides commodity bandwidth to businesses and institutions, while the eZone provides public access to WiFi for those with the appropriate equipment. While the WiFi signals extend across most of the downtown core (one of the city's least wealthy neighbourhoods where many university students rent accommodation) using the eZone indoors requires installing additional antennas. One University of New Brunswick student I spoke to described the efforts he went to in order to use the eZone at home:

> We have this long antenna that goes out to the shed, that's where the signal is. It was either this or spend \$600 a year on internet – it's 50 bucks a month. But we have this antenna; it has to work on USB, and this long tail. We did a lot of research, read everything that we were supposed to do, but we bought a D-link antenna, and it really doesn't work with Macs, that's what we have, a Mac. And the equipment to work with Macs isn't readily available in this area. So it doesn't work that well. It's a bit buggy. (Male e-Zone user, Interview Feb 3, 2007)

Not everyone living in the area covered by the eZone would have the research experience or technical skill to make these kinds of efforts to use the eZone at home. Indeed, another student who was using her laptop during our interview said that she connects to the internet using DSL at home – "I have a little connection that goes in here . . .[points to the port on the side of her laptop]" (Female eZone user, Interview Feb 3, 2007). Her laptop was a new Mac IBook with a built-in wireless card, and our interview was being conducted in a Fred-eZone equipped café.

According to Rideout and Reddick (2005), Canadian communities and especially communities in Atlantic Canada still experience a "dual digital divide" encompassing not only differences in "technical access" consisting of a connection to the internet, but also the experience and interest that would make using this technology relevant. They argue that because it concerns the delivery of public information and services, community networking should be a government initiative. In Fredericton, the provincial government provides a community access program (CAP) that funds computer centres in public libraries and other public places. The CAP formed part of a 1990s federal government initiative to increase broadband connectivity and digital skills that also included the Smart Communities program. It established community based public internet access facilities to help communities in rural and remote areas get access to the internet and develop the skills to use it effectively (Industry Canada 2004).

At the main library in Fredericton, both the computer lab and the eZone provide internet connectivity, although no specific training programs are associated with either of them.

Librarians I interviewed said that around five people bring laptops to the library each day, and that the computer room was regularly used, if not necessarily for education and training: "If there are 50 a day, 40 of them will be the same people every day. Playing games, you know . . . In the summer we get lots of tourists, people who need to tell folks at home where they are." (Head Research Librarian, Fredericton Public Library, Interview Feb 7, 2007). At another CAP site in the science museum, the manager stated that the computers had been purchased for use in educational programs but that members of the local community never use them. The CAP programs in Fredericton, like those in the rest of the country, have been without stable funding since 2001. Without support of training and community content development, the CAP sites – and the eZone as well – support only technical internet access, which is not necessarily used to gain access to government information or community content.

The "Information Super-Sidewalk"

The CAP program and other Canadian government programs like Smart Communities promoting ICT connectivity and training define access to information and communication technologies as a public responsibility because of their ability to deliver public information and services. The policy rationale for these funding programs was that training needed to be provided in order to help Canadians access government information online. If Canadians were going to access government information online, then the government should be responsible for ensuring that everyone could have access to this information using the internet as a platform. Rideout and Reddick's arguments for government responsibility for bridging the digital divide draw from this logic (Rideout and Reddick, 2003). In contrast, the framing of the eZone as "public infrastructure" has focused on the network's ubiquitous presence, rather than its potential uses. Don Fitzgerald described the eZone as "the equivalent of the information super-sidewalk. We put the sidewalks up, we say walk up and down them, this is your transportation infrastructure. As long as you don't ride your bike or break any of the bylaws, we leave them alone" (Interview Feb 3, 2007). Symbolically, the eZone is deeply integrated into the image of an innovative community that the city's municipal and business community has developed. Practically, it is not intended to provide regular connectivity. The role of the network in providing any kind of public information or community content is secondary, although the municipal government has begun to experiment with delivering location-specific tourist information that could potentially include descriptions of historic buildings delivered using captive portal pages similar to those that ISF uses at each of its hotspots. At present the opening page on the Fred-eZone is the same no matter which network node is being accessed. Figure 6 shows how the Fred-eZone designers expected users would gain access to the network, as well as a small image of the opening page.

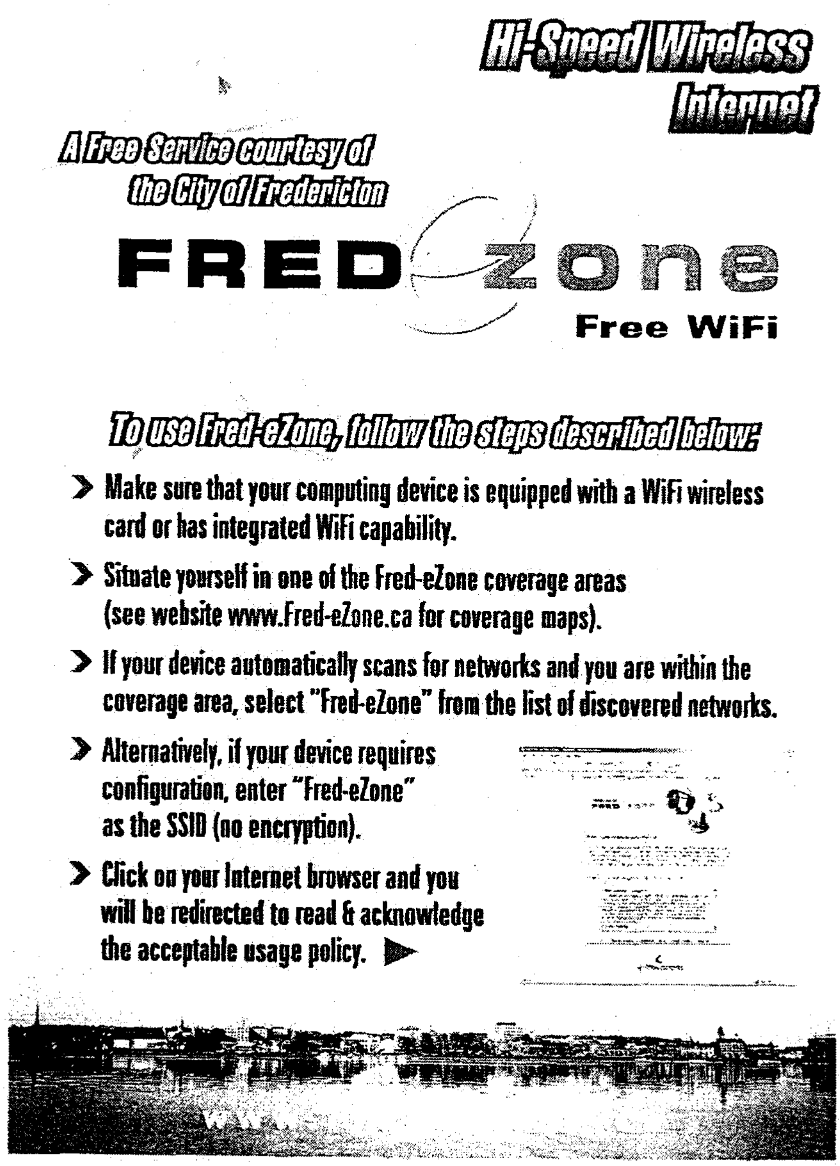


Figure 13: Flyer describing how to access the Fred-eZone. Fredericton Tourism.

Unlike the ISF network, the Fred-eZone was not designed with any specific communication purpose in mind. Initially a demonstration project, it later became framed as a public service that would illustrate the city's connected, forward-thinking nature. As imagined by its designers, the media, and marketers, the eZone would promote ubiquitous connectivity: "Always connected, at high speeds, anywhere in the city and what's more – for free . . . Fredericton now boasts omnipresent broadband service, a truly connected business community and an extensive WiFi zone, which allows individuals to connect to the world free of charge" (Gallant, 2004). Promotional material for Fredericton's tourist market, as Figure 7 suggests, highlights the image of Fredericton as a typically picturesque Maritime community with global connectivity.

Figure 14: Tourist brochure for conference market, Fredericton Tourism

These representations highlight the ubiquitous potential of the network without making any claims about how it might or should be used. Even considered as intellectual infrastructure – or as "information super-sidewalks" the eZone has a restrained footprint. The wireless "sidewalks" cover 40% of the city's municipal wards although network coverage maps, which measure the coverage under ideal situations, suggest a much greater coverage as Figures 9 and 10 indicate.

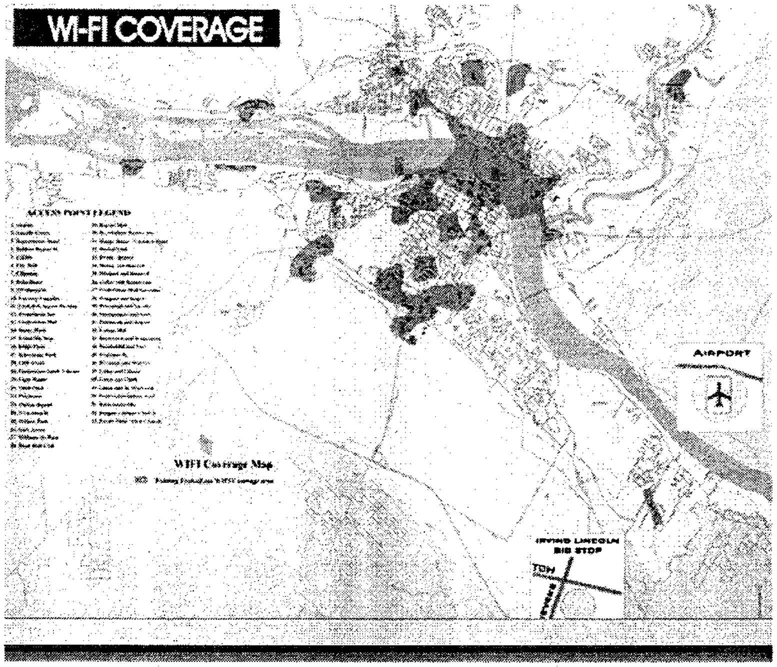


Figure 15: Fred-eZone coverage as of December 2005

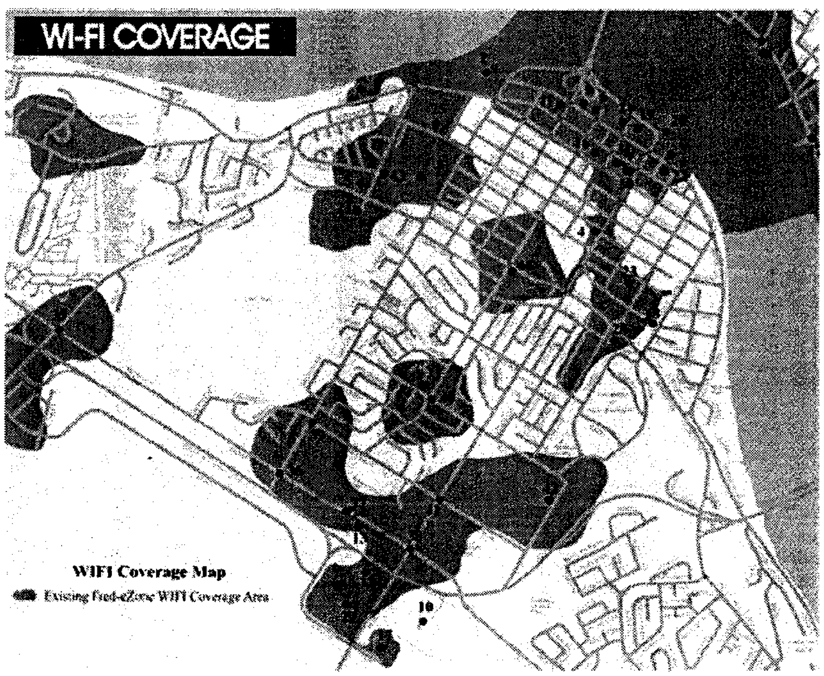


Figure 16: Downtown coverage of Fred-eZone, 2005

Jane Blakely notes that this creates "the illusion of connectivity everywhere, for free" (Jane Blakely, Interview Feb 10, 2007). In addition to the downtown core, there are hotspots at many of the city's major churches (some of them used as antenna sites), on some parts of the university campus, over the parking lots and inside two shopping malls, at the trailer park and truck stop, and at rinks, pools, and recreation centres. Most antennas are located in the downtown core, where interference with other WiFi access points has reduced the effectiveness of the network. The vision of outdoor or mobile use is not well supported in practice: the eZone works well outdoors in the winter months, but during the summer months the leaves on the trees downtown cause interference, which may undermine the potential for the increased outdoor use that eZone developers assured me occurred over the summer. Mobile use is not possible because the network requires a new authorization at each individual access point. Given these constraints, it is important to assess how the Fred-eZone has been used, in comparison to how it was conceived or designed.

Using the eZone

Since its launch in 2004, use of the eZone has grown slowly and steadily. Network management logs obtained from the city in February 2007 indicate that several hundred users are online at any time, with peaks in usage in morning and at noon, when office workers are likely to be away from their desks. Tests inside two residential houses in Fredericton revealed weak signals that could not be reliably used to access web browsers. As of February 2007, the eZone locations with the highest number of clients were the Playhouse Performing Arts Centre, where municipal employees use the eZone to gain access to the city network, at a hotel ballroom where a conference was taking place, and at a downtown café. The access points with the highest traffic rate included the Chapters bookstore in the suburban mall, the University of New Brunswick computer lab, and the Irving Big Stop truck stop on the Trans-Canada Highway. From November 2006 to September 2007, an average of over 11,000 active sessions occurred, or an average of around 400 sessions per day. However, out of 21,000 clients who connected over this period, 24.9% connected only once, and 13.8% connected only twice: nearly half of the repeat users of the eZone thus connected fewer than three times. This suggests that the primary users of the network are short-term visitors to Fredericton.

The online survey that ran during the month of March 2008 revealed use in line with what the designers of the Fred-eZone had imagined, with some unexpected surprises. Receiving 155 responses, the survey indicated that two thirds of eZone users were men between 35 and 44 years old. Half were university graduates, and most were full-time employees. Like the network management statistics, the survey indicated that the downtown cafes, the Irving Big Stop truck stop, and the airport were the most popular location of access. Hotels were also popular access locations. Half of the people who responded to the survey were not Fredericton residents. This supports the findings reported above that suggest that most Fred-eZone users are visitors to Fredericton. Several responses to the question "what do you like most about wireless internet" received responses from truckers using the eZone from the truck stop, including this one: "this relevies (sic) a lot of the stress involved with having to be away from home, thank you for this service. ask any trucker (sic)." Other comments described using the eZone in parking lots from inside parked cars. One respondent described using the internet from a parked car while waiting for a child to finish band practice and another described the advantage of "the privacy of my vehicle" as a reason to use the eZone in the location where he or she uses the network most often.

The uses most frequently reported by survey respondents were sending and receiving e-mail (77.9%), "going online for fun or to pass the time" (53%) and sending and receiving instant messages (45.6%). Only three per cent of respondents had used the Fred-eZone to make a voice over IP call, suggesting that the throttled network effectively limits this type of use. Furthermore, most of the activities on the eZone were "consumption" activities: getting news and weather updates, searching for information or downloading music and videos.

The main advantage of the Fred-eZone, according to most survey respondents, is that it is free. However, forty per cent of respondents indicated that they would be willing to watch an advertisement in exchange for free WiFi access. Still, eighty-seven per cent of survey respondents strongly agreed with the Fredericton municipal government's decision to fund the network. As the survey indicates, the Fred-eZone is used in many of the ways imagined by its designers: as an occasional service for business travellers, truckers, and other visitors to the city. For more regular use, or to provide alternatives to expensive long distance telephone calls through voice over IP, the Fred-eZone would have to be a more open network and not constrained by the bandwidth limits currently in force during the day.

Best Effort

The Fred-eZone is a "best effort" network. The users I spoke to in February 2007 were pleased to be able to use the eZone for free, but noted that it was not very reliable: "Normally it works fine but today it is as slow as dialup . . . it's great, it's really great. But I wish it were in more places. It's only here and sometimes up on the hill at Starbucks, but I can't always access it there, it depends what server you are using" (Male eZone user, Interview Feb. 12, 2007). The Fred-eZone's developers concentrated on creating a ubiquitous public infrastructure to provide technical access to the internet, rather than public information or community-based content. Although this technical access is provided free of charge, it does not provide the reliability or broad coverage that would make it truly ubiquitous. Considering that it is "best-effort," few users expect much reliability from the Fred-eZone. However, it is the only WiFi service available in Fredericton, and it is publicly funded. The following section discusses the implications of Fredericton's framing of the eZone as a public service, in the context of computerization movements.

Institutionalizing WiFi

Thus far in this chapter I have considered how the visions of the Fred-eZone's developers drew on the newness and potential disruptive quality of WiFi to represent it as a component of a smart, innovative community, and described the reality of the uses of the network. I have also examined the network's design, and the way that its intended uses focused on the potential of WiFi to be a ubiquitous public service connecting Fredericton to the world. The next section analyses how the symbolic ideas of WiFi as disruptive or ubiquitous were developed and integrated into Fredericton's civic culture and economic development strategies.

Institutionalizing Disruptive Technology – WiFi as Innovative

WiFi's disruptive potential is integrated into the city's branding strategy that presents it as innovative and "smart." The WiFi champions in Fredericton allude to the "underground" identity of WiFi technology as a way of highlighting their city's innovative decision to develop a free WiFi network: "You know, WiFi started with people writing a big W in chalk on the sidewalk. This is the underground" (Don Fitzgerald, Interview Feb. 3, 2007). Could the municipal managers who designed the Fred-eZone claim any relationship to the technology "underground" of warchalkers indicating free WiFi with symbols on the sidewalk[35] (or even ISF's geeks)?

Fredericton's network is one of the first examples of WiFi institutionalized at the municipal (rather than the university or corporate) level. Subsequent municipal WiFi projects, especially the hundreds of North American projects launched in 2006 and 2007 (Tapia, Maitland, and Stone 2006; Tapia and Oritz 2006; Muniwireless 2008) have not been able to capitalize on the symbolic value attached to early adoption of WiFi. Based on readings of the Muniwireless.com web site[36] from 2004 to 2008, the representation of municipal wireless networks has shifted from an excitement about being "unwired" towards a focus on municipal applications such as meter reading and public safety to WiFi as a public utility that could meet municipal needs. This suggests a broad symbolic and cultural shift away from a focus on the disruptive potential of WiFi in the municipal context. In keeping with this, Fredericton's engagement with the disruptive potential of WiFi has focused on the significance of its network as one of the first in North America, rather than on the undesired disruptions of its network by spammers and file-sharing. Gallant (2004) writes, "Fred-eZone, Fredericton's free WiFi hot-zone has quickly become the envy of many other Cities [sic] in Canada, the U.S. and, in fact throughout the world. We receive weekly calls from other Cities [sic] wanting to emulate the project" (p. 7). Having been the first to successfully deploy and manage a disruptive new technology thus implies, according to city administrators, innovativeness. Although the WiFi network is meant to indicate Fredericton's innovative character and inspire progressive policy strategies like the local ownership of the fibre network, using technical innovation as a means to brand Fredericton as progressive and cool can also be interpreted as technocentric.

Fredericton's economic development strategy depends upon making the city an attractive location for greater private investment. The city's choice to structure the fibre network as a cost-saving measure for local businesses and the municipal government rather than as a public service suggests that the Fred-eZone's contribution to promoting innovation is considered primarily in terms of its ability to help businesses develop. Investing in a disruptive technology provides cachet to Fredericton's government by tapping into the symbolic association between new technology, innovativeness, and creativity.

Institutionalizing Ubiquitous Technology – WiFi as a Public Service

If the disruptive cachet of WiFi could be integrated into Fredericton's economic development strategies as a means of evoking the city's innovative, smart identity, the potential for WiFi to add to its existing fibre network could expand the city's range of public services. Various conceptualizations of "public" are associated with the provision of internet and network connectivity. Clement and Potter (2007) construct a "desiderata" for public broadband connectivity, which, while not arguing for ubiquitous connectivity, posits that connectivity should be universal and available to "every household, business, organization, public space, tourist destination, and public transit corridor in the network's coverage area . . . that is, it should reach every person when and where they need it" (Clement and Potter 2007). This understanding of universality suggests that public WiFi could be considered a public utility like water and sewer service – or sidewalks.

In contrast to Clement and Potter's evocation of universality as an important criterion for public WiFi networking, Stewart et al (2004) use the concept of the public park to make an argument for public appropriation of the internet. They argue that the understanding of the city park as a public good can be used as a reference for internet policy-making. This argument supports public provision of internet services, especially when they are explicitly represented as public goods. Stewart et al. argue that as a city becomes commercialized, some spaces must be set aside for social integration and citizen engagement. These spaces parallel city parks, which the authors define as public goods. They write:

> In spite of its essential economic nature, the term 'public goods' finds its early roots in western philosophical notions of the 'common good'. Indeed, while the latter is conceived as a set of ultimate goals of collective well-being and harmonic existence among the members of a community, the former represents – albeit expressed in different ways by different social contracts – part of the means required for achieving such a situation of collective well-being and prosperity. Thus, the notion of public goods is associated, since its origins, with the collective or public provision of both material resources (such as roads, lighthouses, bridges, sewers, mail service) and non-material conditions (such as national defense, a legal system, universal education, a domestic currency or collective health) (p. 346).

The metaphor of the public park is an evocative one for a public network. Public parks are shared spaces set aside from the commercial city, where sociability, relaxation, play, and public participation occur. Such a metaphor might describe a network like the one proposed by the partnership between ISF and the City of Montreal, where WiFi hotspots are publicly available for a variety of uses. Fredericton's Community Network fibre ring and Fred-eZone wireless project have also evoked the idea of communications infrastructure as a public good but have framed it in terms of infrastructure.

Currently, the Fred-eZone is neither a public utility nor a public park, and in many ways it is not a very good infrastructure either. City officials I spoke to used not only the metaphors of sidewalks but also water services and health care to define their WiFi network. Although these metaphors suggest that WiFi and communications infrastructure are perceived as public goods by Fredericton's decision-makers, the network is only available in a relatively limited area and can only be used for a limited number of purposes. Officials also acknowledged that WiFi is not essential: "Well, you could probably do without it" (Jane Blakely, Interview Feb 10, 2007); "It's a little bit tricky, sometimes you are blocked by a building or something" (David Seabrook, Interview Feb 13, 2007). These comments resonate with those of the eZone users who responded to the survey, and who would like to see the network expand and provide more reliable and faster service, but who are still pleased that it is available for free. The Fred-eZone introduces a very basic level of public accessibility, but does not reliably provide a public service.

Despite creating an "illusion of being everywhere" the eZone is only available in specific public places. Furthermore, sidewalks or roads are expected to be maintained and usable, not 'best effort'. The Fred-eZone clearly requires conceptualization as a public service other than a sidewalk or water system. Stewart et al's suggestion of a public park may make sense, but as of yet the way that the eZone has been integrated into the municipality's existing communications infrastructure has not developed the potential for WiFi to operate as a community media, or to provide content or information to engage its citizens like the ISF portal pages attempt to do. As a public park, the Fred-eZone is a piece of bare ground.

Stages in Computerization Movements: Institutionalization

Touraine (1977) argues that social movements end in institutionalization, and Lovink and Rossiter (2007) note that institutions are essential for the development of creative industries. Therefore, struggles over symbolic meaning eventually result in interpretations that have been viewed as radical, becoming more acceptable. Like ISF, the Fred-eZone developed around a specific local culture and operated within the expectations of its developers. Much of the value of the e Zone is located at what Touraine calls the synchronic – symbolic – level: it is an international prize-winner and provides the economic development and tourism office with examples of the city's vibrancy and innovativeness. However, the decision of the municipal government to license its own competitive telecommunications provider has also influenced policy and regulation of telecommunications within the local region. Thus, some parts of Fredericton's overall innovation strategy operate at the diachronic – state and regulation – level by changing the expected relationship of a municipality to telecommunications provision. Still, the WiFi network has not yet been integrated into this broader pattern of change. It is symbolically imagined as providing ubiquitous coverage across the city, yet it has not been designed to provide broadly accessible coverage.

As part of an institutionalizing trajectory within computerization movements, the Fred-eZone suggests an intermediate state that is more formal than grassroots experimentation like Île Sans Fil and more flexible than large institutions like nationwide telecommunications infrastructures. The small scale and local culture of Fredericton are still important elements of their innovative practices, but they are beginning to challenge expectations of what kinds of infrastructures city governments should provide. As Strover and Mun (2006) point out, the role of North American cities as defined in the 19th century was as an executor of specific powers as defined by the state. Cities' responsibility for communications had been limited to rights of way such as streets and roads, canals, and conduits for telephone lines and fibre optics. The expansion of ICT infrastructures used for transferring information as well as for communication potentially expands the responsibility of cities to provide communications infrastructure. Fredericton's locally scaled interventions in policy and infrastructure do have precedents in other infrastructural technologies. As Fischer (1992) describes, the early telephone infrastructure often depended on autonomous local governments to create co-ops in order to aggregate enough demand to build higher-capacity trunk lines. Yet the integration of the local fibre network and WiFi indicates a new focus on integrating the development and management of communication infrastructures under municipal responsibility.

Integrating Infrastructures

Sawhney (1992) also argues that large-scale infrastructural developments including communication infrastructures begin as experimental islands unconnected to previous infrastructures, and then begin to connect to them, eventually complementing the previous infrastructure and then, after long-distance links formed, transcending it. Although it elegantly describes how some infrastructures replace others, this system-level explanation fails to explore how specific social, cultural, and political-economic contexts contribute to the shift from "islands" to "systems." In the same vein, Sawhney (2003) argues that wireless and WiFi technologies rerun the cycle of infrastructural innovation. While wireless technologies may be building into a broad infrastructure for internet connectivity and communication, the process of transforming isolated islands into a cohesive system involves a great amount of cultural variation. Like many other observers of the WiFi phenomenon he notes that non-commercial actors like grassroots citizen groups initially participated in promoting WiFi innovation, setting the groundwork for the development of new infrastructures once they could offer service superior to the existing infrastructures.

However, Sawnhey's framework glosses over the role of local cultures and institutions in shaping how WiFi systems are adopted. As the Fredericton case illuminates, the symbolic aspects of an infrastructure – in this case an 'intellectual infrastructure' – become integrated into the city's self-presentation, even as the new technical infrastructure becomes embedded into an existing installed base. The integration of discourses about WiFi as 'intellectual infrastructure' into Fredericton's municipal government concurrently with the integration of the WiFi network into its municipally-owned communication infrastructure suggests that infrastructures integrate not just technically but also into social and cultural frames.

Conventional histories of infrastructure normally situate involvement by communities at the beginning stages of development before institutionalization begins. Fredericton's Fred-eZone demonstrates how the community scale, where the community is the city as a whole, creates a very specific contextualization for WiFi. This municipal network occupies the space between the grassroots, user-generated innovation of ISF's geeks and the state-level decisions that regulate information infrastructure. However, there are no geek-publics in Fredericton. The Fred-eZone's civil servant developers already had expertise and influence, as well as a mandate to develop public services. Unfortunately, there is no community-public either. Although the Fred-eZone succeeds in establishing a new institutional framework for community WiFi, it seems useful to the city primarily as a part of its branding strategy rather than as a platform for community engagement. This suggests that as WiFi networks become infrastructure, they may still struggle to serve their communities.

Conclusion

Fredericton's integration of its networking projects into its branding as a "smart community" highlights how institutions can build around not just the symbolic aspects of new technologies but their material aspects. Although the government began developing ICT infrastructure as a response to a lack of connectivity, the WiFi project was intended not to solve a practical problem but to demonstrate the city's innovativeness. However, the WiFi project was also structured in some ways as a public service: it was integrated into an institutional framework where the municipal government managed technical infrastructures and provided connectivity. Technical choices, like the decision to run network traffic through the city's own firewall and servers, as well as to block ports and throttle speeds during the day limited the openness of the Fredericton network, configuring the most desirable uses.

Framing the Fred-eZone as part of a branding strategy that markets Fredericton as a connected, "smart community" boasting an "intellectual infrastructure" presents a paradox. More communication links may make Fredericton more visible when compared with other cities, as evidenced by the international recognition the city has received,[37] but the visions of using WiFi to symbolize an intelligent, creative city obscure the realities of how connectivity is integrated into local culture. Expanded networking does not automatically inspire global competitiveness. Sassen (2001; 2002) argues that increased availability of communications has bolstered the dominance of cities that were already major hubs of finance capital and communication infrastructure. Connectivity has not "flattened the world", she argues, and each individual city is not made equally competitive merely because of better communications infrastructure. Instead, high-tech clusters emerge and create cities with desirable cultural attributes (including connectivity), which motivates the development of subsequent communications infrastructures (Zook 2004). Florida's (2002) notion that a "creative class" of innovators contributes to the development of creative cities links cultural attributes (including both creativity and connectivity) to the concentration of talent in particular locations. Florida claims "technology, talent, and tolerance" as key indicators of increased creativity may have inspired technology projects like the Fred-eZone, and help to explain why these kinds of projects are used to symbolize innovativeness and creativity. Both Fredericton and Montreal attempted to use WiFi technology projects to differentiate their cities from others by evoking "intelligence," "innovativeness," or "creativity."

In an era of competing "creative cities" (Lovink and Rossiter, 2007), connectivity alone may not be enough to distinguish Fredericton. The city must integrate its ICT projects into broader social and economic development, which could include developing applications for the city's WiFi network. People working in Fredericton's technology-sector already focus on the city's culture. A CEO of an online rights management company described a shift from "being anywhere, and doing your job from anywhere" (Barry Friedman, Interview Feb 15, 2007) to being part of a cohesive strategy for attracting and maintaining high-tech businesses and educated workers. Although Fredericton (and to an extent, Montreal) draw on their WiFi networks as means of creating positive images of their cities as innovative, the networks they develop are most useful to residents themselves, since they reflect local priorities and contexts. Because of this, creating and maintaining a cohesive IT sector cannot begin and end with providing the technical connectivity. A Fredericton city councilor describes why he feels that the city has not developed an IT sector: "there are lots of little things going on here and there, but they are not necessarily connected to one another" (Tommy Jelnik, City Councillor, interview Feb 18, 2007). Developing local capacity must continue beyond building networks and branding them as innovative. For the Fredericton municipal government's evocation of WiFi as a public service to move beyond the purely metaphorical level, choices may have to be made, especially as the disruptive cachet of WiFi diminishes.

Fredericton's municipal government has institutionalized discourses and practices related to WiFi, and changed the landscape for provision of network connectivity within its municipal area. It has also established a WiFi network that represents the city as a smart community and a knowledge centre within its own region. The city's approach to developing these identities has been to use WiFi to indicate city-owned property, and to encourage occasional use of the internet not only in "third spaces" between work and home but also in hotels, truck stops, and parking lots. This approach concentrates on Fredericton's image as a knowledge centre, in comparison with other cities, as part of an overall economic development strategy designed to boost business development, immigration, and retention of skilled workers. This approach positions WiFi as a symbolic marker of innovation rather than a means of bridging the digital divide or offering an alternative to commercial residential internet services. The Fred-eZone is one small symbolic element of a broader "intellectual infrastructure" made up of ICT infrastructure, research institutions, business development, and transportation links like the airport and highway system. While the concept of "intellectual infrastructure" suggests that WiFi will be a public service or broadly accessible, the Fred-eZone has not been specifically associated with strategies for bridging the digital divide.

The Fred-eZone project presents an alternative to the paradigm of corporate ownership and delivery of telecommunications. It can therefore be understood as an example of how contemporary computerization movements become more institutionalized while retaining their local impact. This is not the only possible way for computerization movements to develop: in the next chapter I explore how community wireless networking became framed as part of a broad national – even international – movement. For a computerization movement that focuses on the importance of local community, this requires a consideration of how communities and publics might influence the policy-making process. The next chapter examines how the communities and publics involved in CWN create forums for knowledge exchange that also establish new opportunities for policy development.

Chapter Five: The Community Wireless Networking "Movement" -- Articulating Technology and Politics

We drove for twenty hours from Montreal, down through impoverished Michigan, across rural Indiana and into Missouri. "We" were half the Canadian representatives at the National Summit for Community Wireless Networking of 2006, which was held in a suburb of St. Louis, Missouri. The group included two of the founders of Île Sans Fil – Benoit Gregoire, at the time one of the main developers of the WiFiDog software, and Michael Lenczner, the self-proclaimed "mascot" who so clearly articulated the social potential of WiFi hotspots. There was a camera operator making a documentary on community WiFi in Canada (a project that was never completed), and me. The other Canadians, who traveled from Toronto included Graham Longford, the CRACIN project's postdoctoral fellow, Dory Kornfeld, a geography graduate student, Gabe Sawhney, the founder of WirelessToronto, and Hanna Cho, a graduate student researching social capital development through technology development. Our identities and practices during these Summits contributed to the ways in which this event and similar others defined new socio-political frameworks for WiFi technology, by explicitly connecting it with social justice goals in a purported "movement." Instead of being institutionalized through an organizational structure like the municipal government in Fredericton, the CWN movement contextualizes community WiFi as part of a new social movement where discourses, practices, skills and knowledge transfer horizontally among participants.

On the first day of the 2006 Summit I attended a session discussing ways of mobilizing community organizations using wireless technology. Dharma Dailey, a community activist who had worked first with community radio activists and more recently with WiFi, referred to a "community wireless movement." Soon others in the session began talking about a movement. I asked, "What is this movement? Who is it for?" to which others responded: "a political movement based on lobbying for more open radio spectrum", and the statement "we are looking for more communication for more people" (Field Notes, April 5, 2006). A year later, at the following Summit, Eddan Katz, an intellectual property lawyer and head of the Yale University Information Society Project observed a panel on policy research, saying "I'm having trouble getting a sense of what's important here . . .it seems that technology is the framing for the whole movement" (Field Notes May 20, 2007). These two vignettes raise the question of what a CWN movement might be – and how WiFi technology might be meaningfully placed into the flexible, global and networked forms and institutions that characterize new social movements.

Introduction

Background: Community Wireless Networking

This chapter examines the process by which Community Wireless Networking becomes politicized. As the case studies of ISF and the Fred-eZone have shown, local WiFi projects have unique social, political, and organizational impacts, including the development of WiFi publics and the symbolic linkage between local WiFi networks and an innovative local culture. These previous chapters have hinted at some of the broader policy issues that local WiFi networking raises. This chapter begins to explore these policy issues through an examination of the broader CWN "movement" as I experienced it as a participant. It outlines the origins of this "movement", linking it first to FreeNetworks mobilizations concerned with free and open information infrastructure development, and then to IndyMedia community media mobilizations. The chapter describes how these origins and their political ideologies help to define two important articulations – connections – that CWN participants make between technology and society. After discussing some of the tensions between these two articulations, the chapter concludes by discussing how the CWN Summits in 2004, 2006, and 2007 acted as network forums (Turner, 2005) creating sites of exchange between groups of people with different ideas about the connections between WiFi and politics, including geeks and social justice advocates. Finally, the chapter suggests that the concept of 'hacking' acts as a type of 'contact language' (Star and Greisemer, 1989) that establishes both a shared identity for participants, and a more politicized context for community WiFi.

The "Movement"

Sascha Meinrath deserves some of the credit for first circulating the discourse of a CWN "movement" by helping to organize in 2004 a "National Community Wireless Summit" meant to "launch the Community Wireless Networking Movement" (2004). This Summit, and the others that followed in 2006, 2007, and 2008 attempted to mobilize technology developers, strategists, and policy advocates to contribute to a broader assessment of CWN's potential influence beyond merely the impacts of individual local projects. The central questions defined by this first meeting and those that followed were technical, strategic, and political. The explicit questions motivating the 2004 Summit were the following:

- Do community wireless networks really serve the populations they ought to reach, and if not, what needs to be done?

- What is the future of the Federal Communication Commission's (FCC's) unlicensed spectrum policies that enable the innovations that drive community wireless technologies?
- Can dozens of independently-operating community wireless initiatives join together to create a positive future for the movement?
- What technological innovations and software innovations do we already have, and what projects are currently being worked on? (Champaign-Urbana Community Wireless Network 2004).

By 2007 the National Summit had become the International Summit, and the "movement" was described this way:

> The Community Wireless Networking (CWN) movement has evolved since its beginnings in the 1990s. Although it has made impressive strides in the area of developing autonomous mesh networks, the larger success of the CWN movement has been the encouragement of citizens, small businesses, and local governments to get involved in local telecom infrastructure as important stakeholders. More than ever we are taking hands-on approaches to ensure that our communities have the telecommunications infrastructure necessary for an inclusive, dynamic and socially just future. (Champaign-Urbana Community Wireless Network 2007)

By 2007, the "movements" successes were framed as both technical and political: for example, the development of "autonomous mesh networks" and the participation of alternative actors in policy-making processes. They are linked to a broad politicization of WiFi technology that positions it as an alternative to other types of networks. Through the CWN Summits, this politicization connects the technical and organizational questions that the CWN Summit organizers posed with the vision of an "inclusive, dynamic, and socially just future." WiFi technology and practices are discussed in more explicitly political terms than at ISF or in Fredericton. The CWN Summits, much more than individual WiFi projects, have introduced and developed the notion of a CWN "movement" with explicit political goals. However, the ideologies of different participants in CWN, especially geeks and social justice advocates, draw from differing political inclinations – some even claiming that their contributions should not be considered to be political at all.

Methods

As a participant in CWN Summits in 2006 and 2007 I observed and described different ways of connecting technology and politics through WiFi. I participated and observed the Summits, conducting interviews and reviewing documents. In addition to participating in the Summits[38] as a member of ISF and as a researcher exploring CWN, I monitored public mailing lists, websites, wikis, and discussions[39] and created and contributed to discussions about CWN on several different blogs[40]. Through participant observation, structured interviews and informal discussions, and the analysis of mailing list postings (all conducted in 2006 and 2007) I collected a corpus that I thematically coded to explore CWN actors' goals, values, strategies and tactics. I examined how the common values and goals of CWN were framed simultaneously as both technical and political: particularly the goals of accessible networks, autonomous community, and open systems. As I became more active in policy issues related to CWN[41] I encountered more policy actors active in defining the terms of the North American debate. I conducted interviews with some of these actors in 2007 and 2008, as detailed in Appendix Three.

As I observed at the 2006 Summit, two strong currents define the political importance of CWN: one focusing on the possibility of WiFi to create disruptive network configurations that upset conventional structures, and another focused on its ability to act as a cheap form of ubiquitous connectivity. As in Fredericton, these two elements balance each other in a dialectic. The difference in the case of the "movement" is that the balance between interpretations of WiFi as disruptive and ubiquitous influences ideas that can shape policy structures. For example, policy advocacy drawing on the disruptive character of WiFi could focus on its differences from other communication infrastructures, and propose alternative forms of regulation. Advocacy focused on the potential of WiFi to extend internet connectivity might instead concentrate on creating WiFi access that would be available to more people. As this chapter explains, both of these articulations emerge at the CWN Summits and within the CWN "movement."

Origin Stories

Two origin stories for the CWN Summits illuminate the roots of these different articulations between WiFi and politics. One origin story suggests that the precursors to Summits were geek meetings focused on hacking and the development of autonomous networking that created disruptive alternatives to the networks established at the time. The other origin story situates the roots of the "CWN movement" in IndyMedia mobilizations dedicated to expanded communication opportunities and media production by a greater number of people. I briefly discuss these origin stories, describing how the politicization of WiFi was foreshadowed by Indymedia's integration of technical and social goals in its activism.

Libertarian Origins: FreeNetworks Summits

SeattleWireless, established in 1999, was possibly the first CWN in North America. Its members were dedicated to using wireless mesh technologies to create a citywide, non-commercial, autonomous community-controlled network and perceived hacking as a revolutionary activity. Once a year from 2002 to 2004, they joined similarly-minded geeks from around the world for a FreeNetworks Summit, described in 2003 as "combin[ing] overviews of the technologies and motivations, status reports from the frontline, and in-depth coverage of implementation details that provide the conference attendee with the knowledge to bootstrap a CWN in their own locale" (Nettime 2003). The focus was on developing networks, because few had been built, but also on the essential liberation many participants envisioned as being part of the FreeNetworking process, which used free software and open standards. In a link with the somewhat libertarian history of computerization movements the 2004 FreeNetworks Summit featured a speaker from the Electronic Frontier Foundation. The inclusion of this speaker suggests that the FreeNetworks Summits were interested in policy, but perhaps more in terms of retaining the freedom of WiFi hackers to modify equipment than from a social justice perspective concerned with leveraging increased access to communications. The libertarian strain in computerization movements, sometimes appearing in the discourses surrounding free software development, has linked free access to software code with free speech. This has motivated linkages between free software and open WiFi networks.

In 2004 Matt Westervelt, one of the organizers of the FreeNetworks Summit announced another Summit on his blog:

> Not to be confused with this weekend's FreeNetworks Summit in SF, the Champaign Urbana Wireless Network (CuWiN) is throwing a 'National' CWN Summit this August in Urbana, IL. It looks to be a bit different than the Summits up to this point, as it has some funding and is catering to the non-networking-but-interested crowd. (Westervelt 2004)

The "non-networking-but-interested" crowd presumably included people who did not know how to build networks or hack WiFi devices, but who were still potentially interested in other aspects of CWN. As it turned out, the CUWiN hackers had a different understanding of the importance of building and promoting WiFi networks that may have developed from the group's genesis in a local IndyMedia collective.

Social Justice Origins: IndyMedia

In Champaign-Urbana, IL, community WiFi activists drew on the metaphors and practices of the Indymedia movement when they planned their CWN network, called CuWiN. The engineering students and communication activists who were involved with CuWiN were interested in using the network as a distribution platform for community media, as well as a citywide, dynamic mesh network. Many CuWiN members came to community WiFi through community media activism through Champaign-Urbana's IndyMedia collective. The IndyMedia platform, developed on open-source software, supported the distribution of alternative media using a content-management system now common to blogs. This permitted anyone to "be the media": most famously at the anti-World Trade Organization protests in Seattle in 1999. Academic literature on Indymedia is extensive. In some representative literature Kidd (2003) heralds Indymedia as a new form of autonomous media production, while Halleck (2003) describes how its distributed local networks establish a global reach through the web, leveraging its network to challenge corporate media outlets, Downing considers it as part of the anarchist social tradition (2003); in turn, Milberry (2003) assesses it as a social movement in its own right. It also drew from, as Coleman (2005) notes "another, relatively new social movement – that of 'liberated' Free and Open Source software. For example, the first web-publishing tool, Active, was an open-source project for media dissemination coded by Australian hackers" (n.p.). Hill (2003) also analyses the role of software development and software politics in Indymedia, noting that the decisions made by Indymedia's software developers represent the developers' political convictions. However, Jones and Martin (2007) describe how the reliance on technical elites to channel decision-making about how and whether to publish Indymedia content undermines the potential for open publishing to promote a democratic public sphere.

Given these previous insights on Indymedia's history and organization, the role of software development in Indymedia and CWN can be considered potentially politically significant. As Chapter Two has argued, the political compass of the free and open-source software (FOSS) movement is complementary to that of social justice movements, but the two are not necessarily aligned. Without explicitly declaring a political position, the FOSS movement has connections with both utopian and anarchic streams of thought. Although software production is not explicitly positioned as political, Bradley (2003) argues that "a utopian impulse is nonetheless revealed in the typically vague invocations of political anarchism and social democratic ideals that accompany the discursive promotion and legitimization of these modalities [of software production]" (n.p.). The politics of the FOSS movement orient themselves more towards freedom of information than to the principles of equality and anti-oppression, or to anti-globalization associated with social justice advocacy.

CuWiN's activists wanted to reproduce Indymedia's open contribution structure, but at an infrastructural level, through the use of a WiFi architecture consisting of a distributed mesh network. With this goal in mind, they adapted commercial equipment designed to broadcast home and office internet signals to create dynamic mesh networks where each radio acted as both sender and receiver. As IndyMedia was intended to offer an alternative to corporate media, meshed wireless networks were meant to provide an infrastructure alternative to the commercial internet service providers. For the activists in Champaign-Urbana, IndyMedia was political because it expanded who had access to media, and what they could contribute. WiFi could be political in the same way. This shared understanding of the political potential of WiFi led to CuWiN's active role in organizing the National Summits on Community Wireless Networking in Champaign-Urbana in 2004 and St. Charles, MO in 2006, and International Summits in Columbia, MA in 2007 and Washington DC in 2008.

These CWN Summits began to define a "CWN movement" that aimed to politicize WiFi technology as a means to provide more people with internet connectivity, and as a disruptive technology that could easily be modified to serve local needs, including hosting community media. Compared to the goals of the FreeNetworkers, these goals focused less on the technology of WiFi and more on its organization and implementation as they related to other forms of communication and media. Although the questions of freedom and openness that concerned the FreeNetworkers were important to the activists involved in the CWN movement, other questions of policy and regulation also impacted the ability of the CuWiN network to fulfill the roles its participants envisioned. In 2004, CWN members began discussing it as a social movement, but one with at least two political antecedents. The following section examines how the two differing political perspectives described above developed into two different articulations between politics and WiFi technology within the CWN movement.

CWN: A new social movement?

Touraine (1973) argues that social movements emerge from within unique historical contexts, and are always engaged with the salient aspects of these contexts. He writes, "in a society defined by the role of scientific and technological innovation and by a social hierarchy based upon knowledge, and by the pursuit of privatization in the realm of consumption, no social movement can exist oriented toward any other type of historicity" (p. 311). The shape, control, ownership, and value of communications infrastructure are politicized within CWN because actors see in the reconfiguration of technology the potential to engage with one of the most important elements of contemporary society (Lievrouw, 2007). The examples of the FreeNetworks and Indymedia phenomena suggest that CWN is one in a series of interventions where technology and social forms are co-produced.

In the following sections I examine the CWN "movement" in terms of how different groups of actors think about the political consequences of WiFi technologies. I use the concept of "articulation" to describe how politics and technology are connected by different groups of people. In cultural studies, this co-construction of society, culture and technology is referred to as articulation, (Slack, 1999; Slack and Wise, 2005) and as I explored in Chapter One it can conceptualize linkages like the one that CWN participants make between technology and society. The concept describes how politics and technology can be connected. In CWN different articulations between technology and politics contribute to defining the so-called "movement" as a social, political, and technical mobilization that tried to argue for the social and political significance of computer networks.

Articulations

CWN provides a good example of how technologies can be articulated with politics: that is, not just how political discourses are mobilized to inspire social action, but also how technical action works like a discourse to become connected to – articulated with – politics. Through CWN, technology is articulated with politics in two different ways that produce different sites for action. First, WiFi can become politicized because of its potential to provide communications access to more people. This articulation frames technology as intrinsically political, presuming that the expansion of internet access using WiFi assists in extending democracy. I call this the *ubiquitous network articulation.* The actors most often drawn together in this articulation are likely to describe themselves as interested in the social justice aspects of WiFi. Technology is therefore framed as political because access to it influences whose voices are heard, which groups can gain expertise, and where power is produced.

Second, the disruptive nature of WiFi can become politicized; especially in terms of the challenge its architecture might pose to existing communication media. In this articulation, WiFi's political impact is framed in terms of its openness to modification, its unregulated quality, and therefore its potential to allow people to contribute to it (provided that they have the appropriate expertise). This articulation, which I call the *disruptive network articulation*, draws on the newness, flexibility and openness of WiFi technologies as being potentially disruptive to existing communications systems. This articulation between technology and liberation is predicated on the assumption that CWN projects use open-source software, create open networks, and that these structures are politically valuable because they permit freedom of expression by virtue of allowing expert users to modify the technology. The *disruptive network articulation* also promises more horizontal political and technical alternatives to existing communication structures, inspired by the non-hierarchical social structures (volunteer organizations) and distributed technical structures (for example, mesh networks) that develop around WiFi networks.

Efforts to create a broader CWN "movement" motivate these articulations, each of which proposes different means of politicizing WiFi, and each of which mobilizes a slightly different set of actors. In the ubiquitous network articulation, WiFi technology is understood as serving a political project: making communication more just by making it more broadly accessibility to individual citizens. Within this articulation, social action is required to structure WiFi technology so that the political goals accompanying it may be met. WiFi technology is therefore envisioned as a tool employed to expand access to communications. In the disruptive network articulation, WiFi technology is envisioned as intrinsically political – a system shaped by a particular set of values built in to the material form of WiFi. Once the networks have been built with these democratic principles embedded in them, the disruptive network articulation suggests that their disruptive quality could challenge the existing organizational structures of the telecommunications sector.

Table 3 summarizes how these two articulations between technology and policy shape the CWN movement. It describes the key actors associated with each articulation, as well as the existing frameworks or historical antecedents. As I explored in terms of CWN's antecedents, these existing frameworks contextualize the perceived problems to which CWN is responding. In the CWN case, the ubiquitous network articulation frames barriers to access of communication networks as the main problem, while the disruptive network articulation suggest that the greater problem is the lack of openness at a network's structural level.

Finally, the chart suggests that these articulations are associated with different goals. The disruptive network articulation concentrates on the potential for WiFi's flexibility and openness to facilitate the development of more democratic communications, while the ubiquitous network articulation sees new technology and its flexibility as establishing a broader distribution of access to communications. The envisioned – and achieved – outcomes for each articulation are different as well: the ubiquitous network articulation prefigures the development of municipal WiFi projects, while the disruptive network articulation sets the symbolic grounding for advocacy about the political influence of network structures, which includes the politicization of Network Neutrality.

Table 3: Articulations between technology and policy in CWN

Articulation	**"Ubiquitous Network"**		**"Disruptive Network"**	
Key Actors – who participates?	***"Social justice":*** Community media activists, community organizers, telecom policy lobbyists, academics		***"Geek":*** WiFi geeks/hackers, telecom policy lobbyists, academics	
Pre-existing frameworks – what are the existing contexts for these articulations?	***Context:*** Indymedia; Universal access projects	***Problem:*** Barriers of access to communication and media	***Context:*** Free and Open Source Software; FreeNetworks	***Problem:*** Increasing enclosure of existing communications
Goals and Outcomes – what results?	***Goals:*** Democratize technology		***Goals:*** Create technology in line with democratic principles	
	Outcomes: Municipal WiFi		***Outcomes:*** distributed physical networks, social networks lobbying for Network Neutrality	

(Chart adapted from Smith 2005))

The goals of the two articulations sometimes appear to diverge from one another, although they may also blur and blend together. The *ubiquitous* network goals express opposition to telecommunication monopolies and resistance to agenda-setting by corporate interests. As Schiller (1985) and McChesney (1999) describe, ownership and management of telecommunications is increasingly consolidated. One of the major concerns with this consolidation is that control of ownership of telecommunications can also influence the types of media messages distributed, limiting their diversity and reliability. As a response to the consolidation of both communications infrastructure and media content, IndyMedia created the possibility for more access to publishing. As well, computerization movements through the 1990s lobbied for community ownership and control of the means of communication. These efforts created the context for the ubiquitous network articulation. Actors who help develop this articulation perceive WiFi as contributing to an overall expansion of access to media and communications. As I explore in the next chapter, this articulation has influenced the discourses framing the municipal WiFi movement.

Goals associated with the disruptive network articulation define the main problem associated with existing structures of communication networks as a problem of enclosure. In this formulation, one of the main advantages of disruptive networks is their potential to mitigate against the tendency of existing networks to restrict access and forbid modifications. Proceeding from the assumption that the internet and other large information networks increasingly underlie most mediated communication, this set of goals proposes to keep the structure of communication as open as possible, and is oriented towards repairing or replacing the existing internet-based communications networks with a proliferation of WiFi networks that would be easier for geeks to modify, and which would thus prevent communication from being centrally controlled.

At the 2007 Summit, for example, Matt Westervelt described the job of CWN hackers as responsible for "mak[ing] a network that doesn't suck. Right now the internet kind of sucks . . . we can't make it not suck until a network is up and we can fix it" (Field Notes, May 20, 2007). The comment implies that not only is the internet not available to everyone, it is beginning to be restrained and controlled in ways that contravened the spirit of its original, open design. WiFi hackers could, by putting up their own networks, create an alternative, disruptive system that would be more accessible to end users, but more importantly, modifiable by geeks, who could ensure that the networks would not "suck."

Organizing the Summits: Points of Contact and Separation

The CWN 'movement' has created a point of contact between the disruptive network articulation and the ubiquitous network articulation by bringing together individual activists whose perceptions of WiFi were aligned with one or the other of the articulations. Specifically, it has brought together geeks who perceive their WiFi work as disruptive, and social justice actors who describe WiFi as being important because it might make communication infrastructure more ubiquitous. As Slack and Wise (2005) note, articulations are not firm nor totalizing and in the CWN case the alignment of actors with one or another articulation is not mutually exclusive. Geeks describe themselves as oriented towards social justice, and many CWN actors deeply committed to social justice have strong technical backgrounds. Still, discussing the tensions between different types of articulations provides another example of how social movements organized around technology can be politically ambivalent and create flexible and contingent socio-political institutions. This section describes how the Summit's organization contributed to this political ambivalence by both bringing together geeks and social justice advocates, but also by separating them based on their interests.

The 2004 CWN Summit was the first point of contact for a broad range of people interested in CWN, including geeks and members of social justice organizations, even though many local CWNs, like ISF, have some members who identify themselves as geeks and others who put forward a more politicized identity. However, the Summits established an organizational structure in which these different actors might influence one another. In contrast to other CWN meetings like the FreeNetworks Summits that focused mostly on hacking and coding, defining politics as interesting rather than central, the 2004 Summit included parallel tracks on "Technology" "Policy" and "Implementation." These inclusions were meant to help the newly-defined CWN "movement" transcend the narrowly-defined, technologically-focused goals that had previously been associated with community WiFi projects and that Sandvig (2004) found lacking in political influence[42]. However, the creation of these parallel tracks had an unintended consequence for the CWN movement: as the participants divided themselves by interest, the "Technology" track segregated participants most interested in discussing new technology and network structures, while the "Policy" and "Organizing" streams attracted many people with fewer technical skills but with interest in extending internet connectivity to more communities through the use of wireless technologies, or for advocating for changes to policies that impact wireless and internet technology.

At the 2006 Summit, some self-identified "WiFi geeks" participating in the Technology stream, stated that they were not "policy people," and that they weren't interested in politics. In a defense against the movement's potential association with a-political geekery, comments during the Summit's plenary session specified that "this isn't a geek movement – it's a movement of people who know how to use certain tools, working with other people. It's not just about the technology" (Field Notes, April 5, 2006). In many ways, these comments establish even more distance between geeks and non-geeks by reiterating that the "movement" should not be "about the technology." As I described above, these different social imaginaries were already associated with different articulations between WiFi and politics. The next section describes geek and social justice imaginaries in detail, drawing out some of the points at which different articulations between technology and politics come into conflict with each other, particularly around issues of interest and expertise – elements which also connect with gender, race, and class.

Movement Geeks

As I have already discussed, geeks and hackers use technology to define their social imaginaries. Geeks at the Summits envisioned community WiFi as facilitating increased control of the networks by their (geek) designers, as well as liberation from the obligation to use code or systems that were under proprietary ownership. Furthermore, they envisioned community WiFi networks as ideally built in a non-hierarchical manner, following 'open standards' that would permit any device equal access to the network. Open-source software and open access standards could, as far as these geek visions were concerned, go some of the way to routing around the enclosure of the internet, characterized by corporate ownership of its backhaul bandwidth or government control of content (Goldsmith and Wu 2006). Autonomous WiFi networks controlled by their creators could thus offer an alternative to enclosed or controlled communication systems, in a problem that also concerned other critical computerization movements.

CWN also helped to define geeks as socially involved "citizen hackers" and to underline the importance of technical skills in inspiring social change. Like IndyMedia, it made technical expertise central in social change projects. This created an almost aspirational quality to being a geek in CWN: the national and international meetings, even more than local projects, established technical expertise as cool and powerful[43]. As part of a blog discussion of technology and political action, Michael Lenczner expressed his opinion of how geeks contributed to social change:

> I can understand people looking at ISF as grassroots and as succeeding because of "bottom-up" or people-power type stuff. But mostly I don't feel that way. I feel that these people are technical experts. Our knowledge is power and our ways of collaboration as arbitrary and byzatine (sic) as any other way of working. I feel sometimes that we are using our power + expertise (sic) to impose infrastructure on people (comment by Lenczner on http://youcancallmeal.flinknet.com, Sept 16, 2006).

This comment describes geeks as having power and expertise that they can use to "impose infrastructure." While it gestures at more socially inclusive "people-power type stuff" it rarefies geek expertise. In the case of Lenczner, who was very competent in modifying WiFi devices and developing web pages, but was not a skilled programmer, the comment can also be read as a desire to be part of a group of experts with the power to change the modes through which people communicate. To be a geek, or to aspire to be a geek, is to endeavor to cultivate a special relationship with technology and with others who also have the same kind of relationship. As I explored in the Île Sans Fil case, geek identities area also gendered, and often part of hegemonic masculinity.

Other people at the Summits also seemed to aspire to geekdom. One afternoon at the 2007 Summit I was writing notes when a colleague, who in his day job was a senior technologist at Cisco, leapt over to me. He had been discussing the function of a particular piece of hardware with some other participants, all much younger and dressed in t-shirts with ironic logos. In striped shirt and khaki pants, he exclaimed, grinning, "I'm a geek" before turning and skipping away. I read my colleague's announcement as a hope of becoming accepted by a radical group capable of revolutionizing communication. Since being a geek does not depend on professional status but on rather on technical prowess, becoming a CWN geek or "citizen hacker" is all the more desirable because of the skill it implies – and CWN also, conveniently, provides an outlet for these kinds of geeky skills not necessarily valorized elsewhere (as Chapter Three explored).

Practical Politics: Making Social Change through Technical Change

Because technology's political character was at the centre of the movement, geeks with strong technical skills perceived themselves – especially at the earlier Summits – as being able to influence policy by building things. At the 2006 Summit one participant remarked, during the final roundtable session: "we need to build an independent, redundant communications network . . . policy be damned. If we build the network, we control the network." (Field Notes, April 5, 2006). Another expression of the same sentiment was posted on my blog after the Wizards of OS conference in 2006:

> Consider a member of a community who goes down the street to talk to a neighbour . . . they have a conversation. They both take responsibility for what they say and engage in a liberal flow of words and sentiments. The same thing should take place in network communities – an electronic conversation inside a private network which is decentralized, self governing and self propagating. If this requires re-writing the IP stack then why the hell not – there's plenty of time before tea! (Comment by Will Hall on http://youcancallmeal.flinknet.com, September 20, 2006).

Both of these comments express the idea that building a network could establish values and conventions (community control or rational liberal discourse, respectively) that could be as or more effective than taking political action. In many ways, this action-oriented approach to politics is reminiscent of the libertarian politics of individual freedom enacted through software and licenses by Richard Stallman's Free Software Foundation. Community wireless geeks look to the CWN movement for a valorization of both their skill and oppositional ethic, even if this ethic is not well expressed. Similarly, a community wireless "movement" depends on geeks to provide expertise and legitimacy by creating resistant or oppositional forms that challenge existing media and communications infrastructures.

Social Justice Advocates

The geek perspective on doing politics by building networks instead of politicking highlights the difference between geek politics and those of social justice advocates. For the most part, the self-identified geeks were white, educated men, who were not representative of broader CWN participants who may have self-identified differently, including most of the women and people of colour I met at the Summits. These participants were often critical of what they saw as a valorization of technology for its own sake. The 2006 Summit concluded with a passionate discussion of who geeks were, and how to get more people to be geeks. This essentializing perspective mirrored the essentializing of gender at ISF. Similar affirmations of the broader non-technical goals of CWN included references to community wireless as "part of a media reform movement" and as "a cultural movement; technology is just part of it." One participant suggested that a key framework was the way WiFi and other technologies facilitated communication: "when you strip it down, everything is about communication" (Summit Field Notes April 5, 2006).

Some participants who were more invested in the social justice potential of WiFi were highly critical of what they saw as the depoliticized actions of geeks. One of them, Josh Breitbart, became involved in CWN because of an interest in community development through the production and distribution of alternative, community-produced media[44]. In a blog posting reflecting on community participation in municipal WiFi projects, he describes what he sees as the failing of geeks contributing to their communities by building tools and networks. Breitbart argues that the development cultures of community wireless networks do not create the kind of engaged, democratic local population that should be the goal of social justice interventions:

> One problem was that many (though not all) of the so-called "community wireless networks" were actually civic wireless networks. Rather than community-based efforts to solve local problems, they came from a small group of technologically-endowed people wanting to contribute to their city. This becomes a problem when the city or a corporation moves in. If people's only connection to the project is access to the technology, they will not care who provides the technology." (http://breitbart.wordpress.com, April 16, 2006).

In this analysis, Breitbart criticizes the geek ethic of 'giving back' arguing that civic participation through network building does not amount to a solid engagement with community. He claims that without a broader community participation in creating or managing a network, or determining what kind of content should be distributed across it, the benefits of community WiFi are reduced to technical access alone, as occurred in Fredericton. This criticism echoes concerns that without community media or local content, geek-publics are mobilized to make contributions that ultimately serve to establish consumer expectations for free WiFi in public spaces, as opposed to broader access to and engagement with media.

Politics of Inclusion

Social justice advocates at CWN Summits conceived of the politics of technology in a different way than the geeks: instead of primarily concentrating on the potential of WiFi's unique structure to inspire alternative forms of communication infrastructure, they framed the central issues as related to access and control of communications infrastructure. Many social justice activists did not necessarily consider hacking WiFi devices as a sufficient means of achieving political goals. For social justice advocates, WiFi was politicized because it could create a way for communications infrastructure to be built more cheaply and flexibly in order for more people to gain access to media. Like the CWN geeks, the social justice advocates involved in CWN found the dynamic mesh form inspiring because its more horizontal structure promised a more equitable and open alternative to broadcast forms[45]. However, the political quality of the network was in its application, not in its intrinsic technical qualities. Social justice advocates drew on the historical context of open publishing for their political framing of the potential of CWN: in the same way as the IndyMedia system provided a much broader group of people with the ability to contribute to online media before blogging became widespread, community-owned WiFi networks could provide more people with access to the internet, and also potential access to community media.

The Dialectic Reappears

The connections between technology and politics that emerge within CWN are thus somewhat ambivalent: different ways of articulating politics emerge in connection with different social imaginaries. Feenberg (1999) argues that technology is available for different political ends: its ambivalence permits both (or either) a conservation of hierarchy and a democratic rationalization of technology. Thus, the dialectic of computerization movements continues even as "movement" goals become more politicized. Geeks often valorize their own expertise, which is in some ways a conservation of hierarchy and a solidification of technocracy, but as Proulx (2007) argues, geek movements can also be perceived as democratic rationalizations of technology because they create new sites for political engagement. This political engagement mobilizes both geeks (through their ability to leverage the disruptive potential of WiFi) but also social justice advocates who work to enroll more citizens and communities in the control of their own communications infrastructure.

Both the ubiquitous network articulation and the disruptive network articulation establish politically progressive visions that establish WiFi as contributing to democratic life. In many ways, the tensions between them create shared commitment to working towards technical and social change. Compared to a social justice movement concerned with equality, a "geek movement" – or better, a "mobilization" – may not carry conventional political markers. The individualistic, libertarian politics associated with a desire for free and open information infrastructures contrast with the greater democracy of access to communications espoused by media democracy and community technology movements. However, these two articulations were brought together at the CWN Summits to create a shared image of WiFi as a "hack" of existing structures and policies that were, for different reasons, unjust. This suggests that the Summits acted as a type of network forum that connected together different perspectives through shared concepts and objects.

Synthesizing Political Dialectics: Network Forums

At the Summits, and particularly in 2006 and 2007, a continuing tension remained between seemingly a-political (disruptive) perspectives oriented towards technical goals brought forward by participants who primarily identified themselves as geeks, and a social justice focus on increasing ubiquity and access to communication. Although this tension highlighted differences between groups of actors, it also brought them together, since both articulations concentrated on the political significance of WiFi networking. This suggests that the Summits have a role as "network forums" where bridges are built between different social imaginaries. Turner (2006) defines network forums as "meetings, publications, and digital networks within which members of multiple communities could meet and collaborate and imagine themselves as members of a single community" (p. 5). He argues that network forums bring together different types of actors who have different proximal relationships to technology, and produce "new social networks, new cultural categories, and new turns of phrase" (p. 5).

Network forums produce a shared language that can bring together people with different types of expertise. In his example of the 1984 Hacker's Conference, Turner argues that hackers "close to the machine" shared their expertise with cultural entrepreneurs who occupied a social category that was much more concerned with transforming technologies into symbolic social goods than in focusing on the technologies themselves. Turner's network forum introduces a key concept into the study of computerization movements: the idea that the people at a remove from technology may have greater influence on how people think about and use new technologies. To do this, journalists, think tank researchers, and other "cultural entrepreneurs" need to have access to people working closely with technology – in Turner's case hackers, and in the CWN case, WiFi geeks.

In the CWN movement, "the cultural entrepreneurs" include advocates and academics motivated by a shared interest in criticizing existing ownership, governance and regulation of communications. These shared values motivated Sascha Meinrath, and other key actors, including lawyer Harold Feld of the Media Access Project, to establish discourses – both at the Summits and through blogs and discussion lists – linking the disruptive and ubiquitous network articulations into a cohesive call for political and social change that underlines the democratic potential of new communication technologies.

Creating a Common Language and Politics

CWN Summits create a common language of a movement, which bridges the different articulations between technology and politics and frames the efforts of a variety of actors as being in the service of a broader common good. This common language reiterates that CWN's fundamental aim is to develop as a social movement dedicated to making communications more democratic.

The discourse of the "CWN movement" circulated before the Summits, connecting a range of vaguely political impulses. For example, the libertarian Foundation for P2P Alternatives (an online clearinghouse of documentation related to peer to peer initiatives) described the Community Wireless Movement as "a worldwide movement to create a bottom-up and wireless broadband infrastructure, accessible by all citizens" (Foundation for Peer to Peer Alternatives 2006). The "Wireless Commons Manifesto" claimed, "Low-cost wireless networking equipment which can operate in unlicensed bands of the spectrum has started another revolution. Suddenly, ordinary people have the means to create a network independent of any physical constraint except distance" (Wireless Commons 2003). These broad evocations of a "CWN movement" encompass an extraordinary range of political motivations, from libertarian interest in constructing autonomous, grassroots networks to social justice perspectives that mobilize "ordinary people" to transform their lives through technology.

In contrast to these vague evocations of WiFi "movements" and "revolutions" the contact language of the Summits establish a WiFi moment as a public interest response to communications problems emerging at a specific critical juncture shaped by regulatory changes occurring around the time of the Summits. This context included issues of community ownership of networks, network structure, and technical principles such as network neutrality. I discuss these below in detail. To address this context, CWN organizers concentrated on bringing together sympathetic people with different skills and interest in WiFi networking. Sascha Meinrath explains "around 2004 we realized that even if we could build these technologies we couldn't deploy them because of different issues like it being illegal or not having spectrum, and made me think in my work with Free Press [a media reform nonprofit] about the idea of community wireless blending geekery and wonkery" (February 22, 2008). The "wonkery" that Meinrath is referring to describes policy advocates or policy makers (policy wonks). As a way of connecting CWN hacks with policy change, discourses and technical projects that emerged after the CWN Summits concentrated on defining the movement's politics in terms of political and social change.

Discourses of the CWN "Movement"

Turner argues that the main product of network forums are new types of discourses: "contact languages" that are produced as ways of bringing together people with diverse backgrounds working in different areas, and public discourses that communicate the commingling of different social imaginaries. He argues that at the 1984 Hacker's Conference journalists like John Markoff, who worked for the New York Times at the time, reported on the countercultural hackers, setting up a public discourse in which countercultural politics were linked with hackers. Markoff (2005) revisits this process in his history of the links between the counterculture and the computer industry. Similarly, blog posts, videos, and documentation contributed by participants at the Summits circulated discourses about politics, while retaining a sense of playfulness in the Summit environment.

Documentation from the Summits mixes references to the political impact of CWN with reference to the "do-it-yourself," hacker spirit of participants. After the 2006 Summit Lisa Yeo, a technologist from the city of Edmonton, wrote "There's a bit of an 'information wants to be free' energy. Neat. The speakers talk about the importance of communication to democracy. . . .Participating in the most profound revolution in the history of the species . . .Relationship between technology and the 1st amendment rights to free speech. . . .The agents of change are the geeks!" (http://ablogofherown.postopolis.com/category/community-wireless/ April 2, 2006).

After the 2007 Summit, a review article in *Government Technology*, a blog discussing online government, opened a discussion of the policy challenges facing CWN projects by describing the difference in approach between CWN actors and the participants at commercial WiFi conferences. Josh Breitbart writes:

> Compared to the more professional attendees of other wireless conferences like MuniWireless and W2i, the people at the International Summit for Community Wireless Networks are a ragtag bunch. They do things like walk up to a McDonald's drive-thru window at 2:30 in the morning impersonating a car in the hopes of scoring some late-night food. But its folks like this that invented wireless networking and, judging by the Summit attendance, they have spread their innovation to every corner of the globe. Their gusto was on clear display at the three-day affair. (Breitbart 2007)

The article continues by discussing the commercialization of the "cultural rebellion" of community WiFi by municipal wireless projects and concludes by referring to the need to continue "hacking" – or mobilizing geek interest in the disruptive potential of WiFi to construct more ubiquitous, accessible, or community-owned networks.

Hacking Politics

Keynote speeches made at the Summits by public-interest lawyer Harold Feld and reproduced on his blog emphasized how the CWN movement acted as a way of "doing" politics that could have important policy implications for goals of expanding social justice. The online version of the 2006 keynote speech reads:

> Politics is our desire to make a better world, and our deliberate actions done to make it so. That can start as small as wanting to unwire your neighborhood, or writing software documentation to help someone set up a node. You make a conscious choice to do something to make a better world. You have made a political act, and given yourself power. NEVER let them make you ashamed of that. NEVER let anyone make you so desperate not to get caught doing "politics" that you would rather stay helpless (Feld 2006).

Feld's speech concentrates on the political intent inherent in taking action to "make a better world." Using examples of technical activities, his speech makes a tangible link between hacking and politics.

This connection re-emerged at the 2007 Summit, in a discussion on the "demise of the citizen hacker." Initially, the discussion focused on the decline of "device hacking" – working directly with WiFi software and hardware – within CWN. Even the title of this panel suggests that self-identified "hackers" felt defensive about how their activities contributed to a more politicized CWN "movement." However, by 2007, municipal WiFi projects were announced in an increasing number of cities (a more detailed discussion of municipal WiFi follows in the next chapter). This increasing enclosure prompted Matt Westervelt to comment that he felt that CWN projects, as they attempted to influence municipal networking projects, were departing from "what community needs . . . People making money don't care about neutral networks or openness" (Field Notes, May 20, 2007).

The 2007 conversation about "hacking" shifted to defining the characteristics of a community wireless network, which participants claimed should offer "access to all kinds of devices", and be "hackable." These comments seemed to indicate a clear opposition to large-scale networks constructed primarily to facilitate access to the internet without remaining open or "hackable." The ideal community network, participants argued, should be both broadly accessible to a wide population as well as being open to modification. In essence, it should be *both* disruptive and ubiquitous. Going further in connecting the different articulations by creating a shared language, Rich Mackinnon, another participant, attempted to expand the definition of hacking: "Sometimes hacks in technology open the way for policy hacks" (Field Notes May 20, 2007). The idea of policy advocacy as also a "hack" created a shared frame of reference for Summit participants engaged with more conventional social justice work focused on shifting political discourse and impacting regulation, and geeks "doing politics" by hacking. By the end of this discussion the divisiveness expressed in the comments above had dissipated, and participants collectively understood that the CWN movement encouraged "hacking" of all kinds. This contact language reclaims "hacking" as part of the political process, blending together the playful, critical resistance of geeks with the broader questions of political justice mobilized by social justice advocates involved in CWN.

Critiques

The emergence of "hacking" as a key part of the contact language that developed around the CWN movement's politicization is somewhat problematic. It overly valorizes the libertarian, geek contribution to politics; after Feld's 2006 keynote, Summit participants engaged in a critical discussion of whether "doing" politics required technical expertise. If it did, participants worried that this might form yet another barrier to political and social engagement, which could counteract the efforts of those working for greater social and political inclusion. The 2007 discussion on the demise of hacking suggested that some fundamental elements of inclusion had not been achieved– all of the people in the session were men, except for me. All were white.

However, the CWN Summits have still created the opportunities for diverse groups of people who may have had opposing views on the political character of WiFi to join together to actualize its progressive political potential. Aligning CWN with political ideologies of social justice as well as with geek libertarianism brought many more women and people of colour to the CWN Summits than I had encountered at ISF meetings or in the Information and Communication Technology offices in Fredericton. Telecommunications policy analysts, heads of grassroots organizations dedicated to expanding access to communications, and academics also attended the Summits, helping to define the political significance of CWN in social justice terms – rather than in the (somewhat defensive) geek terms of "citizen hacking". However, like the rest of the participants involved in CWN, these "non-geeks" felt that the CWN movement made important social contributions. For example, it could provide community members a chance to work directly with the people who had expertise in building networks, create more accessible networks that could resist corporate monopoly, or highlight examples of grassroots innovation (Powell 2006) .

Establishing the "movement" within the network forums of the Summits provided a clearer political orientation for CWN than the previous vague, technologically deterministic references to a "wireless movement." The North American CWN combined an action-oriented approach to "doing" politics with a sharper sense of the implications of community WiFi networks for access to public radio spectrum, control over communications, and redevelopment of community media. The connections between these visions of WiFi's importance were evoked in contact language that described CWN as a "movement" based on "hacking" technical structures and politics. The next chapter describes and analyses the full extent of how "policy hacking" bridges discourses and practices from CWN to broader policy spheres. The connection between *disruptive* and *ubiquitous* perspectives on CWN's political potential indicates how network forums like the Summits connect different forms of discourse, practice, and expertise. At the Summits, diverging politics and expertise began to be connected through a contact language evoking a "movement." This contact language also helped establish a loose but flexible organization of people who advanced public interest perspectives on WiFi at a critical juncture in policy and technology.

Conclusion

In this chapter, I have summarized the historical antecedents of the North American CWN movement, arguing that it has both libertarian and social justice influences. These influences align with two articulations between WiFi technology and politics: one I call the *disruptive network articulation*, which connects politics with the open, modifiable, disruptive qualities of WiFi hardware and software (and with the individual freedom creating and modifying these networks can provide to their developers). The other I call the *ubiquitous network articulation*, arguing that it connects WiFi's inexpensiveness and ease of deployment with visions of expanded access to communications in the context of greater social justice. I describe two groups of actors – geeks and social justice advocates – who are often associated with these articulations, and explore the tensions produced by these two different ways of thinking about WiFi politics.

In the second section of the chapter, I propose that the CWN movement, although it allows these competing articulations to develop, actually serves as a point of contact between them, establishing a network forum that frames WiFi as a technology that can serve the public interest. This politicization frames WiFi network development as a type of action-oriented politics, and evokes "hacking" as a political act. Overall, the chapter outlines the role that Summit meetings – as network forums where people meet and exchange ideas – can play in changing the political orientation of WiFi. In the next chapter I argue that the connections created through the contact language and shared politicization of WiFi influence expectations emerging around the development of institutions and public policies governing wireless communications.

Chapter Six: Policy Hacking as a Discursive and Practical Bridge

In late 2007 I am invited by Sascha Meinrath to attend a meeting in Washington DC, to discuss the future of municipal wireless. I'm not able to travel to the meeting, so I watch the videotaped proceedings on YouTube. I can see that most people in the room are wearing suits. I recognize some people I know from community wireless meetings – they are wearing suits too. Sascha introduces the theme of the conference, which is to discuss policy strategies for expanding both municipal wireless and the open spectrum where unlicensed devices like WiFi routers operate. The speakers at the meeting are familiar colleagues: CWN advocates, people working in organizations dedicated to creating more accessible media and communications, and scholars concerned with democratic media and communication rights. The event is sponsored by the Washington DC-based progressive think-tank the New America Foundation, where Sascha works as the Research Director of the Wireless Futures program. Suddenly all of this seems so serious and political: the suits, the conference room, and the opening speech by a sympathetic United States congressman. The congressman, the Pennsylvania Democrat Mike Doyle, says in his speech, "You have to remember that WiFi was a technology for connecting conference rooms. The fact that it has expanded to cover downtowns and entire communities is a triumph. The massive expansion of WiFi is a testament to the efforts of engineers. Now the task is to extend the benefits of unlicensed spectrum to other areas" (Feb 6, 2008).

Watching the speech, I am struck by this new, mainstream politicization of WiFi, by the conceptual and technical distance that it has travelled, from being discussed by enthusiastic geeks in black t-shirts to inspiring serious suit-wearing policy wonks. I remember the 2007 Wireless Summit, and the discussion about hacking that ended with Rich McKinnon from Austin Wireless saying, "hackers like unfriendly spaces, so sometimes hackers in technology open a way for policy hackers" (Field Notes, May 20, 2007). Maybe Sascha, sitting next to the congressman in his suit, is still doing a kind of hacking, one that he had defined and experimented with ever since his grad student days when he "invited some geeks over to my apartment for some pizza and beer" (Sascha Meinrath, interview Feb 22, 2008). In transforming the practices of WiFi hacking, and moving its self-taught, grassroots experts into more influential spheres, maybe hacking could be transformed – even into something like "policy hacking."

Introduction

This chapter describes the expansion of the discourse and practice of hacking, defining "policy hacking" as a critical response to political or policy issues connected with community wireless networking. Describing the policy making actions of CWN actors as "hacking" reinforces what Turner (2006) and other STS scholars in communication studies refer to as bridging discourse: a 'contact language' between two previously unrelated fields that enhances their social significance. Like Turner, I argue that bridges can connect both discourses and practices: "policy hacking" brings together technical modifications of WiFi technology and interventions in policy and regulatory spheres, framing them in a new context of public interest advocacy directed at policy change. In this chapter I examine the emerging discourses and practices of "policy hacking" as it is connected with CWN. I first describe a conceptual framework and some possible genealogies for policy hacking, and then I examine how key CWN actors have bridged discourses and practices of hacking. WiFi's potential disruption of existing communication ownership and governance structures also contributes to a potential critical juncture for communications in North America. In the second part of the chapter I describe how the politicization of Network Neutrality as a media reform issue connects CWN geeks and media policy actors. Finally, I consider the response of CWN actors to the expansion of municipal WiFi projects in North America. This chapter concludes by describing the limits of CWN policy hacking.

Methods

This chapter, like the previous one, is based on participant observation of the 2006 National Summit for Community Wireless Networking in St. Charles, Missouri and the 2007 International Summit for Community Wireless Networking in Columbia, Maryland. It also draws on telephone interviews with CWN and media reform actors Josh Breitbart, Dharma Dailey, and Sascha Meinrath conducted in February 2008[46].

"Policy Hacking"

The bridging discourse of "policy hacking" connects hacking and politics by expanding the activities that can be considered hacking. It aligns the creative development and modification of software code and hardware devices, with political advocacy, which more often involves writing texts directed at governmental employees or elected officials, making phone calls to gather knowledge or mobilize people, and organizing events. The idea of policy hacking suggests that in order to advocate for policy reform and policy in the public interest, current policy making structures should be transformed.

This is a different kind of political framing for hacking than 'hacktivism', a term that refers to political actions undertaken online. Samuel (2004) defines hacktivism as "the nonviolent use of illegal or legally ambiguous digital tools in pursuit of political ends. These tools include web site defacements, redirects, denial-of-service attacks, information theft, web site parodies, virtual sit-ins, virtual sabotage, and software development" (n.p.). The development of community WiFi systems certainly involves software (and hardware) development in the pursuit of political and social ends, but as previous chapters have explored, these actions have been framed as disruptive or innovative rather than illegal or legally ambiguous. In addition, hacktivism as Samuel understands it appears to primarily act as a way of representing political ideas in the digital realm, rather than being part of a process of creating open communication structures using whatever tools (code, radios, legislation) are available. My concept of policy hacking considers hacking as a type of engagement with and modification of many types of constraining structures. Furthermore, none of the CWN participants I encountered ever referred to what they were doing as "hacktivism." However, they did use the term 'hacking" to refer to advocacy pursuits that did not involve modifying devices, but which held the same purpose as "device hacking": to critique, route around, or reconfigure structures that constrained liberty of expression or openness and accessibility.

Policy Hacking as Sociotechnical Work

This chapter completes my examination of 2000s computerization movements by analyzing how the discourses and practices of policy hacking form a bridge between CWN and the media reform movement, defining the participation of non-commercial, municipal and community WiFi advocates in the policy-making process. The chapter describes how community WiFi becomes politicized through its integration into the broader media reform movement, and how this movement in turn influences North American (especially U.S.) telecommunications policy changes. The previous chapter has explored how the CWN movement brought together geeks and social justice advocates who shared concerns about the structure and function of communication technologies. This chapter examines how a broader range of actors besides the geek-publics normally associated with hacking leverage its discourses and practices to highlight the importance of developing communications infrastructures in the public interest. These bridges between geeks and policy advocates more firmly establish the political influence of communication technology and suggest that CWN work, like other sites of social and technical co-production, is political. This in turn transforms previous perspectives, including STS perspectives that considered policy as merely a contextual framework within which sociotechnical change could occur.

In an example of this turn towards policy, Bijker (2002) calls for STS scholars not only to consider policy as context, but also to be aware of the political nature of their own work. He writes, "societal problems urge a broadening of the STS agenda. The big issues of social order, international peace, local and social security, national and religious identity, and democracy should be addressed again" (p. 4). This appeal for the politicization of research has also occurred in communication studies, with the U.S. Social Science Research Council establishing a program funded by the Ford Foundation called Necessary Knowledge for a Democratic Public Sphere, "premised on the belief that advancing public-interest agendas requires not just the scaling up of political activity, but also a more robust and better-integrated process of knowledge production in and around issues of media, communications policy, and the public sphere" (Social Science Research Council 2007). This chapter addresses not only the co-production of WiFi's social and technical influence, but also the emerging coproduction of knowledge through research and activism. This co-production of knowledge by academics, policy advocates, and geeks may be one of the most powerful and enduring results of CWN engagement.

Like other actors, policy makers play important roles in defining the symbolic and institutional contexts for new technology. Further, policy is co-produced along with the technology it regulates. Dutton's (1999; 2006) ecology of games framework not only treats policy-makers as actors, but also acknowledges that they play competing and overlapping roles; thus, policy is the result of the negotiations not just between policy makers and other socio-technical actors, but also between the different roles that individual policy makers play. Understanding policy as being produced along with new technological developments expands the range of actors who can be considered policy actors. Proulx (2007) defines grassroots technology developers as potential policy advocates, and argues that the social appropriation of technology, which requires technical and cognitive mastery over a technology, can lead to new and politically progressive mediations of technologies. These mediations sometimes contribute to the politicization of these new forms, giving voice to their developers in the process. Therefore, the process of technology production is also a process of political and social engagement. "Policy hacking" is a simultaneous engagement with social and technical aspects of media and communications. In keeping with Dutton and Proulx, I advocate for a consideration of policy not as an external force creating the context for the development of technology and social forms, but as an intrinsic part of this development. To this end I focus in this chapter on the bridging of discourses, practice, and expertise from CWN into policy spheres, using "policy hacking" as the organizing concept[47] and focusing on the influence of media reform at what McChesney (2007) argues is a critical juncture for media, policy, and communications technology.

Hacking as Critique of Existing Structures

Politicizing technology by hacking devices or policies reaffirms the role of hacking as a critique of existing structures. This interpretation of hacking highlights its critical and resistant potential rather than its destructive or subversive nature. Computerization movements since the 1970s have contained this element of critique, but until the 1990s internet boom era, hacking was restrained to a small group of experts (Levy 1984; Markoff 2005). However, the expansion of open-source software development (Moody 2002) and the interweaving of geek expertise into media-oriented new social movements such as IndyMedia (as discussed in Chapter 5) publicized hacking and began to frame it as a potentially politicized activity associated with media-related new social movements including, as I discuss below, the media reform movement. The early 2000s present a critical juncture for media and communications where policy hacking becomes even more important as an intervention in technology, regulation, and media production and distribution. Thinking about public interest policy advocacy as a form of hacking extends its criticism and resistance into a new realm of discourse and practice. It also provides a new kind of identity and expertise to public interest policy advocates: the identity of a hacker confers the credibility of a technical expert and an activist, as well as being associated with creativity and resistance to authority.

The rest of this chapter describes how CWN discourse, practice, and expertise create bridges with the media reform movement and engage with the municipal wireless boom. After describing the contributions that CWN discourses and practices have made in media reform and municipal wireless, the chapter then explores one specific site of 'policy hacking' and analyses its influence on media reform and municipal wireless. This site is the foundation of a non-profit consultancy called The Ethos Group, which grew out of CWN activism, connecting some of the people who had been most active in framing and discussing the policy relevance of community wireless networking in North America. These people developed their knowledge of WiFi hacking by working with CWN geeks and participating in the network forums of the Summits, and their association through the consultancy creates an intermediate institutional space between grassroots activists including geeks working on local CWN projects, and policy decision-makers.

The chapter's final example of bridging describes a CWN intervention in the Requests for Information (RFI) process for the municipal WiFi project developed in Boston, Massachusetts. The chapter concludes with an assessment of the limitations of hacking in the context of institutional changes for WiFi at the current critical juncture. These limitations are related to scale: no matter how well organized CWN advocates become, nor how well connected to other public interest advocates, they can not compete directly with telecommunications companies, as the example of the radio spectrum auctions that took place in the United States in late 2007[48] indicates. Because CWN's influence in policy spheres has resulted from its bridges with the media reform movement, I begin the chapter with a discussion of democratic media reform and its importance at the current critical juncture.

Media Reform

The media reform movement, or "democratic media reform" has been defined as a social and political mobilization dedicated to addressing the "massive democratic deficit in the field of public communication. Hackett and Carroll (2006) describe the movement as a type of new social movement linking broad criticism of existing, hegemonic media institutions with grassroots engagement oriented towards ameliorating the public sphere through the creation of counter-hegemonic media and sensibilities, establishing the function and importance of alternative and community media. They describe eight main themes of concern:

- the media's increasing failure to help constitute a democratic public sphere;
- the centralization of political, civic, and symbolic power inherent in the political economy of commercial media industries, in the era of 'convergence';
- the reinforcement of gender, ethnic and especially class inequality resulting from the commodification of information, the dependence on advertising revenue, and other economic as well as ideological mechanisms;
- the relative homogenization of the potential diversity of publicly articulated discourses;
- the media's subversion of a healthy political culture and a sense of community, at local, national and global levels, through such imperatives as fragmentation, ethnocentrism, and consumerism;
- the transformation of the public commons of knowledge into a private enclosure of corporate-controlled commodities, notably through the expansion of 'intellectual property rights';
- the elitist and often secretive process of communication policy-making in the US and UK[49];
- the erosion of privacy and free expression rights since the 9/11 terror attacks, particularly in cyberspace. (p. 3-4)

By engaging with these themes, the media reform movement attempts to construct a new paradigm and public interest policy regime for public communications. McChesney (2007) argues that media and communication systems in North America is at a critical juncture, because of the increasingly undemocratic nature of mass media – which is converged in ownership and limited in content – and the unfolding and often vexatious debates about how to regulate the internet. The political consequences of unpopular military conflicts and the failure of conventional media to criticize government also contribute to this critical juncture, which is intensified by consolidation of media ownership and an evisceration of quality, investigative journalism. McChesney (2007) also argues that the current ownership, regulatory, and technological context places communications at a critical juncture because of three factors: a revolutionary new communications technology (distributed digital media); a discreditation of existing media content; and a major political crisis where the existing order fails and oppositional social movements form. This argument establishes media and communications as central issues of concern for democratic life at the current critical juncture.

As this chapter explores, a key aspect of this critical juncture is that communication infrastructures are increasingly integrated with content providers and within large organizations. For example, in Canada Bell Canada Enterprises owns a broad swath of the communications landscape, from mobile telephony, television, and newspapers in many markets. Not only does this situation produce greater profits for these companies, it can also limit the diversity of the media content available in each individual market. Where local newspapers once carried critical and well-researched local news, consolidation of media markets has limited this local influence by centralizing newsrooms and media production. As alternatives, local community and broader "alternative media" outlets such as IndyMedia, political websites like TakingITGlobal (not to mention local community-run radio stations) promise the diffusion of more diverse voices in the media. The promise of Île Sans Fil's leverage of WiFi as a community media tool draws on this aspect of the media environment's critical juncture.

Media's critical juncture also extends to the level of infrastructure. As cable and telephone companies control more of the backhaul infrastructure that allows people to connect to the internet, they have an increased ability to control how traffic is transferred across those sections of the network. Local networks including WiFi networks provide potential means of routing around this consolidation. WiFi networks also potentially create a platform for community media, since they are accessible to a wide variety of devices without charging fees for connection. However, as the developers of these local networks begin to be involved in broader CWN mobilizations, and share knowledge with people involved in policy formation, democratic engagement increases as more people become involved in the policy making process. Therefore, the expansion of CWN has the potential to provide several new paths for communication policy at this critical juncture.

As Napoli (2006) argues, media and communications policy research is reflecting media reform practice by studying a much broader range of subjects including how media and communications systems are defined, built, and used, as well as the process of media activism. This parallels the bridging efforts that bring together the discourses and practices of geeks and media justice advocates. Similarly, Kidd and Barker-Plummer (2006) argue that linkages are emerging between media reform, alternative and independent media, and the social movement sector. They argue that these linkages can create alternative public spheres that change the nature of media as well as media institutions. The linkages between people with different sets of experiences and a shared commitment to the public good can create alternative public spheres where new policy orientations form.

The media reform movement has an obvious resonance with computerization movements (particularly the critical counter-computerization movements that proposed alternatives to military-industrial structures) through its critique of the hegemonic nature of the existing media system and the encouragement of alternative institutions and structures. However, there is one key difference between the two: computerization movements, even when they are highly critical of the hegemonic nature of the computerization industry, still struggle with the challenge of making computing more accessible and less linked to technocratic dominance. In this context, discourses and practices developed in the more technically-oriented, specialized space of the CWN Summits are reoriented towards openness, justice, and accessibility as they bridge towards media reform's response to the current critical juncture.

Expanding Hacking

As I discussed in Chapter 5, the CWN movement itself is not always explicitly politicized or policy-oriented, although its members (in spite of the tensions between their politics) are brought together by a sense that they are working for the greater public good. Moving from this politically agnostic perspective towards one where politically motivated policy changes are part of the agenda involves a further bridging of discourses and practices. Many participants in local CWNs are volunteers primarily concerned with keeping their networks functional, accumulating enough funding to continue their work, and making their projects relevant to their local communities. Meinrath describes the difficulties of mobilizing CWN participants to contribute to policy reform: "for the most part people have not played active roles in the policy sphere and it's difficult to get people active. The most we see is people sign on to commentary on a proposed bill or something. I certainly don't blame anyone, when you are talking about groups that are all volunteer and have many other responsibilities" (Interview Feb 22, 2008).

I argue that CWN projects have impacted telecommunications policy in important ways. First, the WiFi hacking described in Chapters Three and Five has altered expectations about WiFi's potential uses, expanding the types of organizations who build and managed communication networks. For example, ISF's evocation of the community-public through the development of its WiFiDog hotspots as sites for community media has reframed how WiFi is understood and used in Montreal. Among other things, it suggests that grassroots community development and management might form an appropriate organizational structure for WiFi – much as the development of Fredericton's communication infrastructures suggests that municipal ownership is appropriate there. Second, this hacking became integrated with a second set of discourses and practices that enrolled WiFi activism into a wider set of concerns framing the expansion of participation and expertise in technology as a means of creating greater social and political justice. For example, the CWN "movement" suggests that social justice advocates could develop WiFi networks along with the geeks. This bridging brings the discourses and practices of hacking – often associated with a perspective of WiFi as a disruptive technology and with a libertarian political ideology – into a context that politicizes WiFi technology as part of a broader movement towards more ubiquity and accessibility of communications. The first example of bridging is the representation of network neutrality as a political issue, especially in the context of media reform.

Net Neutrality – From a Technical Issue to a Civil Rights Question

Net neutrality (or, "open internet") provides a good example of how the politicization of technology that emerged in the CWN movement has transferred to a broader context with specific relevance to the social justice concerns of media reform. As discussions of network neutrality have shifted away from describing technical principles to describing neutrality as a political goal, its meaning has changed. In this chapter I use "network neutrality" to describe the principle of neutral network design, an original feature of the internet's design based on non-discrimination in packet switching, and "Net Neutrality" (with capitals) to refer to the policy goal. In technical terms, network neutrality refers to the principle that packets are not prioritized based on their origin, destination, or content. The principle emerged from the design of the internet, a "dumb" network where packets follow the fastest route from origin to destination, rather than being controlled by network switches along its path. Such a 'neutral' network does not distinguish between packets originating from a video and packets originating from an e-mail. When most internet traffic moved over telephone lines, the principles of common carriage that had regulated communications since the age of canal shipping applied: no operator could prioritize or impede the transfer of information regardless of its origin, destination, or content. This neutrality became a structural feature of the internet (Barratt and Shade 2007; Sandvig 2006) and arguably facilitated the participation of its users in its development, since the network's structure did not differentiate between different types of content, meaning that individuals' blogs load as fast as mass-media outlets' web pages.

The classic definition of network neutrality, as Wu (2003) argues, is a design principle based on non-discrimination of network traffic: no carrier should discriminate against any type of content delivered over the network. In 2003, Wu argued that this non-discrimination principle would better preserve the architecture of the internet in an age of vertical integration between internet service providers and cable companies, rather than a market-based "open access regime" where everyone is free to choose internet service providers, since consolidation could reduce the economic interest in maintaining neutrality. Further, neutrality should definitely apply to public networks.

Politicizing Net Neutrality: WiFi wants to be free

As a standard, WiFi has historically been open: the 802.11 standards provide interoperability between a variety of devices. Furthermore, since WiFi devices use unlicensed or license-exempt radio spectrum, they do not need to be closed to protect a specific privately owned resource. Schmidt and Townsend (2003) evoke this by claiming that WiFi "wants to be free": "It is the expert opinion of the authors that the popularity of open wireless networks is a combination of open standards and the benefits of mass-production and interoperability they bring, and the intrinsic value that a wireless 'cloud' brings to the place in which it is located" (p.49). However, while they were initially structured as ad-hoc networks where anyone with a WiFi modem could participate, these early efforts proved more useful at demonstrating how many geeks with WiFi routers lived in a given area than providing robust and useful networks (see Priest 2004 for a description of this phenomenon in London, UK). Now some CWNs including ISF receive tens of thousands of connections. These large networks require management. Structural choices made by the developers of CWN networks have not always followed the most technically open path, especially as the size of networks has scaled up. Therefore, practical and ideological tradeoffs mark the efforts to construct open systems using WiFi networks.

Conversely, a politicized concept of Net Neutrality provide a technical frame of reference for media democracy issues such as equality of access and the right to communicate. This interpretation of Net Neutrality operates as a bridge between geeks dedicated to open systems and social justice advocates and media reformers interested in promoting more democratic access to the means of communication. The ideal of network neutrality's equality of access and non-prioritization based on content resonated with geek interest in maintaining open technical structures as well as with social justice principles of fairer access to communications.

Network Neutrality paradigms in research and advocacy

Two paradigms characterize research and advocacy discourse about network neutrality: the first considers the internet's information transfer as a type of basic transport network that should be regulated in the public interest. Sandvig's 2006 article "Network

Neutrality is the new common carriage" represents this point of view, which is shared by Wu (2003). The other paradigm is that telecommunications operators should be allowed to charge people using their networks to transfer data commensurate with the amount or type of that data. Under this paradigm, downloading large files, for example, would cost more than sending text-based e-mails. The polemical split between these two perspectives illustrates how technical structures can become politicized.

These two perspectives were broadly debated in a series of venues including the 2006 Telecommunications Policy Research Conference[50], where McTaggart (2006) of Telus Corporation, a Canadian ISP, argued for providers' rights to charge for transfer of information, and scholar Frieden (2006) referred to regulation favouring net neutrality as "bias." Some economic analyses attempt to rationalize the consequences of choices between paradigms. For example Aronson et al (2006) argue in favour of allowing providers to choose whether they offer customers a neutral or non-neutral service while Lehr et al (2006) create various scenarios for a "Network Neutrality arms race" where "even in the absence of network neutrality regulation, end-users (and upstream providers) have a range of technical and market-based strategies for responding to discrimination" (p. 1). From a public interest perspective, Meinrath and Pickard (2006) identify concerns about neutrality and regulation as being fundamentally questions about internet freedom, outlining ten guidelines for a "new network neutrality" intended to transcend the debates about regulation and refocus them on questions of free and open access.

In 2007, the *International Journal of Communication* published a special issue on network neutrality, including fifteen articles discussing legal, economic, and regulatory details. In their editorial comments Peha et al (2007) note that "further discussion and research is required before broad consensus will be possible. An immediate barrier to progress is the lack of a consistent definition of network neutrality among these papers, which demonstrates both the scope of the issues included and the lack of consensus as to which problems/potential solutions are most important/likely to be effective." (p.711). The papers generally agreed that extreme forms of network neutrality regulation would probably be counterproductive. Otherwise, expert assessments of network neutrality as a design principle contrast with the politicized perspectives of Net Neutrality advocacy work, which bridges the concepts of the common carriage established by previous generations of communication infrastructure like the telephone, with public interest perspectives dedicated to expanding access to communications infrastructure.

Negotiating Neutrality in Principle and Practice

In practice as well as in theory, different interpretations of neutrality must be balanced. As I have already explained, community and municipal wireless networks generally employ one or a combination of network models: 1) WiFi hotspots connected to backhaul bandwidth provided by sympathetic individuals or organizations and which broadcast WiFi signals to an area of 100 to 300m; 2) Hub-and-spoke systems where a single high-powered antenna can broadcast a signal from, for example, a hill to the homes of the valley below; and 3) a dynamic mesh where individual nodes act as both receivers and relays for WiFi signals. A dynamic mesh network is self-healing, and makes it possible to share one internet connection among many users who are not necessarily all in proximity to a tower.

Of the architectural choices available to CWN, the distributed mesh network form is perceived to provide the highest level of openness, because the entire network is constructed non-hierarchically[51]. Beyond deciding on the basic network architecture, network operators must decide whether to leave the network open, or whether to authenticate – track – who uses it. This is the purpose of "gateway software" like NoCatAuth (discussed by Sandvig, 2004) and WiFiDog (discussed by Powell and Shade 2006), which provide opening splash pages that indicate to people that they must register to use the network.

However, even without gateway software to provide a visual indication of authentication, the RADIUS protocol (Remote Authentication Dial In User Service) is built into any WiFi network – hotspot, mesh, or Voice over IP – that authenticates its users. The protocol manages remote authentication so that each device (wireless router, for example) does not have to authenticate each person it connects to the network. Even though it is primarily a way of authenticating who is allowed access to the network, the protocol also makes it possible to track individual users of the network. The RADIUS protocol is standard on WiFi networks like ISF's and Fredericton's that have a central point of management such as a central server. To provide some ability to track abuse, or even to produce statistics, such centralized management is important or even essential for CWNs. However, the necessity for this management suggests that the perfectly open, neutral network[52], where open, free bandwidth is available to all, anonymously is much more of an ideal than a practical model.

Unlike the mythical wireless commons evoked by Schmidt and Townsend (2003), bandwidth on a RADIUS-controlled, centralized WiFi network is not a boundless resource. In a mesh network, the greater the number of nodes, the more robust the network, since each node opens an alternate route for information to travel. Centralized networks, however, experience declines in performance when more users are added. This means that people using more than a "fair share" of bandwidth decrease the performance of the network for all. Network managers, including the network managers at ISF, employ "traffic shaping" that limits the transfer of some kinds of data and prioritize others, or blocks the communication ports that are used to send spam, as do the Fred-eZone's operators.

Considering these real-life constraints, network designers, even of CWNs, approach network neutrality as a principle rather than a prescription for network design. In contrast to industry-based experts who use the argument that "the Internet was never neutral" to advance the right of ISPs to control or censor content (McTaggart 2006) network designers of CWN networks (and the Fred-eZone network as well) describe network management as a balance between mitigating the problematic actions of a few people, and protecting the common good. For example, ISF volunteers decided to employ traffic shaping because they felt it was important to create a middle ground between universally rejecting certain types of traffic and allowing unlimited use of bandwidth that might raise costs for their hotspot hosts. After a hotspot on the ISF network was overwhelmed by one person using too much bandwidth, more powerful traffic shaping tools were used to limit the overall amount of bandwidth available to each individual user. Still, other volunteers view the use of traffic shaping as an ideological failure, admitting with embarrassment that the ISF network is not completely neutral (Field Notes March 2007). Regardless of whether it can be achieved in practice, network neutrality remains discursively important as a technical manifestation of the principles of openness so valuable in the geek conception of liberty. However, it accumulates a new political importance when it is bridged from the more hands-on technically expert context of CWN and into the politically mobilized media reform movement.

Bridging Net Neutrality into Media Reform

Among media reformers, the politicized concept of 'Net Neutrality'[53] became a catch-all term for the political aspects of internet structures and capacities. Introduced and developed by CWN advocates also involved in democratic media reform, "Net Neutrality" provided a way of describing the potential political impact of technical structures and protocols that were regulated by rapidly changing telecommunication policies. The following section describes how discourses about Net Neutrality as a policy issue (rather than the design principle of network neutrality) created a point of contact between CWN and the primarily U.S.-based media reform movement.

The 2007 National Media Reform Conference (NMRC) in Memphis Tennessee, a North American but primarily U.S.-based meeting, organized by Free Press[54], assembled over three thousand people to discuss issues of public interest communications ranging from minority ownership of media outlets to political organizing using blogs. This was the third such event. Within the conference, CWN advocates discussed the impact of CWNs on communication policy. A panel featuring Harold Feld, a legal advocate for the Media Action foundation, Sascha Meinrath – at the time working as a policy consultant at Free Press, Michael Maranda of CTCNet, a community networking organization, Dharma Dailey of Ethos Wireless and Michael Lewis of Wireless Harlem argued that CWN projects inspired three public interest perspectives on local networks. These included "digital inclusion" (or an expansion of network access to more people, along with training programs); pervasive connectivity (internet connectivity everywhere); and the preservation of "Net Neutrality." As frameworks for politicizing technology, the first two of these perspectives reiterate the established public interest argument that increased access and ubiquity for communications networks serves the public good. However, the third perspective argues that more accessible technical structures and protocols would also be in the public interest. In essence, this third perspective politicizes the structure and function of networks as communication infrastructures. Whereas the public interest perspective of digital inclusion concentrates on providing training and education to people who will also receive the benefits of pervasive connectivity – a perspective in line with the ubiquitous network perspective I described in the last chapter - securing Net Neutrality as a public interest goal focuses not only on the benefits of internet connectivity, but on the political significance of its design and technical structure.

While the discussion introduced by this panel focused on harnessing the technical potential of WiFi technology in order to design open networks, the rest of the media reform movement framed the internet – like other forms of media – as under threat from large corporations and power-hungry telecom and broadcasting lobbyists. At the 2007 NMRC, community wireless networking and Net Neutrality were discussed in three panels, one each in the Media Policy track ("The Growth of Wireless Internet: From community to municipal to corporate"), the Independent Media track ("Owning Our Own Media Infrastructure"), and the Media, Civil Rights and Social Justice track ("Bridging the Digital Divide"). Net Neutrality was also mentioned in the keynote speeches at the conference, which even featured a "Save the Internet" party where music videos and invited speakers encouraged participants to join the "Save the Internet" coalition, explained below. Net Neutrality was compared to the civil rights movement in terms of its potential to inspire democratic participation and equal representation in media. The NMRC established the concept of an "open internet" as a rallying point for democratic media advocates. However, the political framing of "Net Neutrality" conflates the technical compromises required to negotiate neutrality as a network design principle with public interest arguments for increased access to and control of communication media and infrastructure. It also brings together strange bedfellows.

Saving the Internet – Net Neutrality as Political

The Save the Internet campaign, funded by Free Press, MoveOn.org and the SavetheInternet.com coalition framed Net Neutrality as one of the most pressing public interest issues of 2006. During that year, the U.S. Congress voted on several bills that defined the ability of telecommunication operators to control the transfer of information over their networks. Organizing through local and national coalitions supported by Free

Press, as well as through the online advocacy program MoveOn.org, a petition signed by 1.3 million people was delivered to Congress, along with 50,000 phone calls to Congressional representatives (Free Press 2006). As the diversity of the literature discussing network neutrality suggests, the Net Neutrality coalition was composed of strange bedfellows: charter members include trade union Teamsters, the American Civil Liberties Association, P2PNet, and numerous local and regional community networking organizations. Like the CWN movement, this coalition focused members with competing ideologies on the single shared goal of changing regulatory legislation. This bipartisan and cross-ideological pressure led to a variety of bills appearing in the U.S. Congress in 2006 and 2007, many of them supporting principles of network neutrality (Wyden 2006).

In Canada, organizing to represent Net Neutrality as a public interest policy issue has so far attracted less attention. Canadian advocates have mobilized through a coalition similar to Free Press, the Campaign for Democratic Media (Campaign for Democratic Media 2007), which focuses on opposing consolidation of media ownership and foreign ownership of Canadian media, but which also provides information on network management and neutrality. Partly, media consolidation itself limits the ability of Canadian media reform advocates to lobby for Net Neutrality as a political issue: Canadian media consolidation has been paralleled by consolidation of its internet service providers, who are often owned by the same large media conglomerates – Bell Canada and Rogers Communication. These two companies own the majority of the country's television and radio stations. Therefore, the "Fight Big Media" campaign attracts more

Canadian attention and action than neutrality issues, which are perceived as being more technical, although a major mobilization called Save our Net began in aimed at influencing legislation. This mobilization has included public events including a rally on Parliament Hill in Ottawa. Despite these mobilizations, the small number of political allies for Canadian media reformers and the consolidated ownership of telecommunications and media companies in Canada have perhaps limited public interest involvement in Canadian telecommunication policy reform (Longford and Shade 2007).

Some new intermediary institutions are beginning to evolve in Canada. In 2006 Leslie Shade and Marita Moll convened an Alternative Telecommunications Policy Forum (the Alt.Telecom Forum) in response to the 2006 Telecommunications Policy Review Panel (TPRP) proceedings, which had been dominated by industry and commercial representatives. The recommendations of the TPRP included passing a network neutrality provision, thus securing in law the technical openness of networks. However, the TPRP failed to recommend any type of regulation for the internet or digital communications in Canada, instead arguing that Canada's telecommunications regulation should depend primarily on market forces (Telecommunications Policy Review Panel 2006)

The Alt. Telecom Forum was an effort at creating the kind of broad citizen and community based coalition that emerged around Net Neutrality in the U.S. and bridged technical and economic questions about network structures into public interest questions of equal access to communications. It convened academics, policy advocates and members of community networking organizations including Mike Richard from Fredericton and Michael Lenczner from ISF. Ben Scott, the policy director from Free Press, and Sascha Meinrath also attended. The Alt.Telecom Forum participants drafted a proposal for a Canadian government guideline on network neutrality: "network operators shall not discriminate against content, applications, or services on broadband Internet services based on their source or ownership" and called for amending references to market forces to account for situations in which market forces fail (Alternative Telecommunications Policy Forum 2006).

Despite this mobilization and the increasing interest in the Save the Net campaign, Net Neutrality legislation continues to be contested in both the United States and Canada. In September 2007 the United States Department of Justice submitted a statement to the FCC disagreeing with Net Neutrality and saying that they would "support . . .a system that would allow Internet service providers to provide quicker download times or site access for those willing to pay for it" (United States Department of Justice 2007). In November 2007 Free Press and MoveOn.org reported that Internet Service Provider Comcast was blocking BitTorrent, the popular file-sharing application that is also throttled over the Fred-eZone network and by Rogers Communications. The U.S. FCC is investigating, but determining the level of government oversight of network management is difficult, and heavily influenced by the incumbent telecommunication lobby.

In Canada, where ISP Telus blocked its subscribers from accessing pro-union websites during a labour dispute, the government seems uninterested in regulation of any kind, continuing to rely on the discourse of "market forces" (Longford 2007a). In addition to ignoring Telus' site blocking, Canadian regulators including the Canadian Radio-Telecommunications Commission, Industry Canada and the Competition Bureau took no action whatsoever when Rogers Communication reported in an industry meeting that it limited the rates of peer to peer (p2p) internet traffic, and Bell Canada has confirmed that it will fully throttle p2p services by early April 2008, despite the fact that the Canadian Broadcasting Corporation uses p2p service BitTorrent to distribute its content (Geist 2008). Geist claims that Canada is already in a "slow lane" with respect to mobilizing political debates about Net Neutrality and other telecommunications policy issues, although the introduction of a private members' bill by the New Democratic Party representative Charlie Angus in Spring 2008 may succeed in creating a regulatory framework for these issues in Canada. In addition, CRTC chairman Konrad von Finklestein recently called for a hearing on Net Neutrality in Canada, which may effectively reopen the debate.

As the technical challenges of network management indicate, network neutrality is primarily a principle, rather than a prescription. However, the bridging of Net Neutrality as a political issue from CWN and into media reform conflates the technical potential of creating open networks with the political aims of creating more open systems of communication. In the broader political arena, some of the issues that geek designers of CWN networks negotiate from a more technical perspective are recast by a diverse group of advocates seeking to convince governments to regulate communications in the public interest. This establishes a political slant to the technical negotiations of the principle of neutrality, creating a movement towards "Net Neutrality," which became politicized in the U.S. and Canada. In the U.S. context, media reform actors who gained experience from direct involvement with CWN groups helped to establish Net Neutrality as a central media reform issue. In Canada, where CWN projects have been more oriented towards community media applications and less towards policy changes, the same momentum is still developing.

In the following section, I describe how the municipal WiFi industry, like the political mobilizations that transformed principles of network neutrality into the more politicized Net Neutrality, also resulted from bridging discourses and practices from technically skilled participants to policy advocates. I focus primarily on the United States context[55].

Muni WiFi

Political action over issues like network neutrality resulted from bridges built between CWN and the media reform movement. Similarly, the boom in municipal wireless was influenced by CWN innovations in technology and organization. In 2006, WiFi became framed as the technology of the moment for municipal governments creating broad-scale networks (Lehr, Sirbu, and Gillett 2006), particularly in the United States. This can be interpreted as indicating the extent and the limitations of CWN's influence on the structure and organization of communications. On one hand, the municipal WiFi bubble drew from the success of community WiFi actors in developing functioning technologies: not only did these projects provide proof-of-concept for WiFi development companies, they also often released their open-source software to be freely reused. Île Sans Fil's WiFiDog served as a captive portal for small municipal WiFi projects including the

CapeWiFi project in Cape Cod, Massachusetts, and CuWiN's experiments with mesh routing protocols established the feasibility of this network form for broader-scale applications[56]. On the other hand, the organizational structures and culture of grassroots experimentation and knowledge exchange that had evolved along with community WiFi technologies was decidedly not part of the first explosion of municipal WiFi projects, which were put forward by corporate consultancies and telecommunications companies.

Regulatory changes, especially in the U.S., opened up municipal networking as a potentially lucrative new industry. After the Supreme Court ruled that telecommunications companies were not required to let third-party providers sell service from their leased lines (Supreme Court of the United States 2005), any U.S. ISP delivering information services had to own its own infrastructure[57]. For ISPs like Earthlink, whose business model was based on re-selling internet service it leased from other companies, becoming a municipal WiFi provider created an opportunity to own infrastructure and thus to stay in business. Further, other state and national policy shifts meant that cities took on more responsibilities for service provision (Strover and Mun 2006) as United States government legislation that prevented cities from owning telecommunications companies began to change. As well, the representation of WiFi by CWN and media justice advocates as a cheap and flexible way to provide broadband connectivity emerged as the United States slid in the Organization for Economic Cooperation and Development (OECD) international broadband connectivity rankings (Organization for Economic Cooperation and Development 2007), from 4th in 2001 to 12th in 2006, behind the Nordic countries, Korean, Canada, France, Belgium, and

Luxembourg, among others. This slide in international rankings focused attention on the poor broadband connectivity in many parts of the United States.

Since the United States, unlike Canada, never developed a national broadband or connectivity policy like those discussed above, many cities and isolated areas were left without a means of guaranteeing affordable access to communications infrastructure. WiFi came to be represented as the magic bullet – and if it was not yet perfectly technically sound, community-based WiFi projects had demonstrated what the industry saw as "proof-of-concept" networks. However, the development of the municipal WiFi industry, as much as it drew from some of the CWN 'hacks' and the representation of WiFi as a tool for social justice through expanded connectivity and local ownership, developed in a different direction.

Ubiquity? Accessibility? Responding to the Muni WiFi Boom

The rapid expansion of municipal wireless projects in 2006 featured corporate WiFi providers proposing fairly similar public-private partnership models to municipalities: in all, over 350 new projects launched in the United states that year, according to Tapia and Oritz (2006). In Canada, Toronto Hydro Telecom's wireless OneZone also launched in the same year. Most of the U.S. projects were large-scale connectivity projects that focused on "secondary" outdoor access that was not meant to cover inside buildings nor to provide adequate quality of service to be used as a primary internet connection (Middleton, Longford, and Clement 2006). Others attempted to boost WiFi signals using high-powered antennas to create home service delivered to customers. These were often very wide-scale projects that used proprietary equipment, some of which home users were required to purchase. Many public-private partnership models depend on municipal governments to provide financing up-front, along with access to infrastructure, and base their business models on fees from consumer access, advertising, or anchor tenants like universities or municipal utilities.

Potter (2007) outlines eight possible business models for local networks: public utility, non-profit, publicly owned/privately operated, consortium, public-private or franchise, subscriber-based, ad-based, or ownerless[58]. Regardless of this potential diversity of ownership and governance models, many of the municipal wireless projects announced in 2006 were either public-private partnership or franchise models that depended on municipal government financing or anchor tenancy, and directed revenues to the companies developing them, often through exclusive contracts. The bidding process for municipal contracts favoured large companies since owning communications infrastructure was illegal, organizationally difficult, or too expensive for most municipalities. This was a far cry from the community owned and developed infrastructure advocated by CWN and media reform actors.

Initially, municipal WiFi projects drew on the discourse of greater accessibility to communications. Tapia and Oritz (2008) describe how the discourses of requests for proposals and other official documents included claims that WiFi would improve business and reduce poverty. However, most final project proposals submitted by ISPs like Earthlink, MetroFi, and Clearwire designed public-private partnerships that would allow companies to lease or gain access to municipal infrastructure like light posts while according them ownership of the WiFi network itself – including the right to charge market price for access to the network. Many municipal WiFi plans also included franchise fees similar to those developed in the cable television industry. The profits from these franchise fees were meant to fund public interest projects through funds called Community Benefits Agreements (Digital Inclusion Coalition 2006).

The Collapse of Muni WiFi

Many municipal WiFi projects spectacularly collapsed in 2007 after providers realized that consumer spending on secondary internet access would not provide a viable revenue stream, even when advertising supported the model. Since many municipalities and community organizations had lobbied for providing broadband to underserved areas, most municipal WiFi proposals contained some free or low-cost element – but people receiving free, low-quality connectivity were perhaps not a desirable market for advertisers. In the United States, public-private partnership networks owned by telecom providers often failed to find an appropriately scaleable, inexpensive technology and a business model that permitted them to make profit while still covering some areas free of charge. Providers scaled back their networks (for example, the Wireless Philadelphia project was not completed), laid off employees (as Earthlink did) or changed the terms of their network provision, (as MetroFi did in Portland, OR). Meinrath and Breitbart (2008) describe the political and social machinations that influenced the decline of the Philadelphia network. At the end of 2007, only four large North American cities had WiFi build-outs still in progress: Toronto, Philadelphia, Minneapolis, and Portland. Aside from Minneapolis, all of these projects were significantly scaled back from their original plans. Only the Minneapolis network has continued to consult community stakeholders as part of its network development, and this project's Community Benefits Agreement is considered a benchmark in creating and maintaining community participation. As of June 2008, the Portland network will be disassembled and its components sold to the city.

The Toronto network, Toronto Hydro Telecom's One Zone Wireless (THT), resembles some American municipal WiFi projects in that it is a commercial network that charges a market rate for wireless broadband access. However, since Toronto Hydro is a public utility, the network is also constructed upon publicly owned infrastructure. Clement and Potter (2007) argue that THT is missing an opportunity to use the municipal ownership of its infrastructure to public advantage: "basic broadband service could be provided in a sustainable manner to all of Toronto's one million households, as well as the 80,000 businesses, for roughly $10/month, giving an average annual saving of over $300 each to the 60% of Toronto households that currently subscribe to broadband. This saving is so significant that it could even make it politically attractive to include basic internet service in property taxes and offered as part of the city infrastructure in the way that many other popular but costly city services are currently handled collectively (e.g., sidewalks, street lighting, schools and libraries)" (p.?). Unfortunately, THT is unlikely to ever become a public service network: in June 2008 it was sold to cable operator Cogeco. This sale contributes to the divestment of public properties into the private sector.

Hacking Muni WiFi: Portland and Philadelphia

Through the rise and fall of municipal WiFi projects in the United States (and to a lesser extent in Canada), the involvement of community actors remains important not just as a method of experimental pre-testing and preparation of a market for free WiFi. Two brief examples illustrate how CWNs continue to present critiques of the very institutions they helped to inspire. In the following section I consider CWN responses to municipal networks in Portland, OR and Philadelphia, PA. These examples illustrate how policy hacking continues to draw from the hands-on practices of hacking, even when the original "device hacks" of the early WiFi geeks have been institutionalized into municipal WiFi projects.

Portland, OR had one of the first community wireless networking projects, PersonalTelco, which began in 2000 with geeks installing nodes in their own homes. Like ISF, PersonalTelco's members set up WiFi hotspots in bars and restaurants and created a location-based social software application. In 2005 Portland's municipal government contracted with MetroFi to build a municipal wireless network. In summer 2007 the promised proof of concept network was completed, and MetroFi requested bids for an assessment. PersonalTelco members submitted a bid, but it was not accepted. Since some of the members of the group were still interested in measuring the municipal network's performance, they volunteered to conduct a network assessment, which indicated that the coverage was weak and not as reliable as the company had promised. In fact, the MetroFi network was almost unusable for regular internet access.

CWNs can establish community expertise that challenges the exclusive control of knowledge and technology by corporations. The PersonalTelco survey of the MetroFi network was conducted by volunteers, using independent metrics and without relying on data from MetroFi. This may have led the local media to portray the community surveyors as acting in the public interest, since they had no economic ties to MetroFi. The results of the survey, as Senior (2008) indicated, suggest that the network assessment produced by contractors hired by MetroFi, who used assessment indicators provided by the company were flawed. This assessment claimed that the network was accessible 95% of the time within the coverage area (based on the ability of a measuring device to obtain a signal from a MetroFi antenna), whereas PersonalTelco's assessment suggested that its functionality was closer to 60%, based on the ability to establish a connection to the internet using the MetroFi network.

The PersonalTelco methodology is based on how Portland's citizens might actually be expected to use the MetroFi network. Skilled volunteers provided their expertise to critique misleading information and establish alternative information that might be more valuable. PersonalTelco's "community" orientation distinguishes it from any company or organization that would be in competition with MetroFi. This comment frames the volunteer network survey as part of learning and having fun with wireless. The organization's president adds this comment: "Many people in our tech community and especially those working with wireless networking continue to look on PersonalTelco and its membership as very well educated, experienced experts on wireless technology" (Michael Weinberg on Personal Telco Wiki, 2007). Focusing on PersonalTelco as a site of expertise, Weinberg establishes the legitimacy of the volunteer survey as an expert critique of MetroFi's inadequacies. Curiously, due to circumstances unrelated to measurement issues, the entire MetroFi network was up for sale as of July 2008.

Other types of community-based knowledge production indicate how politicizing technology through CWN can shift understandings of where knowledge comes from and whom it serves. The Wireless Philadelphia project, one of the first large-scale networks planned in the U.S., was meant to draw heavily on participation by community-based organizations in the political and organizational process of network deployment. According to Breitbart, et al (2008), the city's executive committee held a public consultation and stakeholder assessment, and then voted to construct a "Cooperative wholesale" network owned by a non-profit company who would outsource construction, management, and retail service. This nonprofit, called Wireless Philadelphia was established in 2005. However, in early 2006 the Philadelphia city council voted to contract Earthlink to own and operate the network, arguing that this would prevent the city from spending public funds. The failure of the Philadelphia project to follow through on its non-profit ownership might not have become an issue of public interest. However, because the main source of information on the planning and development process of the Wireless Philadelphia project was a blog written by journalist and media reform advocate Josh Breitbart, the project's public interest potential became more widely discussed.

The citizen journalism approach that Breitbart used to chronicle the development of the Wireless Philadelphia also establishes community-based expertise about networks – in this case, critical perspectives from a community member participating in the organizational process. Breibart's aim in blogging the Wireless Philadelphia story was to provide better information about the network's development, and thus to ensure that the network would be developed with community participation. These goals are more oriented towards media reform than the volunteer measurement project at PersonalTelco, but they also establish community criticism of many aspects of the network development process, particularly the relationship between Civitium, the consulting company who had helped to craft the RFP, and Earthlink, which eventually won the contract. With other activists he met through participation in CWN Summits, Breitbart decided to try and develop a way of intervening in this process, especially as a way of providing a citizen's point of view in a process which had garnered positive media attention as a best practice example for building a municipal network that could address the digital divide (Hellweg 2005).

These examples suggest that the expertise generated by participants in CWNs not only influence media reform movements by bridging expertise from geeks to policy advocates, but that they also establish a certain type of community technology expertise that can be channeled to act in the public interest. In the case of PersonalTelco, this expertise was primarily technical, and challenged the knowledge and information generated using data provided by MetroFi. In the Philadelphia case, knowledge about community organizing established public interest perspectives as centrally important for the development of the project.

From the perspective of computerization movements as new social movements, the expansion of these forms of community-based knowledge are important, because they situate expertise within specific community contexts and destabilize the control of information – not to mention technology and media – by entities concerned primarily with profit-making. Creating these forms of knowledge may be one way of transcending the dialectic between technical expertise and accessibility of technology that seem to characterize computerization movements. In the following section, I continue to explore how bridges are built between expertise generated within CWN and the media reform movement, examining how key players in the two areas worked together to create a non-profit consultancy.

Public Interest Consultants: Ethos Wireless as a Bridge between CWN, Media Reform, and Muni WiFi

Sascha Meinrath, Dharma Dailey, and Joshua Breitbart formed a non-profit consulting company called the Ethos Wireless Group (or "Ethos)[59] in 2006. Focusing on "thoughtful infrastructure" the partnership "promotes universal access to high-speed Internet by supporting the development of new community-controlled infrastructure" (Meinrath, Breitbart, and Dailey 2006). Ethos focuses on community ownership of infrastructure – an interest that Meinrath developed in 2001 when looking for a distribution channel for some of the media content that the Champaign-Urbana Independent Media Centre had developed. At around the same time Dailey had been working with the Prometheus Radio Project in Philadelphia, a non-profit organization that taught community members to build and operate low-power radio stations, as well as being involved in lobbying for more access to radio waves for community radio stations. Like CWNs, Prometheus connected hand-on experimentation and modification of radio equipment with policy advocacy about political-technical issues, including expanded access to radio spectrum (Dunbar-Hester 2008). In policy circles, Prometheus is well known for having contributed to lobbying that opened the U.S. airwaves to low-power community radio stations (Prometheus Radio Project 2008).

Each of the founding members of the Ethos Group describes the application of practical knowledge about technologies as important in their advocacy work. Dailey explains that she's driven by a "DIY instinct" that has pushed her to learn how to build radio stations and hack wireless routers. Breitbart's experiences in Philadelphia suggest that local ownership and a broader community level understanding of technical and policy issues was essential. Dailey echoes these calls for local ownership of telecommunications, describing local media as a tool used to draw together people living in the same area who may not have shared interests. She reflects: "networking technology is really good at organizing or integrating vertical communities, people with a specific interest, and good at vertical integration . . . so large corporations like Wal-Mart can use it for supply chain management. But to connect together vertical communities in a shared geographic space still needs a lot of work" (Dharma Dailey, Interview Feb 20, 2008). Similarly, Meinrath's work at CuWiN has exposed him to local "geek" expertise in creating technical solutions to what he and others originally perceived as limitations in media distribution. Together, they have created a loose institutional framework that helps to put into practice some of the goals expressed by both geeks and media reform advocates into policies.

Ethos Policies – Public Interest Framing of "Openness"

A core Ethos document, the group's policy statement, frames CWN goals in the context of struggles against increased media convergence and the spread of wireless internet. It reads, "new technologies offer one of the most significant opportunities we will have in our lifetime to completely redesign how we communicate and exchange media" (Meinrath, Breitbart, Dailey 2006). To capitalize on this opportunity, Ethos has defined a set of policies, using discourse that are familiar to CWN advocates but that also include a decided public interest slant:

> 1. Open access: our communication systems are now closed – the owners of the wires control who uses them and what travels over them. Net neutrality does not go far enough . . .it does not address the divide in ownership of and access to infrastructure;
> 2. Open source/open standards: Open source allows for fast, inexpensive innovation and adaptation. Open standards allow different devices, whether from a major corporation or hobbyist, to communicate with each other;
> 3. Open airwaves: the current, closed licensing regime restricts public access to the airwaves. In contrast, unlicensed spectrum lowers the barrier to participation in our communication networks and promotes innovations like wireless Internet access. (Meinrath, Breitbart, Dailey 2006).

These policy statements illustrate how concerns of CWN actors, including the more technical principles of openness, can gain influence within media reform when they are framed in a way that highlights their public interest potential. This bridging discourse connects open-source software development and technical innovation with social justice aims such as increased access to media and communications. The centrality of "openness" in the policy statement suggests a focus on disruptiveness or innovative potential more in keeping with the geek focus on the political implications of technical structures. At the same time, the implications of openness are all expressed in terms of accessibility, which draws more on social justice. Most significantly, while these policies refer to ways of configuring and governing wireless networks, they make a broader gesture towards these networks as elements of an entire media system that Ethos argues must be restructured.

Developing and Bridging Expertise

The consultancy hoped to provide cities with another route to developing municipal WiFi, a route that would make public interest and community ownership central. Initially, the partnership planned to consult with municipalities to help build municipal networks based on their policy statements, but this did not occur, for reasons that I discuss below. Instead, all three founding members found themselves in new professional positions where their expertise in bridging wireless networking and policy played important roles. The consultancy as a whole was reoriented to provide research and organization support to non-profit organizations. The occupational changes of the three core Ethos members allowed them to use the expertise they had gained through involvement in CWN on projects more directly connected to policy advocacy.

Meinrath moved from Free Press to the New America Foundation and began a "whole life spent doing telecom policy and media reform" (Interview Feb 22, 2008). Dailey began representing community interests at high-level policy-making bodies like the Internet Company for Assigned Names and Numbers (ICANN) and directing an Ethos research project on local broadband infrastructure and research needs for community networking advocates. Breitbart moved to New York City and began managing a project for People's Production House (also funded by the Social Sciences Research Council) linking technical training in new media to popular education about communication issues: one strand of the project conducts a needs assessment for internet infrastructure, while another creates a video describing the physical and communication infrastructure of New York City. This project links hands-on experience of media production with empirical research to build telecommunications knowledge within inner-city communities. Breitbart, who has testified to FCC commissions on issues of access to communication, says the project is about "creating a way for other people to become experts so it is not me giving testimony" (Interview Feb. 22, 2008).

For her part, Dailey felt that her ability to work in high-level abstract policy spheres, which included not only ICANN but also tracking policy issues in state legislatures, drew directly from her hands-on experience. She said,

> I'm getting lots of opportunities to do work in national international work on abstract technical issues because I'm perceived as someone who is authentically representing community interests. It's somewhat ironic and there's always this schizophrenic feeling that I'm working on things that aren't very connected to a canned food drive (Interview Feb 20, 2008).

The three founding members of Ethos Wireless all reflected that they felt like "accidental" WiFi experts. Having all worked in grassroots media backgrounds, they learned about WiFi technology by spending time with people who shared technical expertise with them. They were able to bridge this expertise into the media reform and advocacy spheres by reframing the discourses and expanding the practices of the hands-on learning – hacking – they encountered in CWN and in other DIY media contexts. Ethos Wireless members also worked at hacking the municipal wireless bidding process, one of the original aims of its principals, who had hoped to establish ways of breaking down the corporate consultant's monopoly on municipal WiFi contracting.

Engaging with the RFP Process

Ethos' intervention in the municipal WiFi bidding process was not as extensive as hoped. Despite developing a strong partnership with municipal network proponents in Oakland, CA, Ethos did not succeed in hacking the municipal WiFi consulting market. The

Requests for Proposals (RFP) process, which requires organizations interested in constructing a municipal network to respond to a written request that details the specific requirements for the network, created a significant barrier. Often, organizations draft RFPs based on earlier submissions to Requests for Information (RFI) documents. RFIs are non-binding suggestions offered by a variety of interested parties, not all of who respond to the RFP. Being involved in creating or responding to an RFP structures expectations for how municipal wireless networks will be built. However, in the municipal WiFi boom of 2006 and 2007, the scale of the RFP process prevented all but the largest and best connected consulting groups – such as Civitium, the company who built the Philadelphia network – from participating in the process. As Breitbart reflects, "being corporate consultants to cities – that is a very specific kind of business . . . the RFP process is a huge barrier to entry, and is only really set up if you are prepared to do hundreds of RFPs, it doesn't work if you have a particular commitment to one city" (Interview February 22, 2008).

The institutional structures of RFP production limited the potential for hacking the municipal WiFi development process by establishing a consultancy, even when it created opportunities to route around the corporate ownership of dominant ISPs and the vested interests of consultants. Still, Ethos has continued advocacy work based on its policies. Meanwhile, CWN geeks at the 2007 Summit developed another hack of the RFP process. Drawing from a strategy workshop, they created a volunteer-led submission to the RFI for the municipal WiFi project in Boston, MA. The Boston government's Wireless Task Force requested information on building a network based on a model of nonprofit ownership of physical infrastructure. The RFI was to address six components of the digital divide: 1) awareness of the benefits of broadband; 2) motivation to take advantage of technology; 3) affordability of internet access; 4) affordability of equipment; 5) training; 6) technical support (Boston Wireless Task Force 2007). The network was also to be built with open access in mind and in a way that supported open standards. The city-owned non-profit, OpenAirBoston, developed an RFI document to which a coalition of CWN members responded. Beginning at a breakout session at the 2007 Summit and continuing online, a small group of people produced a document that was submitted to the official RFI competition.

"Hacking" RFPs

Immediately after forming this ad-hoc coalition, the participants called the RFI project "a hack", and themselves "we . . . the hackers." They talked about "pushing the envelope" (Field Notes, May 19, 2009). These comments seemed to indicate that they shared a common identity despite the fact that their expertise ranged from hardware construction to social and policy research. Coming just a few hours after the first mention of 'policy hacking' this meeting brought together a range of CWN participants with different backgrounds, including hardware hackers from SeattleWireless, software developers from CuWiN and ISF, network designers including some of the founders of the FunkFeur citywide mesh network in Austria, as well as Meinrath, Breitbart, Laura Forlano, and myself. The RFI proposed the use of use open-source equipment, grassroots expertise, and horizontal organization to respond to the challenge of constructing a municipal network with an open platform, broad coverage, and adequate bandwidth, that could be used for conducting research on network use, and that would allow for innovative experiments in application development. The submission focused on the fact that its authors were not only volunteers representing community and public interests, but also experts with important hands on knowledge of WiFi.

The RFI response was not intended to outline a perfect response to all of the needs of OpenAirBoston: one of the contributors felt that the large number of demands in the RFI document suggested that the Task Force wanted a "WiFi dreamland"(Kaplan 2007). Instead, the document outlined how open-source solutions and horizontal organizations of volunteers could produce a reasonable alternative to commercial proposals by recommending different hardware and software configurations, and providing actual, as opposed to artificially low, costs for purpose-built open-source equipment. More profoundly, though, the RFI "hack" bridged a significant amount of CWN expertise into the municipal world by creating a document meant to influence the discourse of an RFP for a large municipality. However, reflections by some of the participants at the 2008 Summit bemoaned the fact that the review of the RFI concentrated primarily on the cost of the network rather than being concerned with whether the proposal satisfied the various criteria for openness or accessibility.

Conclusion: Bridges and Barriers

Bridges

The examples in this chapter reveal the possibilities for bridging the values and ideas of CWN into advocacy and policy spheres using the discourses and practices of 'policy hacking.' Within geek culture, hacking creates a way of critiquing technical and organizational structures by drawing attention to failures, creating alternatives, or proposing radically new structures. In the ISF case, the geek-public suggested that hacking could extend out into the city. Similarly, the CWN movement bridged hacking into the policy sphere with the intention of criticizing existing media and communication structures and proposing new ones. Bridging the discourse and practice of suggests that hacking can route around the current (damaged) media system by contributing to the development of new organizational forms and discourses linked with WiFi technology. This bridge also establishes a way of resolving the dialectic inherent in computerization movements by connecting technical issues with political ones. The examples discussed above illustrate the consequences of this bridging. For example, presenting Net Neutrality as a political issue reiterates the importance of the concept of common carriage. In addition, creating the Ethos consultancy addresses the weaknesses of the municipal WiFi consultancy process through a kind of institutional hack, as does the CWN contribution to the OpenAirBoston RFI process. Free Press, Ethos, and the community participation in the municipal wireless sphere all construct different types of intermediate institutions – neither ad-hoc like local CWN projects, nor broad-scaled like state-level regulations where discourse and practice are bridged from grassroots spheres like CWN. According to Touraine (1992; 1999), the appearance of new institutions is one of the final stages of a new social movement, and it indicates that the insights and struggles of the movement have established a new historicity.

Barriers

Despite the social transformations suggested by the bridging of expertise and the development of new institutions, barriers still remain. The scale of many media institutions limits the effectiveness of smaller-scale policy hacks. For example, WiFi projects have contributed to reforms of radio spectrum allocation. The success of WiFi has in part been influenced by the fact that no license is required to operate or modify a WiFi device, and that all devices using the 802.11 technical standard are interoperable (Snider 2006). As interference increases on the tiny portion of unlicensed spectrum available – 2.4 GHz – open spectrum advocates lobby for the removal of licensing regimes that regulate access to the airwaves (Longford 2007b). As with the expansion of community networking, expansion of open spectrum establishes access to the radio spectrum as part of a set of broader communication rights (O Siochru 2006). Open spectrum advocates lobby the FCC in the United States and Industry Canada for the expansion of unlicensed radio spectrum – estimated as currently making up less than two per cent of available radio spectrum in the United States. These advocates often use examples of community media using unlicensed spectrum in their arguments (Best 2006). In 2006 the FCC ruled that 50 MHz of radio spectrum in the 3650 – 3700 MHz band could be shared between license holders and municipal broadband projects. Harold Feld, a lawyer lobbying for spectrum reform, announced to the CWN community: "We Win" (Feld 2007).

However, these spectrum auctions have been overshadowed in the past year by the bidding process on the 700 MHz band of spectrum – a much more powerful lower-frequency band that, unlike the unlicensed spectrum at 2.4GHz, travels through buildings and over long distances. This radio spectrum will be available for use once terrestrial television stations, which are currently using bands adjacent to it, begin digital broadcast[60]. In the United States, the 700MhZ band has been split into five blocks, some of which require that spectrum within the block must be left open to competing devices. The total of high bids on the first day of auction of this spectrum was $2.78 billion and as of March 2008 the total top bids for all blocks of spectrum was over $15 billion. Finally, telecommunication giants Verizon and AT&T purchased the rights to the most desirable spectrum, frustrating hopes for a wireless "third pipe" other than the cable companies and former telephone companies. All the public interest policy hackers could do was watch – Meinrath posted regular updates on his blog that speculated on the likely outcome of the auction based on the bidding pattern (Meinrath 2007).

The values and ideas held by public interest communications activists have influence – but it is harder to see them at the institutional level of the FCC spectrum auctions. It may be possible to influence the language of a piece of legislation as occurred with the politicization of Net Neutrality, or influence the requirements of one municipality's WiFi network RFP, but this does not mean that it is possible to put in a competing bid against a telecommunication operator in a spectrum auction. Since the winners of the auction were incumbent telecommunications operators, the shape of a wide-scale wireless network in the United States will be determined by how astutely the FCC apply the regulations governing the use of the new radio spectrum. This might seem to suggest that the era of the grassroots WiFi hackers building devices that were disruptive to the existing incumbent telecommunications providers has ended, or that CWN as a computerization movement has primarily served to create demand for free municipal WiFi. However, given the impact that the values and ideas of CWN geeks and policy hackers have had, perhaps the influence will be less visible but equally important. After all, hackers are said to like unfriendly spaces.

Chapter Seven: Outcomes and Conclusions

Introduction

In May 2008, while completing the final version of this thesis, I was again driving through America, this time returning from the CWN Summit with Dharma Dailey. We were talking about activist research, strategic alliances, and the way that Ethos Wireless had assembled associates with a broad range of expertise, making the consultancy the main point of contact for research and knowledge about the social impacts of local network building. On this drive I reflected on how CWN had come of age, and how the visions of local geeks had bridged and transformed into realities that produced some functioning networks, but also a large amount of expertise that has since been channeled into modifying policy or developing research protocols for studying local networks. The drive also allowed me to reflect on how the Summit had remained young, fresh, and fun despite its trappings of conventionality.

The 2008 Summit was held at the elegant offices of the American Association for the Advancement of Science, in downtown Washington DC[61]. The keynote speakers included the Executive Director of the United Nations Office for Partnerships, and the director of Article XIX, a human rights organization. The focus of the Summit was to connect local WiFi networking with human rights causes, framing CWNs as means to establish the right to communicate. Attracting many of the same participants as in years past, the Summit re-established the importance of community-based networking projects as means of creating networks broadly in the public interest. With a budget identical to previous Summits, the increasingly influential connections of CWN leaders made it possible to leverage space and high-profile keynote speakers. In 2008 the connection between open technical standards, social justice goals, and policy change was even more clearly articulated through keynote speeches that focused on social aspects of networking. Furthermore, the 2008 Summit marked a moment of shifting balance in CWN expertise. A group of geeks finally succeeded in refining a mesh networking solution that could function immediately "out of box" with very little input from its users; Ethos Wireless repositioned itself as a site of social research expertise, and instead of for-profit companies seeking to build municipal wireless networks, the best-funded visitors to the Summit were representatives of non-profits engaged in community development. The 2008 Summit suggested that the visions of democratic communications infrastructure development put forth by CWN geeks have not necessarily produced the realities that they may have expected, but they have created realities in which communications technology might yet be democratized to serve communities and publics, partly by bridging expertise between geeks and other actors in the CWN "movement."

This thesis has concentrated on three aspects of the North American CWN phenomenon as a co-production of technology, policy and culture by exploring first how local CWN projects leverage progressive visions of technology to create interventions in the communications landscapes of particular cities, then how these efforts contribute to the democratization of communications technology, and finally, how discourses, practices, ideas, and knowledge shift between different actors, especially geeks, social justice advocates, and policy hackers. It has used a theoretical and methodological approach situated at the intersection of STS and constructivist communication studies, pursuing a participatory, inductive approach to the transformations in material forms, discourses and practices of community WiFi networking. By considering how CWNs act as a contemporary form of computerization movements, the first part of the thesis describes how progressive visions of computer technology have appeared in different social contexts over the past forty years. Computerization movements promise progressive alternatives to existing computing technologies, but paradoxically, these alternatives sometimes end up justifying or even contributing to a capitalist, technocratic society. Computerization movements are therefore a type of new social movement: their products are not necessarily changes in state apparatus nor changes in technology, but changes in the way access to and knowledge about computers and ICTs is symbolically represented. CWNs transform both the structure of communications and the way that ICTs are integrated into local cultures.

The case studies of Île Sans Fil and the Fred-eZone demonstrate how local CWN projects produce different types of networks with social benefits that flow towards different communities and publics, and also how the symbolic association between WiFi and innovation branded Montreal and Fredericton as "smart" and "innovative." The case studies also indicate some of the limits of CWN projects as democratic rationalizations of technology: in Montreal, Île Sans Fil mobilized a geek-public of experts who created partnerships, built software and hardware, and attempted to establish an infrastructure for community media that might mobilize a community-public of other local residents. However, the reality of use of the ISF network suggests that the community-public rarely uses the hotspot network as a form of community media. Despite this, the city of

Montreal works to leverage the symbolic connection between geeks, innovation, and civic participation, proposing a partnership whereby the network will be supported by the municipal government. This potentially creates a new type of institution in which the progressive civic participation of geek-publics can be leveraged to brand Montreal as innovative. Fredericton also leverages the idea of WiFi as innovative by adding a free WiFi network on to its existing fibre-optic network. Once again, the vision of the Fred-eZone as defining Fredericton as a "smart community" contrasts with the reality of a network that is rarely used more than a few times by any individual. Although the public ownership of the Fred-eZone creates the possibility for the network to be considered a public service, the network's design limits the ways in which it can be productively applied in the public interest. Therefore, although public ownership of networks creates an institutional framework for alternatives to corporate ownership, the potential to mobilize communities or publics can be limited by choices made during the design process. Ultimately, the Fred-eZone serves primarily as an example of the power of the symbolic associations between progressive politics, new technologies, and innovation.

These local case studies are part of a much broader shift in the communications landscape in North America. The CWN phenomenon unfolds at what McChesney claims is a critical juncture in media and communications, where social justice issues become increasingly aligned with issues of fair access to media. In particular, community ICT infrastructure including community WiFi are perceived as means of expanding access to high-quality, unbiased and representative local media. This interpretation of the importance of CWN, connecting it with the media reform movement, suggests that WiFi technology can serve the public interest by making internet and network access more ubiquitous. While this is one way of articulating WiFi technology and politics, other articulations politicize the disruptive nature of WiFi. At CWN Summits, geeks and social justice advocates politicize WiFi in different ways, helping to define the parameters of a CWN "movement" that resembles a type of new social movement as defined by Touraine (1972; 1992) and Lievrouw (2007). Besides attracting social justice advocates who focus on ubiquity as a logical connection between technology and politics, North American CWN Summits also inspire geeks – like the ones who developed a geek-public in Montreal – to develop a progressive political argument for WiFi's disruptive nature. This argument suggests that the structures of communication networks can themselves have political impact – as the Fredericton case study indicates as well. The inherent contradictions between these two ways of politicizing WiFi – one by focusing on ubiquity and another by focusing on disruptiveness – limit the effectiveness of CWN as a "movement" and draw into focus the dialectic inherent in computerization movements.

Still, the current critical juncture for media and communications may have made this nascent "movement" more significant. Between 2004 and 2008 the CWN Summits not only established different ways of connecting technology and politics, they also acted as places where these political divides could be bridged. In particular, the discourses and practices of "policy hacking" attached technical language and legitimacy to a broad set of practices that included communications policy advocacy and links between community media and community WiFi. The final chapter of the thesis examines how a non-profit consultancy created by people who had gained knowledge and expertise by working with

CWN geeks established public interest arguments for policies including open source, open spectrum, and open access technologies. I argue that such "policy hacking," while limited in its scope, represents one of many ways of bridging discourse, knowledge and practice among CWN participants. As a participant in CWN, I too have learned about WiFi technology from practitioners, and have created and shared research and policy knowledge. As a methodological strategy, this inductive view of CWN has permitted me to explore the symbolic and material transformations of WiFi as they have occurred in local case studies and in broader policy contexts. The rest of this concluding chapter discusses the outcomes of the CWN phenomenon, paying particular attention to shifts in knowledge production and the development of new institutions that develop, regulate, and govern local communications systems including WiFi.

Shifting Knowledge Production

The CWN phenomenon illustrates how non-institutional actors like community organizations and municipal governments not only build technical systems, but how they transform expectations about the role new technologies should play in the development of communities and publics. Such shifts in the symbolic order result from shifts in knowledge such as the politicization of technical structures through Net Neutrality, to cite only one example. Broadly speaking, the bridges created between technicians, social justice advocates and policy advocates demonstrate how knowledge can be shared horizontally. From the geeks at ISF and the municipal decision-makers in Fredericton to the "policy hackers," the CWN phenomenon indicates how communities whose interests are less heavily vested in maintaining the structures of capitalism and technocracy might make decisions about communication infrastructure more democratically. However, these cases also indicate the limits of this democratization, as WiFi networks become part of cities' branding strategies instead of community services.

Still, the community WiFi phenomenon suggests a shift in the way that knowledge is produced and disseminated, away from purely institutional structures and towards more open, networked forums. Perhaps this is mirrored by the development of small, flexible technologies by non-institutional actors. As these small innovations begin to influence larger institutions, both are transformed. The expertise gained from being part of a group of practitioners becomes valuable for all kinds of people involved in CWN because it is seen as an example of authentic, legitimate knowledge. Community wireless networking is now becoming framed as an example of practice-based, open forums where knowledge sharing reconfigures institutional hierarchies of who knows what. In spite of the way that CWN developments have tended to reinforce the expertise of geeks and the social imaginary of a geek-public, they have also created ways of bridging discourses and practices so that "policy hacking" to promote distributed, non-hierarchical, community-owned communication infrastructure draws from knowledge about the technical possibilities of WiFi and their political implications.

Outcomes

This knowledge transfer is perhaps the most powerful theoretical consequence of the CWN phenomenon, and it is encouraging to observe it at the current critical juncture. The transfer of knowledge from grassroots experts to policy advocates does suggest that more democratic or responsive institutions may develop to govern and regulate communications. However, other outcomes of CWN are perhaps slightly disappointing when compared to the original visions that motivated WiFi projects. Île Sans Fil, for example, never managed to introduce a new community media form using WiFi, although the project forced the development of a new economic model by reducing people's willingness to pay for WiFi in public places. Similarly, the Fred-eZone provided WiFi 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. These outcomes suggest that community WiFi projects may not present commanding alternatives to current structures of communications ownership. Nonetheless, the development of locally-scaled partnerships may provide more opportunities to institutionalize the kinds of knowledge produced by local CWN projects. In turn these partnerships suggest the potential for broader symbolic transformations.

Municipal-community Partnerships

In both the U.S. and Canada, community WiFi projects have demonstrated that internet connectivity and community media can be developed and managed by local organizations without a profit motive. The ISF and Fred-eZone case studies indicate that small scale and integration into local culture characterize successful community WiFi projects.

Currently, a new set of local WiFi 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 WiFi market led ISP MetroFi to announce that it was planning to dismantle and sell the components of the Portland 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 WiFi projects, adopting the ISF model of hotspots sponsored by businesses and community organizations. Quebec City's geeks branded their hotspot project "Zone d'accès publique" or ZAP, and participated with ISF in the Terminus 1525 arts distribution project. In Sherbrooke, the Pôle Universitaire, a strategic alliance between the area's post-secondary 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[62]. 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. The ZAP projects leverage business and government participation in building WiFi hotspots, but they leave behind the artistic collaborations and grassroots experimentation that made ISF so exciting in its first few years.

Defining public space with WiFi also became a feature of the ZAP projects. Over one third of ZAP sites are in universities, libraries, or community centres 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 WiFi to universities and community organizations, and establishes a non-profit model that could become the basis for a future co-operative 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. Its success suggests that CWN might yet have an impact on the diachronic or state-based level in addition to establishing the symbolic importance of WiFi at what Touraine (1973) argues is the synchronic level.

Political Discourse

The success of individual community WiFi projects depends on them developing organizational forms and symbolic representations that fit within specific local contexts.

The outcomes of the CWN "movement" are more wide-ranging, as they begin to include new types of network forums like the CWN Summits where expertise can be shared. As media reform becomes more closely linked with other social justice projects, and as CWN advocates who have learned from geeks begin to shift policy discourses, technical elements become politicized.

U.S.-based activists have had more success in creating broad mobilizations around political-technical ideas like network neutrality, as well as more success in "hacking" WiFi in the political and policy world than Canadian activists. One reason for this may be the very success of the locally focused community WiFi projects in Canada. While in the United States municipal WiFi was framed by some advocates as a way of providing broadband in more areas and bridging the digital divide, the 1990s focus in Canada on expanding connectivity (developed through the National Broadband Strategy) led to ISF exploring the community media potential of WiFi and the Fredericton local government leveraging its symbolic influence to brand its community as innovative. Both of these projects position WiFi as a disruptive technology that can be employed innovatively and not necessarily institutionalized within existing ownership forms like franchise models. It is possible that this focus on local innovation as opposed to universal connectivity has prevented the development of the momentum that has moved U.S.-based CWN actors to participate in policy changes.

The bridges created through technology mobilizations like CWN also include bridges between scholars and activists. Large multi-partner research projects like CRACIN and

CWIRP introduced graduate students to participatory methodologies and their application in policy-relevant research. These projects have encouraged situated research that communicates the experiences of participants and advocates to policy makers. For example, U.S. media reform conferences have begun to consciously integrate academic researchers into the relationships between geeks, social justice advocates, and researchers.

In my own work, following community WiFi actors has sharpened my understanding of the political consequences of shifts in media and communication. It has also opened up new cultures of collaboration and advocacy. Learning about WiFi by participating in WiFi organizations, attending conferences, and spending time learning how to manipulate the technology that is the focus of such intense debate has, I argue, produced a new generation of policy advocates and researchers whose theorizations of socio-technical phenomena are based in practices learned through participation in open, non-hierarchical organizations. This creates situated perspectives and situated knowledge for research practitioners. There are important tensions and challenges inherent in conducting this type of research: it is time consuming and does not always produce the quantitative or outcomes-based research that policy-makers often expect. A situated perspective can be influenced (and limited) by the culture in which it is located, as the gendered nature of ISF indicated to me. However, I consider that the change in research cultures can create spaces for situated knowledge and distributed learning. For example, the Ethos Wireless consultancy has begun promoting qualitative research as rigorous means of assessing the social impact of networks. The consultancy also bridges the gaps between academic research and policy research by providing opportunities for junior academics to contribute to research projects that also include community and policy stakeholders. Thus, some of the outcomes of CWN suggest that the critical aspect of computerization movements can have positive outcomes.

Ways of Knowing: Technological Culture and Social Change

Ursula Franklin (1990) argues that technology produces its own world, and only through understanding this world and its consequences can we create healthy communities and more just human relationships. She also argues that we might benefit from thinking about technologies holistically rather than prescriptively. A prescriptive view of technology situates technologies as solutions to problems, while a holistic view considers technology as one part of an entire unfolding system. My thesis has examined how the CWN phenomenon, as a type of computerization movement, has produced not only material forms but also cultures and policies that may contribute to a more holistic understanding of communications infrastructure. While Franklin might criticize geeks for their fascination with technology for its own sake and their potential ambivalence towards its political consequences, she would appreciate how the CWN "movement" considers both the structure and the consequences of different forms of networked ICTs. She would also likely applaud the way that knowledge about WiFi has bridged into new groups and been applied to social justice goals, although she might continue to question why technical expertise, even in CWN, continues to be gendered as masculine. She might even be cautiously optimistic about community ownership and horizontal expertise as broader consequences of CWN.

Thinking about how Franklin might respond to the CWN phenomenon helps to re-frame it as a form of technological culture. Like the technological culture of the Futurists, whose creative responses to early modernity produced new ways of visualizing technological change, CWN's technical culture may potentially produce new ways of thinking about knowledge and software production, collaboration, and local communication infrastructure. By participating in CWN as well as observing its growth and transformation, I have tried to contribute to creating positive social change within technological culture. As Bijker (2002) writes,

> It is only one step to observe that we live in a technological culture. I will argue that STS needs to make a further step, and actively contribute to politicizing this technological culture: to show to a broad array of audiences—politicians, engineers, scientists, the general public—that science and technology are value-laden, that all aspects of modern culture are infused with science and technology, that science and technology play key roles in keeping society together, and that they are equally central in all events that threaten its stability" (p. 2).

This thesis has responded to Bijker's challenge by analyzing and describing how progressive visions for ICTs like WiFi transform into realities that hold the potential to improve society by linking technological design with social justice, and by advocating for policies that take into account this link. The CWN phenomenon may be merely a contemporary form of computerization movements, but at the current critical juncture, the new institutions and knowledge bridging that it illustrates may have broader consequences for communications, media, and democracy.

Notes

[1] Even if some of the political movements linked to the avant-garde, like Soviet socialism and fascism, eventually became repressive regimes.

[2] WiFi devices use radio waves to create networks that permit access to the internet. The devices use license-exempt radio spectrum at 2.4 GHz. WiFi is the commercial term owned by the Wi-Fi Alliance referring to interoperable devices that use the IEEE 802.11standards.

[3] These debates are historically linked to the split in the Frankfurt School between Habermasian notions of "system/lifeworld" distinctions and Marcusian ideas of integrated nature and culture.

[4] Although a pure ANT theorist would argue that making distinctions between "technology" and "society" is arbitrary. In this thesis technology and society are understood to be co-produced, but separable.

[5] Turner's conception of 'social world' can be taken as analgous to 'social imaginary' as I define it below and as it is used throughout this thesis.

[6] The concept of 'virtual community' was introduced by Howard Rheingold, and marked a turning point in the way that the interactions made possible by networking communications technologies were discussed: previous to the publication of his 1993 book, as Turner (2005) notes, "researchers generally did not take up the question of on-line communities as such. Rather, they focused on computer mediated communication, principally on the ways in which computer technologies shaped interpersonal communication and thereby the performance of work groups, teams, and commercial organizations. For examples, see Ronald E. Rice, "Issues and Concepts in Research on Computer-Mediated Communication Systems," *Communication Yearbook* 12 (1988): 436–76,and Lee Sproull and Sara B.Kiesler, *Connections: New Ways of Working in the Networked Organization* (Cambridge, Mass., 1991)" (Turner 2005, p. 486).

[7] He suggests, in particular, that large-scale research tasks should be distributed across research networks (p. 13). In the context of this thesis, the research on CWN was situated within three larger research projects (CRACIN, CWIRP, and the LabCMO – detailed in Appendix One) which not only provided financial support but also acted as research networks that produced broader research results (surveys, literature reviews, policy reviews), some of which I draw on here. Within the CWN movement, survey research of local CWN development was conducted along with members of Île Sans Fil and with Laura Forlano, a doctoral student at Columbia University and a member of NYCWireless.

[8] These students include myself, Hanna Cho (WirelessToronto; MA 2006, Communication and Culture York and Ryerson Universities); Laura Forlano

(NYCWireless; PhD 2008, Communications, Columbia University); Mark Gaved (DigCoop; PhD 2007, Communications, Open University); Katrina Jungnickel (Adelaide Wireless, Australia; PhD 2008, Visual Anthropology, Goldsmith's College UK); Dory Kornfeld (WirelessToronto; MA 2007, Geography, University of Toronto); Sascha Meinrath (CuWIN; PhD Communications University of Illinois Champaign-Urbana); Anthony Townsend (NYCWireless; PhD 2004, Urban Design, MIT); Matt Wong (Wireless Nomad; MSc 2007, Information Studies, University of Toronto).

[9] These included a general education web site discussing network neutrality (http://www.whatisnetneutrality.ca) and an outline of types of local communication networks, prepared for Ethos Wireless (http://www.betterbroadband.org)

[10] Modifying a computer required technical expertise, while expanding a mind might have involved drugs, laser light shows, or psychedelic music.

[11] The open-source development process has had significant economic impacts impossible to discuss in detail here. Weber (2004) provides a review.

[12] Overseas meetings included the World Summit on Free Information Infrastructures in London in 2005 and a series of "national" and international wireless Summits in the United States. I will discuss these "Summits" in more detail later.

[13] The 2006 survey was developed along with Laura Forlano, Columbia University, who deployed a similar survey in New York City and Bucharest. Comparative findings from all three surveys are presented in Forlano (2008), and I am extremely grateful for her generosity in co-developing and sharing the Montreal survey with me.

[14] The 2007 interviews were conducted as part of a research contract with the Community Wireless Infrastructure Research Project (CWIRP). The semi-structured interview script was developed to touch upon the same themes as the 2005 interviews. 13 interviews with users were conducted as part of this project. An agreement with the CWIRP project has provided me access to raw data collected as part of the ISF case study. For full details of research project support of the research involved in this thesis, see Appendix One.

[15] The Mobile Digital Commons Project (http://www.mdcn.ca), funded by Heritage Canada and led by Michael Longford of Concordia University, was the first partnership created by ISF and provided funding for equipment to establish the first 15 WiFi hotspots.

[16] Original French: "C'est principalement un club de geek, ah, je pense que c'est un club de passionnés"

[17] Original French: "On est une belle gang . . . il y a du beau monde ici"

[18] Original French: "Pour moi, c'est donner accès a quelquechose qui est important, comme l'eau, l'éléctricité – ce n'est pas plus important que l'eau mais ça permet de s'informer."

[19] Locative media are digital media applied to real physical places and meant to inspire social interactions. Locative media depends on the ability to target media or interactive content to a specific location (Russell, 2004).

[20] A funding program that supports the development of artistic content produced by artists aged 15 to 25.

[21] Hub des Artistes Locaux is a partnership project between a community radio station, Île Sans Fil, and the campus television station of Concordia University. The project uses ISF hotspots to host music and video servers that broadcast music and video content curated so as to relate to the specific culture of the hotspot. See http://www.ilesansfil.org/tiki-index.php?page=HAL

[22] For example, the distroboto project developed by Archive Montreal reappropriated cigarette machines that now dispense pocket-sized art: http://www.distroboto.archivemontreal.org/

[23] Original French: "C'est comme on a créé une chaine de production, on a répéter le modèle industriel . . . .La problème c'est qu'il n' y a pas vraiment des buts nobles . . . En dedans il ya une problème de gouvernance. Les gens avec les projets artistiques étaient toujours les 'outsiders.'"

[24] In spite of its supposed lack of hierarchy, some members of ISF were more influential than others. One rather marginal group member consistently posted slightly sexist comments on the mailing list (for example, about how he would like to have blondes in the afternoon and redheads in the evening), but since he did not have much influence, these were mostly ignored. However, sexist comments by a more "powerful" group member had a different weight.

[25] Between 2004 and 2007, thirty articles appeared in the Canadian press referring to ISF. In 2005 each of the three French daily newspapers in Montreal: Le Devoir, La Press, and le Journal de Montréal each published one article: Dumais, Michel (2005) "Le boulevard St-Laurent à l'heure du sans fil." *Le Devoir* – January 31, 2005; Boisvert, Pierre (2005) "Une Île Sans Fil presque partout à Montréal." *Le Journal de Montréal* – May 18 2005; Cardinal, François (2005) "Une île, pas de fil". *La Presse* – May 28 2005. ISF was also discussed in a feature article in the national newspaper *The Globe and Mail*: Patriquin, Martin (2005) "ISF 'collective' helps Montreal go wireless" - December 9 2004. Montreal's English-language daily, *The Gazette*, never published an article on ISF.

[26] Original French: C'est comme on a créé une chaine de production, on a répéter le modèle industriel . . . .La problème c'est qu'il n' y a pas vraiment des buts nobles . . . En

dedans il ya une problème de gouvernance. Les gens avec les projets artistiques étaient toujours les "outsiders."

[27] See http://communities.canada.com/montrealgazette/blogs/tech/archive/2007/12/28/vote-for-montreal-s-sexiest-geek-in-2007.aspx

[28] My travel to Fredericton was supported by the CWIRP project. For a full list of the research projects I was involved in during the production of this thesis, see Appendix One.

[29] For a full list of interviewees for the thesis, see Appendix Two, for summary ethics protocols and interview guides see Appendix Three, and for surveys Appendix Four.

[30] The development of this survey was supported by the CWIRP project and data will, in principle be shared with the CWIRP project leaders and with the members of the Fredericton municipal government who were partners on this project. The data from the survey was presented in Fredericton during the 2008 IEEE Society on Social Implications of Technology Conference, June 26-28, 2008.

[31] According to the Canadian Radio-Television Commission (the CRTC) a non-dominant 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.

[32] See http://iit-iti.nrc-cnrc.gc.ca/index_e.html

[33] See http://www.cisco.com/en/US/prod/collateral/wireless/ps5678/ps6521/prod_case_study0900aecd8031b969_ps430_Products_Case_Study.html

[34] Oudshoorn et. al described how designers creating the online Amsterdam Digital City project, charged with creating an interface and experience in which every citizen could participate. However, the designers failed to account for the diversity of users, instead using their own experiences to create a more homogenous identity for the users, who were supposed to include "everybody."

[35] Warchalking, as Sandvig (2004) explains, was a means of indicating unsecured WiFi networks using chalk symbols on the sidewalk. It was a popular pastime in the early 2000s. The markings were thought to have been inspired by the chalk symbols left by hobos in the 1930s to indicate where to find free meals.

[36] Muniwireless.com is owned by Esme Vos, a consultant based in Amsterdam. It began in 2003 by cataloguing the beginning of the municipal WiFi phenomenon in the United

States and has since developed into a clearinghouse of surveys and white papers discussing municipal wireless business models and success stories.

[37] In 2008 the city was ranked as one of the world's "Top Seven Intelligent Communities" according to the Intelligent Community Forum. See http://www.intelligentcommunity.org

[38] In addition to the 2004 World Summit on Free Information Infrastructures Conference in London, UK these included the 2006 National Community Wireless Networking Summit in St. Charles, MO, the 2007 International Community Wireless Networking Summit in Columbia, MA, the 2007 Wizards of OS Conference in Berlin, and the 2008 National Conference on Media Reform in Memphis, TN. I also reviewed the online audio, video and text archive from the 2004 National Community Wireless Networking Summit in Champaign-Urbana, IL which I was unable to attend.

[39] These include: the Île Sans Fil volunteer announcement list, the WSFII discussion list, the National Community Wireless Networking News, and the mailing list for the Boston Wireless Requests for Information working group struck during the 2007 International Summit.

[40] These included my own blog: http://youcancallmeal.flinknet.com, as well as Sascha Meinrath's blog: http://saschameinrath.com; Michael Lenczner's blog: http://mtl3p.ilesansfil.org; Joshua Breitbart's blog: http://breitbart.wordpress.com; Dharma Dailey's blog: http://dharmadailey.com. Comments posted on blogs are considered public speech and are attributed in the text of the thesis.

[41] I contributed to the educational website http://whatisnetneutrality.ca in 2006 and contributed to the Ethos Wireless Better Broadband Toolkit in 2007.

[42] It is extremely important to note that an explicit focus on politics as defined through public policy seems to be a particularly North American preoccupation in CWN circles. The WSFII Summit in 2005 in London described its "focus on the needs and practicalities of free infrastructure development rather than on theory or policy, though these are possible outcomes of the process" (http://www.wsfii.org/wiki/WsfiiDescription - Accessed October 5, 2007).

[43] Also very masculine. As Kendall (1999) notes, technical and scientific expertise are associated with an increasingly hegemonic masculinity – previously pejorative identities like "geek" and "nerd" are marks of some power.

[44] This type of media, sometimes called autonomous media, is defined by Roncaglio as promoting alternative communication that would not occur within conventional media. Alternative media invites "more participation in the production and transmission of messages on the part of an increasing number and variety of groups" (Roncaglio, 2000, p. 206). Indymedia has been considered as a form of alternative media, but also as a type

of "autonomous media" by Downing (2003) who considers it not just as an alternative but also an autonomous form of media production.

[45] Dynamic mesh networks are also very useful in cases of disaster recovery. CuWiN and other CWN actors created WiFi networks after Hurricane Katrina that functioned better than the United States federal government networks.

[46] See the Appendices for lists of interviewees and interview scripts.

[47] My focus on bridging from CWN to policy contexts may also result from bridges created between my STS-oriented work and the more policy-oriented goals of the research projects that supported it. Both the CRACIN project and the CWIRP project held as goals the production of research that could be used to comment on or improve telecommunications policy. I also participated in research partnerships with community organizations, including an SSRC Necessary Knowledge grant, and consulting work for the Ethos Group.

[48] Beginning in late 2007 the FCC began to auction portions of the radio spectrum made available by the transfer of television broadcast to digital transmission. In particular, the 700 MHz spectrum auction attracted media attention because of the provision that the owners of the spectrum, suitable for mobile communications, would have to leave the network open to access by a range of devices. Industry analysts suggest that this openness may increase competition in the telecommunications sector.

[49] Despite being Canadian, the authors did not mention Canada, arguing elsewhere in the article that the Canadian policy-making process is slightly more transparent.

[50] This research conference is one of North America's most influential venues for discussing telecommunication policy issues and is attended by academics, policy-makers from Washington and Ottawa, and some public interest actors.

[51] CWN examples of the use of mesh networks include the original CuWIN network, the MIT RoofNet project, and some very large European mesh networking projects, including Freifunk in Berlin and Leipzig, and GuiFi in Catalonia that serve thousands of people. CWNs in Canada have primarily used hotspot configurations. The RoofNet project has inspired Meraki, a company selling mesh networking routers. When CWN projects began, mesh networks were perceived as more challenging to broadcast architectures than hotspots or WiFi "clouds" that merely extended existing broadband infrastructure.

[52] Even Freifunk, whose mesh intranet model creates an open network that anyone can join with the proper equipment, uses traffic-shaping to help allocate bandwidth that people contribute to the intranet. This means that a Freifunk member with an internet connection can decide how much of it to contribute to others on the network.

Commercial use is also allowed, and companies can develop innovative ways of sharing costs, or providing free slow internet service while charging for higher speeds.

[53] I am distinguishing network neutrality as a network management principle, from "Net Neutrality" as a political issue.

[54] Free Press is a non-partisan non-profit media reform organization funded by foundations including the Ford Foundation. Its self-described mission is to establish media reform as a central issue in social justice advocacy.

[55] Municipal wireless networking in the United States has focused on bridging digital divides and expanding access to the internet in underserved areas. In Canada, the federal strategies of the 1990s, including the Connecting Canadians initiative, the National Broadband Strategy and Broadband for Rural and Northern Development (BRAND) helped to establish broadband infrastructure in many urban and some rural regions, tempering the expectations for WiFi and wireless technologies as primary internet infrastructure.

[56] When CuWIN began experimenting with mesh routing protocols, it was assumed to be impossible for WiFi radio signals to move more than two "hops" through two nodes. Multi-hop radios are now standard equipment for large-scale mesh networking.

[57] No similar regulatory decision was taken by the Canadian government, a fact that may have influenced the lesser scale of the Muni WiFi boom here. As of March 2008 the following cities have proposed or constructed municipal WiFi networks: Toronto (selected areas only; for profit); Vancouver (in planning); Regina, Saskatoon and Prince Albert (provincial initiative, selected areas only); Fredericton (see Chapter Four) Chapleau, ON (demonstration project by Bell Canada); and demonstration projects in Calgary, AB and Hamilton, ON.

[58] These types of networks are described in more detail at http://ethostoolkit.net/better-broadband-toolkit/choices.

[59] I was employed by Ethos in 2007 to develop part of a toolkit on local networking technologies.

[60] This digital shift will begin in 2009 in the United States and in 2012 in Canada.

[61] See http://www.aaas.org/

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

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Appendix One: Research Projects Supporting this Research

Several funded research projects supported this dissertation. This appendix describes the projects in detail, and which aspects of the dissertation were supported by these projects, along with the nature of the data sharing agreements I established with researchers on these projects.

Canadian Research Alliance for Community Innovation and Networking (CRACIN) http://www.cracin.ca

CRACIN was a research partnership formed in 2003 and funded by the Social Sciences and Humanities Research Council of Canada. Its principal investigators were Andrew Clement of the University of Toronto, Michael Gurstein of the New Jersey Institute of Technology, Marita Moll of Telecommunities Canada, and Leslie Regan Shade of Concordia University. Its goal was to investigate the status and achievements of community-based information and communication technology (ICT) initiatives in Canada. I worked with CRACIN from its formation, first as its initial Research Coordinator and then after beginning my doctoral studies, as a research assistant charged with creating a case study on Île Sans Fil. Although ISF was not originally a partner organization for the CRACIN project, Leslie Regan Shade eventually convinced the other investigators that community wireless networking was a form of community innovation worthy of research. Research funded by CRACIN began in the Fall 2004 semester, continued in the Summer 2005 semester, and through the Fall and Winter semesters of the 2005-2006 academic year. Supervised by Shade, the case study began the long participatory involvement in ISF that serves as the basis for much of Chapter Three, as well as Chapters Five and Six.

Through the support of the CRACIN project I produced many presentations and research papers that developed some of the central concepts in this thesis, and received support that allowed me to present them for discussion at conferences in North America, including the Telecommunications Policy Research Conference in 2006. The CRACIN project also funded part of my travel expenses to the 2006 CWN Summit. The policy focus of the CRACIN project – one of its goals was to create policy-relevant research and include policy-makers in discussion of research results – encouraged me to focus on the communications policy implications of the community wireless networking phenomenon.

Community Wireless Infrastructure Research Project (CWIRP) http://cwirp.ca
Launched in 2005 and funded by Infrastructure Canada, the CWIRP project engages in in-depth studies of Canadian public/community-based ICT initiatives. Their case studies included both Île Sans Fil and the Fred-eZone, as well as K-Net, an aboriginal network in northwestern Ontario, and the Wireless Nomad co-operative that provided WiFi in Toronto. The principal investigator was Catherine Middleton of Ryerson University, and other investigators included Barbara Crow of York University, Andrew Clement of the University of Toronto, and Graham Longford of Trent University. I was a research

assistant on two case studies: the Fred-eZone study, and the ISF study. For the Fred-eZone study, I worked with Catherine Middleton (who was my MA supervisor at Ryerson). The rest of the fieldwork I conducted myself. CWIRP paid my travel and accommodation costs for a three-week research trip to Fredericton in February 2007. Middleton traveled to Fredericton and conducted one interview and some observations with me at the beginning of my fieldwork, for a period of three days. I was also compensated for the time spent composing the case study report. Data collected while in Fredericton was also used to produce Chapter Four. In late 2007 Middleton and I also collaborated on the design of the survey whose results are presented here. CWIRP's established partnership with the City of Fredericton facilitated running the survey. The survey results will be used by CWIRP but are published in this thesis for the first time.

In May 2006 I conducted one week of fieldwork related to CWIRP's ISF case study. This was supervised by Barbara Crow. The fieldwork included site visits to ISF hotspots, interviews with owners of hotspots and people using the network, as well as interviews with organizations connected with ISF, like the Societe du Developpement du Village. I also assisted with translation and any French-speaking fieldwork undertaken during this period. The raw data from these interviews has, with Crow's permission, been used in Chapter Fourn, along with my original 2005 user interview data.

Laboratoire de Communication Médiatisée par Ordinateur (LabCMO)
http://cmo.uqam.ca/
This research project funded by the Social Sciences and Humanities Research Council is led by Serge Proulx at the Université du Québec à Montreal. I conducted a case study on Île Sans Fil for the Lab in 2005-2006, and wrote a case study report that was eventually included as a chapter in an edited collection: *L'action communautaire québecoise à l'ere du numérique* (Presses Universitaire du Laval, 2008). The methodological focus in the LabCMO on francophone traditions of pragmatic sociology as well as actor-network theory oriented my methodological framework. The Lab funding supported the production of the case study report, which occurred at the same time as ongoing participant observation and informal interviews used for this thesis.

Collaborative Survey development
The 2006 survey of ISF was developed by Laura Forlano of Columbia University, who deployed similar surveys in New York City and Bucharest as part of her PhD research,. I assisted in developing this survey, having it translated into French, and liaising with ISF members to convince them to post it on the portal page. Laura agreed to share the research results from the ISF survey with me.

Appendix Two: Interviewees

I. Primary Interviewees (one hour unstructured interviews)

Île Sans Fil (ISF)

Anonymous. Interviewed July 17, 2007.
Philippe April. ISF Volunteer. Interviewed November 7, 2005.
Alexis Cornellier, ISF Volunteer. Interviewed May 14, 2006 and May 19, 2007.
Daniel Drouet, ISF Volunteer. Interviewed February 15, 2005.
Benoit Gregoire, ISF Volunteer and Technical (R and D) Director of ISF, 2005-2008. Interviewed February 4, 2005 and November 24, 2007.
Michelle Kasprzak. ISF Volunteer and Curator. Interviewed March 5, 2005.
Bruno Lacasse, ZAP Sherbrooke. Interviewed November 25, 2007.
Daniel Lemay, ISF Volunteer and President of ISF, 2005-2007. Interviewed February 5, 2005 and December 6, 2007.
Michael Lenczner, ISF Volunteer, Founding Member, and Administrative Director of ISF 2005-2006. Interviewed August 20, 2006.
Richard Lussier, ISF Volunteer. Interviewed May 19, 2007.
Laurent Maisonnave, ISF Volunteer. Interviewed December 6, 2007.
Bernard Plante. Directeur de devloppement, Societe du developpement commercial du Village. Interviewed May 11, 2007. *
Francois Proulx, ISF Volunteer. Interviewed November 4, 2005.

I also interviewed thirteen users of the ISF service: nine in November 2005 and four in May 2007. These interviews were anonymous.

Fred-eZone (one hour unstructured interviews)

Jane Blakely, Director, Corporate Services City of Fredericton. Interviewed February 16, 2007.*
Maurice Gallant, Chief Information Officer City of Fredericton. Interviewed Feb 17, 2007.*
Don Fitzgerald, Executive Direction, Team Fredericton City of Fredericton. Interviewed Feb 4, 2007.*
Barry Friedman, Chairman and CEO, FOG Studios. Interviewed February 16, 2007.
Wade Kierstad, Network Architect, Information Technology Department City of Fredericton – Interviewed February 10, 2008.*
Tommy Jelnik, City Councillor, City of Fredericton. Interviewed February 20, 2007.*
Kerry Jones, Senior Technician, Information Technology Department City of Fredericton. Interviewed February 13, 2007.*
Mike Richard, Manager, Information Technology Department. Interviewed Februrary 3, 2007*, February 10, 2007*, February 18, 2008.
David Seabrook, Manager, Fredericton Tourism, City of Fredericton. Interviewed February 12, 2007.*

Greg Sprague, Project Manager, National Research Council Institute for Information Technology. Interviewed February 18, 2007.*
Brad Woodside, Mayor of Fredericton. Interviewed Feb 3, 2007.*
Sandi MacKinnon, Director of Marketing, Remsoft. Interviewed February 16, 2007.

Canadian Community Wireless Networking Organizers
Matthew Asham. Interviewed August 18, 2006.
Hanna Cho. Interviewed August 17, 2006.
Tracey Lauriault. Interviewed August 20, 2006.

Community Wireless Networking Movement – Ethos Wireless Founders
Joshua Breitbart. Interviewed February 28, 2008.
Dharma Dailey. Interviewed February 27, 2008.
Sascha Meinrath. Interviewed February 28, 2008.

* These interviews were conducted as part of research funded by the Community Wireless Infrastructure Research Project

II. Secondary Interviewees (informal interviews)

a. Île Sans Fil

Pascal Leclerc – ISF Volunteer
Pascal Charest – ISF Volunteer
Robert Crecco – ISF Volunteer
Hugo Gervais – Communautique
Maya Wiseman – ISF Volunteer
Jeff Schallenberg – ISF Volunteer
Martin Reich – ISF Volunteer
Miriam Verburg – ISF Volunteer
Bill Tierney – Mayor, Ste-Anne-de-Bellevue

b. CWN Movement
Sue Beckwith – OneCommunity Ohio
Laura Forlano- NYCWireless
Anthony Townsend – Institute for the Future, NYCWireless
Xavier Leonard – Heads on Fire Media
Becca Vargo Daggett – Institute for Local Self-Reliance
Dana Spiegel – NYCWireless
Matt Westervelt - SeattleWireless
Daniel Meredith – CuWiN
Joshua King – CuWiN

c. Fred-eZone
Susan O'Donnell – Program Director, National Research Council Institute for Information Technology (IIT)

Bill McIver – National Research Council IIT
Mary Milliken – PhD Student, Department of Sociology, University of New Brunswick and Research Associate, National Research Council IIT
Research Librarians – Fredericton Public Library

Appendix Three: Interview Guides

I. Île Sans Fil Founding Volunteer Interviews: 2005

1. What was your first experience with WiFi technology?
2. How would you describe the primary goals and aims of Île Sans Fil?
3. What is your role within the group?
4. How did you get involved?
5. What do you think Île sans Fil does well?
6. What do you think it could do better?
7. What do you see as your future involvement?
5. How do you feel the work of Île Sans Fil has influenced the local community?
6. What kind of value to the community do you believe is provided by community-based wireless services?
7. Do you think that wireless services have the potential to improve accessibility to information and communication services?
8. How do you think WiFi services might be used by community groups?
9. What do you think are the long-term advantages of developing a free wireless infrastructure for the city of Montréal?
10. Who do you think uses ISF service?
11. Who else do you think could use it but hasn't yet?
12. What kinds of capacities do you think the Île Sans Fil infrastructure provides to community groups, local neighbourhoods, and others?
13. How would you describe your ideal use of community wireless services?

II. Île Sans Fil Volunteer Questions: Fall 2005 – WiFiDog Developers

1. What is WiFiDog?
2. What is the ISF portal page?
3. What does it do?
4. Who is it for?
5. Why is it important?
6. What part about it is most important?
7. Tell me about how it came to be developed.
8. What role did you play in its development?
9. What is the most interesting thing about the software for you?
10. Describe a typical user of the software. If there is more than one, describe them all.
11. Would you consider yourself a typical user?
12. What do users do with the portal page?
13.What is the importance of Wifidog?
14. What were the goals in developing it?

15. Tell me about your experience in developing the software.
16. What were the goals for developing it?
17. What do developers do with WiFiDog? With the portal page?

PARTNER QUESTIONS – MDCN
1. Tell me about the relationship between ISF and MDCN.
2. Tell me about the process of working with these groups as the portal was developed.
3. What were the goals?
4. What were the results?
5. What do you think users do with the portal page?

SALES AND MARKETING QUESTIONS
1. Why is the portal page important for users of ISF?
2. What makes this page important or unusual?
3. Tell me about how you used the portal page to get people interested in ISF.

III. Île Sans Fil User Interview Questions: 2005; 2007

1. Gender
2. Age
3. Occupation
4. Location
5. How often do you visit this location?
6. How did you discover that this spot had ISF service?
7. Can you show me how you normally use the service?
   Login – how did you create your account?
8. Validation – what's the process? What do you like, don't like,what would you change?
   Portal page – Do you read this? Would you?
9. Have you set up more than one account?
10. Can you explain to me how this works?
11. What would you change about this?
12. What kinds of features do you use?
13. Why do you come to a public place to use your laptop?
14. Are you interested in getting to know the people around you – for example, the people whose usernames you see?
15. What kinds of the existing features do you use (the map, the list of hotspots, the RSS feeds)?

IV. CWN actor Interview Guide: August 2006

1. What is the name of your group? When did it form?
2. What are your main goals? Mandate?
3. Who are your volunteers? How many do you have? Where are you located, where are they located?
4. What kinds of activity do your volunteers engage in? What do they like to do?
5. What's your group's response to the development of municipal wifi?

6. Why WiFi? What's important about this technology (or not)?
7. Where do you see your group going in the next few years?
8. What are the major technology and policy issues for you?

C: Summary Protocol Forms: Fredericton Case Study

I. Fredericton Interview Questions 2007

a. Contextual Guide: Planner and Network Developers
PROCESS QUESTIONS
1. Can you tell the story of how the EZone idea emerged?
2. What is the relationship between E-Novations, the City, and the E-Zone?
3. What kind of suport was provided by the city community?
4. How would you describe the Fredericton community?
5. What have the benefits of this network been, in your opinion?

PEOPLE AND TASKS
1. What are your backgrounds?
2. What are the main job tasks of the people in this department?

ARCHITECTURE
1. Describe the architecture of the network.
2. What parts of the city does it cover?
3. Has this changed over time?
4. Describe some of the modifications you made.

USE AND USERS
1.How are people using the network?
2. Is this different than you expected?
3. What kinds of changes are you planning to support this use?

EXPANSION
1. What are the plans to expand the network?
2. Can you describe the advantages and limitations of the hardware that you are using right now?

b. Contextual Guide: Tourism, Small Business Owners
COMMUNITY IDENTITY
1. What is the overall image that you intend to project of your community?
2. How do you normally communicate this image?
3. What are the groups of tourists/clients that you aim to attract?

ECONOMIC REALITY
1.What role does your sector play in the local economy? What proportion of jobs are influenced by this sector?

INFRASTRUCTURE
1. What is the impact of the transporation infrastructures?

CHANGES AND IMAGES – HIGH TECH AND IT
1. Are there new groups who you have begun considering now that you had not in the past 5 years?
2. Would you say that the eZone (other IT projects) has changed or influenced your strategy for marketing the city?
3. Can you give me examples of the influence of the eZone on tourism?

PROCESS, VISION
1. Who was involved in developing the eZone?
2.How?
3. What would your department change, if anything, about the ezone? What would be your department's ideal?

VI. Policy Actor Interview Questions 2007/8

GENERAL QUESTIONS
1. Why did you get involved in community wireless networking (CWN)?
2. What is your definition of a community wireless network?
3. What is the main goal of community wireless networking?

SITUATING CWN
1. What kinds of policy issues are most important for CWNs?
2. What kinds of technical issues are most important?
3. What are the greatest organizational challenges?
4. What do CWN actors contribute to internet policy?
5. What other technical and policy fronts have or require CWN intervention?

STRATGEGY QUESTIONS
1. What are some of the strategies that CWNs use to provide connectivity in their local areas?
2. What are the strategies for CWN intervention beyond the local area (municipal networking, peering bandwidth between community networks, creating meshed networks, creating wide-scale regional networks)?
3. What do you think can be gained by creating a peered network of community and municipal projects?
4. What are the limitations – technical, ethical, political, of each of these strategies?
5. How do you connect technical choices, organizational strategies, and political goals of CWN in your work?

CONCEPTUAL QUESTIONS
1. How would you describe an open network?

2. How is openness as a concept important to CWN?
3. How is openness as a concept important to telecommunications policy-making
4. How would you describe a free network?
5. How is freedom as a concept important to CWN, to telecommunications policy-making?
6. How would you describe a community?
7. How is community as a concept important to CWN, to telecommunications policy-making?

Appendix Four: Surveys

I: Île Sans Fil Questionnaire (distributed on paper, 56 responses) – March 2005

PART I: Demographic Information
1. Gender [Female] [Male] 2. Age [A] 18-30 [B] 30- 45 [C] 45-65 [D] over 65 3. Postal code __________

4. Spoken languages [A] English [B] French [C] Other _______________
5. Occupation _________________

PART 2: Computer Access
1. Where else do you access the Internet? [A] Home [B] Work [C] School
[D] Library [E] Other public location

2. Were you aware that Île Sans Fil provides the WiFi connectivity in this location?
[YES] [NO]

3.Were you aware that Île Sans Fil is a non-profit organization? [YES] [NO]

3. Do you use other WiFi providers? [YES] [NO] If so, where?

4. How often do you use this hotspot per month? [A] Once [B] Twice [C] Three times [D] More than three times

5. How long are your visits on average? [A] less than 10 mins [B] 10-30 minutes [C] 30 minutes - 1 hour [D] 1- 3 hours [E] 3+ hrs

6. What kind of device do you use? [A] laptop [B] PDA [C] mobile telephone

PART 3: USES

1. How does this café fit into your routine?
[A] I come all the time [B] I drop in occasionally when I am in the neighbourhood
[C] I'm visiting the city [D] this is my first visit

2. What do you normally do while you are here? Select all that apply

Paid work	[ ]
Looking for information	[ ]
E-mail check	[ ]
Message friends/relatives	[ ]
Telephone over IP	[ ]

Word processing [ ]
Other (specify)

3. What else would you like to see offered through Île Sans Fil?
Profiles of users [ ]
Art on the opening pages [ ]
Community information and news [ ]
Other? Suggestions?

4. What's the best aspect of using Île Sans Fil?
5. The worst aspect?

II : Île Sans Fil On-line survey (distributed via the portal page, 370 responses) – January – April 2006
General Questions / Questions général
1. Where have you used the wireless Internet in the past six months? (Check all that apply.) Où avez-vous utilisé un service d'accès Internet sans fil au cours des dernier six mois? (Cochez tous les endroits pertinants)

Cafe Tribune
Second Cup rue St-Denis / Ave Maisonneuve
Laïka
Café l'Utopik
Second Cup St-Laurent and des Pins
Cafétéria Collège Lasalle
Second Cup Rue Marquette / Avenue Mont-Royal
Resto-Pub 100 Génies
Café Suprême
Kafeïn
Café Pi
Santropol Café
Café Art Java 3030
Spin Café Buanderie conviviale
Salon Alfred Dallaire - Salle B
Zeke's Gallery
Atomic Café
Vices & Versa
Palmyra Resto / Café
Parc Émilie-Gamelin
Other Second Cup locations
Starbucks locations
Pierre-Elliot Trudeau Airport
Autres endroits (spécifiez)

2. Where have you used the wireless Internet most frequently in the past six months? (Enter the name of one of the locations above.) Quel est l'endroit où vous avez utilisé l'Internet sans fil le plus souvent? (Écrivez le nom d'un des endroits ci-hauts.)

1. For the remainder of this survey, please respond based on your answer to Question 2 above. Do you go to this location specifically because of the availability of the wireless Internet? À partir de maintenant et jusqu'à la fin, répondez par rapport à l'endroit que vous avez répondu à la question précédente. Allez-vous à cet endroit à cause de la disponibilité de l'Internet sans fil?

Yes / Oui
No / Non
Sometimes / Parfois
Other (please specify) / Autre (spécifiez)

2. What is the primary purpose for which you use the wireless Internet at this location? Principalement, quelle utilisation faîtes-vous de l'Internet sans fil à cet endroit?

Work / Travail
Personal / Personelle
Both Work and Personal Use / Les deux
Other (please specify) / Autre (spécifez)

3. How often do you use the wireless Internet at this location? Quel est la fréquence de votre utilisation de l'Internet sans fil à cet endroit?

More than once a day / Plus qu'une fois par jour
Daily / Une fois par jour
Weekly / Une fois par semaine
Monthly / Une fois par mois
Annually / Une fois par année
Very rarely / Rarement

6. How long do you normally spend using the wireless Internet at this location? Combien de temps passez-vous à utiliser l'Internet à cet endroit, normalement?

15 minutes or less / 15 minutes ou moins
30 minutes / 30 minutes
1 hour / 1 heure
2 hours / 2 heures
4 hours / 4 heures
More than 4 hours / Plus de 4 heures

7. At what time of day do you usually use the wireless Internet at this location? (Check all that apply.) Quels sont les heures durant lesquelles vous utilisez l'Internet sans fil à cette endroit, habituellement? (Cochez tout ceux qui s'appliquent).

6 a.m. to 9 a.m. / 6h -- 9h
9 a.m. to Noon / 9h -- 12h
Noon to 3 p.m. / 12h -- 15h
3 p.m. to 6 p.m. / 15h -- 18h
6 p.m. to 9 p.m. / 18h -- 21h
9 p.m. to Midnight / 21h -- 24h

8. Why do you use the wireless Internet at this location? (Check all that apply.) Quelles sont les raisons pour lesquelles vous utilisez l'Internet sans fil à cet endroit? (Cochez tout ceux qui s'appliquent).

To get out of my home/office / Pour sortir du bureau, de la maison
To see familiar people/be part of a community / Pour rencontrer des gens, pour faire partie d'une communauté
To get information when I am just passing by / Pour receuillir de l'information sur l'Internet, en passant
Other (please specify) / Autre (spécifiez)

9. How likely are you to use the wireless Internet at each of the following? (1 = unlikely, 3 = neither likely or unlikely, 5 = very likely) Sur une échelle de 1 à 5, utilisez-vous, ou utiliseriez-vous l'Internet sans fil aux endroits suivants? (1 = Non, 3 = peut-être, 5 = décidément)

Airport / Aéroport
Bar / Bar
Coffee Shop / Café
Fast Food Restaurant / Restaurant de restauration rapide
Hotel / Hotel
Library / Bibliothèque
Park or Public Space / Parc ou espace public
Restaurant / Restaurant
Train Station / Gare

Technology and Internet Access Questions / Questions portants sur la technologie et l'accès à intern

10. What computer hardware do you use to connect to the wireless Internet? (Check all that apply.) Quels dispositifs informatiques utilisez-vous pour vous connecter à l'Internet sans fil? (Cochez tout ceux que vous utilisez).

Laptop / Ordinateur Portable
Personal Digital Assistant (PDA) / Assistant Personel Digital (PDA)
Mobile Phone / Téléphone cellulaire
Gaming Device / Console de jeux
Other (please specify) / Autre (spécifiez)

11. Which of the following technologies do you own? (Check all that apply.) Possédez-vous les appareils suivants (Cochez tout ceux que vous possédez).

Laptop / Ordinateur portable
Personal Digital Assistant (PDA) / Assistant Personel Digital (PDA)
Mobile Telephone / Téléphone cellulaire
Pager / Pagette
Gaming Device / Console de jeux
iPod or MP3 player / iPod ou autre lecteur de MP3
Digital Camera / Camera numérique
Other (please specify) / Autre (spécifiez)

12. What Internet applications do you use while connected to the wireless Internet? (Check all that apply.) Quelles applications Internet utilisez-vous lorsque vous êtes connecté à l'Internet sans fil? (Cochez tout ceux que vous utilisez).

Instant Messenger i.e. AIM, Yahoo!, MSN, iChat, ICQ / Messagerie instantannée (AIM, Yahoo! Chat, MSN Messenger, iChat, ICQ)
E-mail Application i.e. Outlook, Mail / Client courriel (Outlook, Mail, Eudora, Thunderbird)
Web-based E-mail i.e. Yahoo!, Gmail, Hotmail / Courriel sur web: i.e Yahoo! Gmail, Hotmail
Voice Application (VOIP) i.e. Skype / Application Voix-via-Internet (Skype)
Microsoft Office (Word, Excel, PowerPoint)
Remote Desktop / Application de contrôle de bureau à distance
Virtual Private Network (VPN) / Réseau privé et sécurisé (VPN)
Streaming Audio/Video Clips / Clips video ou audio
Other (please specify) / Autres (spécifiez)

13. Where else do you have access to the Internet? (Check all that apply.) Mis à part l'accès sans fil à cet endroit, où utilisez-vous l'Internet? (Cochez tout ceux qui s'appliquent).

Home / À la maison
Work / Au travail
School / À l'école
Library / À la bibliothèque
Other (please specify) / Autre (spécifiez)

14. Where do you have access to the high-speed (broadband) Internet i.e. DSL or Cable? (Check all that apply.) Avez-vous accès à l'Internet haute vitesse par cable ou via DSL? Où? (Cochez tout ceux qui s'appliquent).

Home / À la maison
Work / Au travail
School / À l'école
Library / À la bibliothèque
Other (please specify) / Autre (spécifiez)

Content and Activity-Related Questions / Question par rapport au contenu et aux activités.

15. Have you had any problems using the wireless Internet? (Check all that apply.) Avez-vous déjà encontré des difficultés à accéder à Internet sans fil? (Cochez tout ceux qui s'appliquent).

Can't figure out how to connect to the network / Difficultés à se connecter au réseau
Did not know about the availability of the network / Ne saivait pas que le réseau était disponible
Speed of the network is too slow / Vitesse de connection trop lente
Trouble viewing computer screen / Difficultés à lire l'écran
Concerns about privacy and security of data being transmitted over wireless network / Inquiétudes face à la sécurité des informations privées transmisent via le réseau
Concerns about theft of computer hardware / Inquiétudes face au vol de l'équipement informatique
Other (please specify) / Autres (spécifier)

16. What websites do you access while you are using the wireless Internet at this location? Quel sites web fréquentez-vous lors de vos visites à cet endroit?

17. What kinds of information do you access when using the wireless Internet at this location? (Check all that apply.) À quelles types d'informations accédez-vous lors de votre usage de l'Internet sans fil? (Cochez tout ceux qui s'appliquent).

Financial information / Informations financières
General news / Nouvelles générales
Government Information / Informations gouvernementales
Health or medical information / Informations par rapport à la santé ou des services médicaux
Political News / Nouvelles politiques
Product information / Information sur certains produits
Research for school or training / Recherche pour travail d'école ou d'apprentissage continue
Search for information about a hobby / Recherche d'information sur un passe-temps
Search for information relevant to your geographic location i.e. maps, address information, restaurant listings, movie listings, transportation information / Informations à propos de votre environment géographique, comme des cartes, addresses, listes de restaurants ou films, informations sur les transports
Search for new job opportunities / Recherche d'emploi
Sports information / Informations sur les sports
Travel information / Informations de voyages
Weather information / Météo
Other (please specify) / Autres (spécifiez)

18. What kind of activities do you do when using the wireless Internet at this location? (Check all that apply.) Lesquelles des activités suivantes faîtes-vous via l'Internet sans fil? (Cochez tout ceux qui s'appliquent).

Accessing work Intranet / Se connecter au réseau du travail
Buy a product / Magasiner
Buy or make a reservation for travel services / Réserver les services d'une agence de voyage
Buy or sell stock online / Acheter ou vendre des actions de bourse
Contributing content to a blog / Écrire sur un blog
Contributing content to a website (other than a blog) / Écrire pour un site web (mis à part un blog)
Downloading and listening to music / Télécharger et écouter de la musique
Downloading and watching video clips/

Télécharger et écouter des vidéos
Go online for fun or to pass time / Utiliser l'Internet comme divertissement
Graphic or web design / Design graphique ou de site web
Play online video games / Jouer à des jeux Internet
Send instant messages / Envoyer des messages instantanés
Send or read e-mail / Lire et envoyer des couriels
Send or receive instant messages / Lire et envoyer des messages instantanés
Send or receive music files / Envoyer ou recevoir des fichiers de musique
Send or receive photos / Envoyer ou recevoir des photos
Take part in a chat room / Participer à une discussion de groupe (chat)
Writing or word processing / Composer et éditer dans un éditeur de texte
Other (please specify) / Autres (spécifiez)

19. In addition to using the wireless Internet, what else do you usually do at these locations? (Check all that apply.) Autre d'utiliser l'Internet sans fil, que faîtes-vous à cet endroit? (Cochez tout ce qui s'applique).

Eat meals / Prendre un repas
Hold work meetings / Participer à une réunion de travail
Make phone calls / Téléphoner
Meet friends / Rencontrer des amis
Play video games / Jouer au jeux vidéos
Read / Lire
Watch people / Observer les gens
Other (please specify) / Autres (spécifiez)

20. I usually go to this location with: D'habitude, vous allez à cette endroit:

Alone / Seul(e)
Co-workers or business colleagues / Avec des collègues de travail
Spouse/partner / Avec un(e) époux(se), conjoint(e), ou partenaire romantique
Children / Avec des enfants
Other relatives / Avec d'autre membres de la famille
Neighbors / Avec des voisins
Members of a common organization or club / Avec les membres d'une organization ou d'un club
Friends / Avec des amis

Other (please specify) / Autres (spécifiez)

21. Would you be willing to watch a short advertisement in exchange for free access to the wireless Internet at a café, park or other public space? Est-ce que vous accepteriez de regarder une courte publicité en échange d'avoir accès à l'Internet sans fil, dans un café, un parc ou un autre espace public?

Yes / Oui
No / Non
Maybe / Peut-être

22. Would you be willing to pay a small service charge at a coffee shop/restaurant/bar to support the availability of the wireless Internet? Seriez-vous prêt à payer un petit frais de service pour supporter un accès sans fil, dans un café, un restaurant ou un bar?

Yes / Oui
No / Non
Maybe / Peut-être

23. Given two coffee shops of similar characteristics and quality, would you choose the one that provides wireless Internet over the one that doesn't? Assumant que deux cafés sont similaires en tout autres points, choisiriez-vous le café qui offrirait de l'accès Internet sans fil plutôt que celui qui n'en offrirait pas?

Yes / Oui
No / Non
Maybe / Peut-être

Final Questions / Dernières questions

24. What do you like about the wireless Internet? Qu'est-ce que vous appréciez le plus de l'Internet sans fil?

25. What do you dislike about the wireless Internet? Qu'est-ce que vous appréciez le moins?

26. Is there anything else that you would like to share about how you use the wireless Internet at this location? Est-ce qu'il y a d'autres choses que vous voulez partager à propos de votre usage de l'Internet sans fil à cet endroit?

27. How did you learn about this survey? Comment avez-vous pris connaissance de ce sondage?

28. Where else would you like to see a free, public wireless Internet network available? Il y a t-il d'autres endroits où vous ameriez voir s'installer un point d'accès Internet sans fil?

29. Are you interested in participating in future studies and follow up interviews on the use of mobile and wireless technology? Êtes-vous intéressé(e) à participer à d'autre sondages à propos des technologies sans fil, et peut-être même à rencontrer l'auteur de ce sondage pour discuter de vos réponses?

30. If you would like to be entered into the drawing for an iPod, iTunes or a $300 donation to charity, please enter your contact information below. Si vous voulez faire parti du tirage du iPod, du certificat cadeau iTunes, ou du 300$ en voeux de charité, entrez vos coordonnés ici.

Standard Demographic Questions / Question démographiques

31. What is your age? Quel age avez-vous?

18-24
25-34
35-44
45-54
55-64
Over 65 / Plus de 65

32. What is your gender? Femme ou homme?

Female / Femme
Male / Homme

33. What is your racial background? Quel est votre ethnicité?

Caucasian, non-Hispanic / Caucasien (non-hispanique)
Black, non-Hispanic / Afro-Américain (non-hispanique)
Other, non-Hispanic / Autre (non-hispanique)
Hispanic / Hispanique
Asian / Asiatique
Prefer Not to Answer / Préfère ne pas répondre

34. What is your highest level of education? Quels sont les dernières études que vous avez complétées?

Less than high school / Moins que l'école secondaire
Some high school, no diploma / Quelques études secondaires, sans diplôme
Graduated from high school, diploma or equivalent (GED) / Diplôme d'études secondaires
Some college, no degree / Quelques études collégiale, sans diplôme

Associate's degree / Diplôme d'études collégiale
Bachelor's degree / BAC
Master's degree / Maîtrise
Professional Degree / Diplôme professionel
Doctorate Degree / Doctorat

35. What is your annual income? Quel est votre revenu annuel?

Less than $5,000 / Moins que 5.000$
$5,000 to $7,499 / De 5.000$ à 7.499$
$7,500 to $9,999 / De 7.500$ à 9.999$
$10,000 to $12,499 / De 10.000$ à 12.499$
$12,500 to $14,999 / De 12.500$ à 14.999$
$15,000 to $19,999 / De 15.000$ à 19.999$
$20,000 to $24,999 / De 20.000$ à 24.999$
$25,000 to $29,999 / De 25.000$ à 29.999$
$30,000 to $34,999 / De 30.000$ à 34.999$
$35,000 to $39,999 / De 35.000$ à 39.999$
$40,000 to $49,999 / De 40.000$ à 49.999$
$50,000 to $59,999 / De 50.000$ à 59.999$
$60,000 to $74,999 / De 60.000$ à 74.999$
$75,000 to $84,999 / De 75.000$ à 84.999$
$85,000 to $99,999 / De 85.000$ à 99.999$
$100,000 to $124,999 / De 100.000$ à 124.999$
$125,000 to $149,999 / De 125.000$ à 149.999$
$150,000 to $174,999 / De 150.000$ à 174.999$
$175,000 or more / De 175.000$ ou plus

36. What is your current employment status? Avez-vous un emploi?

Full-time Employee / Temps plein
Part-time Employee / Temps partiel
Self-employed, Freelance Worker or Independent Contractor / Travailleur/euse autonome
Entrepreneur or Owner/Partner in a Small Business, Professional Practice or Farm / Entrepreneur
Full-time Student / Étudiant à temps plein
Unemployed -- looking for work / Chômeur, à la recherche d'un emplois
Unemployed -- not looking for work / Sans emploi, ni à la recherche de l'emploi
Retired / Retraité
Disabled / Handicapé
Homemaker / À la maison
Other (please specify) / Autre (spécifiez)

37. What is your occupation? Quel est votre profession?

38. In what industry or sector do you work? Dans quel domaine travaillez-vous?

Education / Éducation
Finance and Banking / Finances et banques
Government Sector / Gouvernement
Health and Medical / Santé
Hospitality and Travel / Hospitalité et voyage
Insurance and Real Estate / Assurances et Immobilier
Manufacturing and Industry / Manufacture
Media and Entertainment / Médias
Non-Profit Sector / Organismes sans but lucratif
Professional Services / Services professionels (consultant, comptables, avocats)
Science and Research / Sciences et recherche
Telecommunications and Information Technology / Télécommunication et technologies de l'information
Other (please specify) / Autres (spécifiez)

39. In what city, state and country do you live? Où résidez-vous?

III: Fred-eZone Survey (distibuted via the login page, 221 responses) March 2008

Section 1: Using the Internet

1. At which locations do you have access to the internet (check all that apply)

Home
School
Library
Workplace
In a public place using the E-zone
In a public place -other
Multiple locations using a BlackBerry or similar device

2. At which locations do you have access to high-speed (broadband) access to the internet

Home
School
Library
Workplace
In a public place using the E-zone
In a public place -other

Multiple locations using a BlackBerry or similar device

3. Of these locations, at which one do you most often use the internet

Home
School
Library
Workplace
In a public place using the E-zone
In a public place – other
Multiple locations using a BlackBerry or similar device

4. How much do you pay for your primary internet connection?

More than $60 a month
Between $40 and $60 a month
Between $20 and $40 a month
Less than $20 a month

5. What best describes how you pay for your primary internet connection?

I share the cost with others
        How many? 1, 2, 3 or more
I pay the whole cost myself
Someone else (employer/parents) pays for it

Section 2: Using the E-zone: General questions

6. Where have you used the E-zone wireless network in the past six months

At Second cup in the King's Place Mall
At Boldon's bookstore
At the Playhouse
At a hotel
At the library
In a city government office
At the Head Hall computer lab at UNB
At the Irving Big Stop
At the Regent Mall Chapters bookstore
At the airport
At home
Other

7. Where have you used the E-zone most frequently in the past six months

At Second cup in the King's place mall
At Boldon's bookstore
At the Playhouse
At a hotel
At the library
In a city government office
At the Head Hall computer lab at UNB
At the Irving Big Stop
At the Regent Mall Chapters bookstore
At the airport
At home

For the next questions, please respond based on your answer to question 7 above.

* 8. Do you come here specifically to use wireless internet?

Yes
No
Sometimes

*9. What is the primary purpose for which you use wireless internet at this location

Work
Personal
Both work and personal
Other (please specify)

*10. How often do you use wireless internet at this location?

More than once a day
Daily
Weekly
Monthly
Annually
Very rarely

*11. How long do you normally spend using wireless internet at this location

15 minutes or less
30 minutes
1 hour
2 hours
4 hours
More than 4 hours

*12. At what time of day do you usually use wireless internet at this location
6 am to 9 am
9 am to noon
noon to 3 pm
3 pm to 6 pm
6 pm to 9 pm
9 pm to midnight
midnight - 6 am (home usage?)

13. Why do you use wireless internet at this location (check all that apply)

Because I don't have access anywhere else
Because it is free
To get out of my home/office
To see familiar people/be part of a community
To get information when I am just passing by
Other

14. Have you had any problems using wireless internet here? - move this question above to specific questions about THIS hotspot

Network is unreliable – not always available
Can't figure out how to connect to the network
No electrical power available
Speed of the network is too slow
Concerns about privacy and security of data
Concerns about theft of computer hardware
Seating is uncomfortable
Can't do what I wanted because the network is too slow
No problems
Other (please specify)

15. How likely are you to use wireless internet at each of the following scale for this?

FREE ACCESS
Airport
Bar
Coffee Shop
Fast food restaurant
Hotel
Library
Park
Restaurant
Government office

Community centre
Shopping mall

PAID ACCESS
Airport
Bar
Coffee Shop
Fast food restaurant
Hotel
Library
Park
Restaurant
Government office
Community centre
Shopping mall

Section 3: Technology and access questions

16. What computer hardware do you use to connect to wireless internet (check all that apply)

Laptop
Desktop
Personal digital assistant
Mobile phone
Gaming device
Other (please specify)

*17. Which of the following devices do you own?

Laptop
Desktop
Personal Digital Assistant
Mobile phone
Pager
Gaming device
IPod or MP3 player
Digital camera
Other

18. What applications do you use while connected to wireless internet? (check all) or what things do you do? - two questions? - try to get at 1. bandwidth intensity of usage and 2. applications that are used (- ie. breadth/scope of usage?)

Internet browser ie Internet Explorer, Firefox, Safari

Instant messenger ie MSN, iChat, Google Chat, ICQ
E-mail application ie Outlook mail, Thunderbird, Eudora
Web-based email ie Gmail, Yahoo!, Hotmail
Voice application (VOIP) ie Skype
Office applications ie Microsoft Office, OpenOffice – Word, Excel, Powerpoint
Remote Desktop
Virtual Private Network
Audio/Video –applications (ie YouTube, GoogleTV)
Other (please specify)

Section 4: Activity-related questions

*19. What websites do you visit while using wireless internet at this location

(open entry)

*20. What kinds of information do you access when using wireless internet at this location (Check all that apply)

Financial information
General news
Local news
Government information
Health or medical information
Political news
Product information
Research for school or training
Search for information about a hobby
Search for information relevant to your geographic location: ie maps, address information, restaurant listings, movie listings, transportation information
Sports information
Travel information
Search for new job opportunities
Weather information
Other (please specify)

*21. What kinds of activities do you do when using the wireless internet at this location? (check all that apply)

Accessing work Intranet
Buying products
Buy or make reservation for travel services
Buy or sell stock online
Contribute content to a blog

Contribute content to a website
Download and listen to music or podcasts
Download and watch video
Create a podcast or videoblog
Go online for fun or to pass time
Graphic or web design
Play online video games
Send or receive instant messages
Send or read e-mail
Make a call using voice over (IP)
Receive a call using voice over IP

*22. In addition to using wireless internet, what else do you usually do at this location?

Hold work or school meetings
Make phone calls
Meet friends
Eat or drink
Read
Play video games
Watch people
Shop
I'm at home
Other (please specify)

*23. I usually go to this location with:
Alone
Co-workers or business colleagues
Spouse/partner
Children
Other relatives
Neighbours
Members of a common organization
Friends
I'm at home
Other (please specify)

*24. Would you be willing to watch a short advertisement in exchange for free access to wireless internet at a café, park, airport, or other public space?

Yes
No
Maybe

*25. Would you be willing to pay a small service fee to support the availability of wireless internet?

Yes
No
Maybe

26. How strongly do you agree with the city government's decision to funding this free WiFi network

5 – very strongly agree – it was a very good idea
4 – strongly agree
3- agree
2 – somewhat agree
1 – do not agree – it was not a good idea

27. In your opinion, what makes the E-zone most valuable for Fredericton

It provides free internet access in places that I visit
It provides visitors and tourists with free internet
It provides an important public service
It demonstrates that Fredericton is an innovative community
It demonstrates that Fredericton is open for business
Other, please specify

Final questions

28. What do you like about wireless internet

29. What do you dislike about wireless internet

30. Is there anything else that you would like to share about how you use wireless internet?

32. Are you interested in participating in future studies and follow up interviews on the use of mobile and wireless technology?

Yes
No
Maybe

Standard Demographic questions

33. What is your age?

in what year were you born?

18-24
25-34
35-44
45-54
55-64
65+

34. What is your gender?

Female
Male

35. What is your highest level of education?

University – postgraduate
University- bachelor's degree
College
High School
Did not complete high school

36. What is your annual income

Under $5,000
$5,000 to $9,999
$10,000 to $14,999
$15,00 to $19,999
$20,000 to $24,999
$25,000 to $29,999
$30,00 to $34,999
$35,000 to $39,999
$40,000 to $49,999
$50,000 to $59,999
$60,00 to $74,999
$75,000 to $84,999
$85,000 to $99,999
$100,000 to $124,999
$125,000 or more

37. What is your current employment status

Full-time employee
Part-time employee
Self-employed, freelance worker or independent contractor
Entrepreneur or owner/partner in a small business
Full-time student
Unemployed-looking for work

Unemployed – not looking for work
Retired
Disabled
Homemaker

38. What is your occupation?
(open response)

39. In what industry or sector do you work? (statscan sectors)
Agriculture, Forestry, Fishing and Hunting
Real Estate and Rental and Leasing
Mining and Oil and Gas Extraction
Professional, Scientific and Technical Services
Utilities
Management of Companies and Enterprises
Construction
Administrative and Support, Waste Management and Remediation Services
Manufacturing
Educational Services
Wholesale Trade
Health Care and Social Assistance
Retail Trade
Arts, Entertainment and Recreation
Transportation and Warehousing
Accommodation and Food Services
Information and Cultural Industries
Other Services (except Public Administration)
Finance and Insurance
Public Administration
Full time student

40. In what city, province or state, and country do you live?

City
State/Province
Country

Appendix Five: Ethics Summary Protocol Forms

University of Toronto

RESEARCH SERVICES – ETHICS REVIEW UNIT

ETHICS REVIEW PROTOCOL FORM

For information concerning submission deadlines, meeting dates, number of copies etc, refer to the
UT Ethics Website: http://www.research.utoronto.ca/ethics_home.html

Provide the following information under the given headings. If a given question does not apply to your project, write N/A. Avoid technical terms that may not be understood outside your discipline.

4. Background, Purpose, Objectives

The *Canadian Research Alliance for Community Innovation and Networking* will bring together leading Community Informatics researchers from across Canada and around the world to investigate the main Canadian government programs promoting the development and public accessibility of internet services. Under the Federal Government's 'Connecting Canadians' agenda, several hundred million dollars have been invested in funding thousands of non-profit and community based organizations to help Canadians communicate electronically, both locally and globally, as well as to access information services and resources that strengthen participation in contemporary economic and social life. We believe that this has resulted in significant benefits to Canadians and has positioned Canada on the leading edge in promoting community networking (CN) as a key element of the 'new economy'. However, so far there has been very little research documenting or assessing the effectiveness of these initiatives, synthesizing "lessons learned" from these efforts (particularly those that might be of interest in guiding future related programs nationally and globally), or ,most importantly, placing these efforts into a wider research and knowledge context so as to determine how these valuable public services can be sustained into the future.

The *Canadian Research Alliance for Community Innovation and Networking* will be constituted through a collaborative partnership between: an interdisciplinary mix of academic researchers from universities across all regions of Canada, along with international researchers in Community Informatics and ICT policy for economic and social development; the three principal federal government departments promoting the Connecting Canadians agenda; and community networking practitioners and advocates from seven of the major Canadian CN initiatives..

The over-arching goal of our proposed research is to begin systematically documenting and assessing how recent government programs supporting the development of community-oriented information and communications technology (ICT) capacity and services contribute to local learning, to strengthening relations in and between communities, and to social and economic development more generally.

> One major strand of research activity will consist of a coordinated series of in-depth structured case studies of leading community networking initiatives across Canada that have received significant funding from government programs. These will be undertaken in collaboration with community partners using a participatory action research approach. The case studies will use and further refine a framework for evaluating community learning networks we are currently building with the support of a SSHRC INE Development Grant. A second strand consists of 9 thematically focused studies each linked across several case study sites. Major themes to be explored include sustainability of community networking initiatives along with an examination of how the Canadian community-based initiatives contribute to: the amelioration of 'digital divides'; enhancement of economic, social, political and cultural capabilities; creation, provision, and use of community oriented learning opportunities, especially for locally relevant employment skills; and development of community oriented cultural content, open source software, learning tools and broadband infrastructures. Cutting across these case studies will be a broader set of studies which are intended to contribute to the wider context of community informatics research, particularly with respect to the major policy themes of evaluation frameworks, infrastructure development (e.g. broadband, WiFi and open source), local content development, e-citizenship and sustainability. These broad themes, and their relationship to specific case studies, will be considered in depth at six workshops organized twice yearly.

The results of the research will be communicated with academic and non-academic audiences through a variety of conventional and electronic presentation and publication modes. In particular the case studies will contribute directly to the expansion of an on-line *Community Informatics* textbook that many members of the prospective research alliance are already engaged in. This project will also serve as the basis for launching the first international journal in this emerging area of research.

This broad thematic study focuses on the community-based development of wireless (WiFi) technology, using the Montréal organization Ile Sans Fil as a case study. Ile Sans Fil is a community group dedicated to providing free wireless internet access points across the island of Montréal. Groups with similar goals exist across North America, suggesting that free and/or affordable provision of wireless infrastructure may 1. provide greater accessibility to internet services, 2. assist with the social cohesion of local interest groups, and 3. provide a low-cost, non-commercial option for a developing technology. Research in this project will attempt to describe the unfolding possibilities of community-based WiFi development and diffusion, making specific reference to Ile Sans Fil.

This broad thematic project focuses on three purposes:

1) To investigate community-based development of wireless infrastructure, and in particular to investigate the development of Montreal's free wireless hotspots by Ile Sans Fil.

2) To determine the usefulness of WiFi technology for community-informatics projects in Montreal in particular and in North America in general.
3) To provide an overview of the Ile Sans Fil organization and its relationship with other community WiFi groups and local community organizations.

5. Research Methodology

The theme-based study of community WiFi development will focus on the members of the Ile Sans Fil community WiFi group in Montréal, the people who use their services, and the other community organizations who collaborate with them.

The human subjects research as part of this project consists of four separate activities: interviews, participant observation, observation at Ile Sans Fil hotspots, and analysis of Ile Sans Fil user logs.

1) Interviews

a. Interviews will be conducted with members of Ile Sans Fil. Four active members of Ile Sans Fil will be chosen by the research assistant and asked to participate in a single interview. The interview will be approximately an hour in length and recorded using an audio recorder. An interview guide is attached.

b. Interviews will be conducted with members of community groups who collaborate with Ile Sans Fil to develop wireless networks and deliver content over them. One member from each of these groups will be asked to participate in a single interview. The interview will be approximately an hour in length and recorded using an audio recorder. An interview guide is attached.

c. Interviews will be conducted with five to ten people who use the Ile Sans Fil wireless service. Participants will be chosen based on responses to a call for participants attached to the Ile Sans Fil home page. These interviews will be no more than twenty minutes in length and will be recorded using an audio recorder. An interview guide is attached.

d. Interviews will be conducted with business owners whose businesses use, or are considering using, Ile Sans Fil services. Participants will be chosen based on their previous relationship with Ile Sans Fil. These interviews will be no more than twenty minutes in length and will be recorded using an audio recorder. An interview guide is attached.

2) Participant observation

The student research assistant will participate in Ile Sans Fil's bimonthly meetings from September 2004 until August 2005. Participant observation will include the student observing the normal proceedings of Ile San Fil's activities. On occasion, the student will also conduct participant observation at Ile Sans Fil sites where installation or maintenance of their services are being conducted.

3)Observation at Ile Sans Fil sites

The student researcher will also, on occasion between September 2004 and August 2005, observe people using Ile Sans Fil's services at public locations across Montréal, such as coffee shops, bars, and parks, as well as within community organizations. These observations will include a description of the physical space of the area, and a summary of how the WiFi technology has become integrated into the area. Photographs of the sites will also be taken. While every effort will be made to avoid photographing individuals in a way that clearly identifies them, those people who are identified in the photos will be asked to sign a consent form. An observation guide is attached.

4) Analysis of Ile Sans Fil user logs:
Raw data collected by Ile Sans Fil describing user patterns will be analyzed to determine the general use patterns for the service, including the most popular locations for access and the amount of time users spend using the services. Although there are no distinguishing characteristics within the data set that would identify particular users, there is a small possibility that individual users could be identified by their patterns of use. This will be reduced by completely randomizing the data.
Secondary data-gathering will include publicly available print and online sources. Secondary data-gathering will focus on describing the range of community-based WiFi groups, their aims, technical strategies, and methods for collaboration with other community groups.

1. Participants
As discussed above, participants will include members of Ile Sans Fil, members of community groups who collaborate with Ile Sans Fil, users of Ile Sans Fil services, and business owners in local areas where Ile Sans Fil services are offered.

2. Recruitment
a. Ile Sans Fil members: Ile Sans Fil members who are active in the group will be asked if they are interested in participating in a research study concerning the community-based development of wireless infrastructure. These members will be known to the research assistant, who will participate in Ile Sans Fil public meetings and visit the group's web site as part of the first phase of research on this project.

b. Participants from other community groups, as well as business owners, will be recruited based on their connection to Ile Sans Fil members known to the research assistant. An introduction letter describing the project (attached) will be provided to each of these participants. Participants will be informed that their participation in the research study is voluntary and will not effect the service provided to them by Ile Sans Fil.

c. Ile Sans Fil users will be recruited through a recruitment script visible on the Ile Sans Fil user login page. The script will read: "Ile Sans Fil users are invited to participate in a research project on community-based wireless technology. This project will describe how community-based wifi groups develop and provide free networks. It will assist Ile Sans Fil and other groups in developing their services to best meet their community's needs. To find out more or to schedule an interview, please send an e-mail to [research assistant's e-mail]. The project leader on this *research study is Prof. Leslie Shade. She can be reached at lshade@alcor.concordia.ca."*

3. Risks and benefits

It is unlikely that anyone will be put at risk in the course of this research. *There is a small chance that individuals could be identified because their user names closely resemble their email addresses, which may be known to the research assistant. Further, since the user group is small, it may be possible to identify an individual based on knowledge of both their user name and the location at which the user logged on. These chances for identification will be eliminated as an Ile Sans Fil member will remove user names from data logs before passing them to the research assistant. User names will be replaced with numeric codes, eliminating the chance of correlating a known user name or e-mail address to a specific location.*

Privacy and confidentiality

Individuals' names will not be used in data-collection or in reports or articles. Names will be coded for use during analysis. All data collected from any participant who decides to opt out will be destroyed. Any data collected from observations will include coded names so as not to identify any members of the public.

Data analysis logs will be coded using random numbers so as not to identify any individual Ile Sans Fil users.

Audiotape recordings, transcript disks, hardcopies, and working documents will be kept in a locked filing cabinet in the principal investigator's office for 5 years after collection and then destroyed. The research assistant will deliver recordings to the principal investigator's office for transcription. Research assistant(s) will be trained in appropriate procedures and will need to agree to and sign a Transcriber Confidentiality Agreement (see attached).

4. Compensation

N/A

5. Conflicts of interest

Provide information relevant to actual or potential conflicts of interest (to allow the Review Committee to assess whether participants require information for informed consent).

N/A

6. Informed Consent Process

The researcher or student research assistant will:

1) State in advance of the interview that there will be an information/consent letter provided before the interview begins.
2) Present each prospective participant with the information/consent letter (attached to this application), ask them to read it, then solicit and answer comments and questions.
3) Paraphrase the section of the letter regarding participant rights.
4) Ask if the prospective participant would like to participate.
5) Remind the prospective participant of their right to decline participation without penalty. If one prospective participant declines then another one will be approached.
6) Request that the participant sign the consent form before the interview.
7) Ask the participant to keep the letter for future reference.
8) Remind the participant, verbally, of their right to opt out before the beginning of the interview.

For observations at Ile Sans Fil locations, an information sheet will be available at the entrance to the location indicating that observations are in progress, and allowing individuals to opt out of participating in the observation process by speaking to the research assistant, who will be identified by a name tag.

Ile Sans Fil users will be informed when logging in to services that aggregate data will be collected in user logs. They will be offered the opportunity to opt out of sharing their usage data in this way.

7. Scholarly review
N/A

8. Additional ethics reviews
N/A

9. Contracts
N/A

10. Clinical Trials
N/A

Concordia
UNIVERSITY

Summary Protocol Form

- ***For faculty and staff research:*** *Submit to the University Human Research Ethics Committee (UHREC), c/o the Office of Research, GM 1000.*
- ***For graduate or undergraduate research:***
    - *For projects covered under a faculty member's previously approved SPF, no new SPF is required.*
    - *For new projects which are supported by external (e.g. Tri-council) or internal (e.g. CASA or FRDP) funds, the supervising faculty member must submit a new SPF on behalf of the student to the UHREC, c/o the Office of Research, GM 1000.*
    - *For new projects which are NOT supported by external (e.g. Tri-council) or internal (e.g. CASA or FRDP) funds, the student must submit a new SPF to the relevant departmental or faculty ethics sub-committee.*

For more information on the above, see
http://oor.concordia.ca/REC/human_research.shtml.
If using the MS Word form, please tab between fields (do not use the enter key) and click on check boxes. If not using the MS Word form, please TYPE your responses and submit on a separate sheet.

Date: August 23, 2004

What type of review do you recommend that this form receive? Expedited ☐ or Full ☒

Part One: Basic Information

1. Names of Researchers:

Principal Investigator: Leslie Regan Shade

Department/Program: Communication Studies

Office address: Loyola, HB 421

Telephone number: x2550 E-mail address: lshade@alcor.concordia.ca

Names and details for all other researchers involved (e.g., co-investigators, collaborators, research associates, research assistants, supervisors – please specify role):

Alison Powell – PhD Student (research assistant)

2. Title of Research Project:

Canadian Research Alliance for Innovation and Community Networking: Thematic study: Community WiFi Development

3. Granting Agency, Grant Number and Title OR Contractor and Contract Title (if applic.):

SSHRC 538-2003-1012
SubGrant: PI is Professor Andrew Clement, University of Toronto

4. Brief Description of Research:
For funded research, please include one-page summary; otherwise, include a brief overall description. Include a statement of the benefits likely to be derived from project. You can address these questions by including the summary page from the grant proposal.

The *Canadian Research Alliance for Community Innovation and Networking* will bring together leading Community Informatics researchers from across Canada and around the world to investigate the main Canadian government programs promoting the development and public accessibility of internet services. Under the Federal Government's 'Connecting Canadians' agenda, several hundred million dollars have been invested in funding thousands of non-profit and community based organizations to help Canadians communicate electronically, both locally and globally, as well as to access information services and resources that strengthen participation in contemporary economic and social life. We believe that this has resulted in significant benefits to Canadians and has positioned Canada on the leading edge in promoting community networking (CN) as a key element of the 'new economy'. However, so far there has been very little research documenting or assessing the effectiveness of these initiatives, synthesizing "lessons learned" from these efforts (particularly those that might be of interest in guiding future related programs nationally and globally), or ,most importantly, placing these efforts into a wider research and knowledge context so as to determine how these valuable public services can be sustained into the future.

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One major strand of research activity will consist of a coordinated series of in-depth structured case studies of leading community networking initiatives across Canada that have received significant funding from government programs. These will be undertaken in collaboration with community partners using a participatory action research approach. The case studies will use and further refine a framework for evaluating community learning networks we are currently building with the support of a SSHRC INE Development Grant. A second strand consists of 9 thematically focused studies each linked across several case study sites. Major themes to be explored include sustainability of community networking initiatives along with an examination of how the Canadian community-based initiatives contribute to: the amelioration of 'digital divides'; enhancement of economic, social, political and cultural capabilities; creation, provision, and use of community oriented learning opportunities, especially for locally relevant employment skills; and development of community oriented cultural content, open source software, learning tools and broadband infrastructures. Cutting across these case studies will be a broader set of studies which are intended to contribute to the wider context of community informatics research, particularly with respect to the major policy themes of evaluation frameworks, infrastructure development (e.g. broadband, WiFi and open source), local content development, e-citizenship and sustainability. These broad themes, and their relationship to specific case studies, will be considered in depth at six workshops organized twice yearly.

The results of the research will be communicated with academic and non-academic audiences through a variety of conventional and electronic presentation and publication modes. In particular the case studies will contribute directly to the expansion of an on-line *Community Informatics* textbook that many members of the prospective research alliance are already engaged in. This project will also serve as the basis for launching the first international journal in this emerging area of research.

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This broad thematic project focuses on three purposes:

2) To investigate community-based development of wireless infrastructure, and in particular to investigate the development of Montreal's free wireless hotspots by Ile Sans Fil.

2) To determine the usefulness of WiFi technology for community-informatics projects in Montreal in particular and in North America in general.

3) To provide an overview of the Ile Sans Fil organization and its relationship with other community WiFi groups and local community organizations.

5. Scholarly Review of Proposed Research:

Complete the Scholarly Review Form (SRF) if you are conducting non-funded or contract bio-medical research or any other non-funded or contract research involving more than minimal levels of risk.

N/A

Part Two: Research Participants

1. Sample of Persons to be Studied:

The theme-based study of community WiFi development will focus on the members of the Ile Sans Fil community WiFi group in Montréal, the people who use their services, and the other community organizations who collaborate with them.

The human subjects research as part of this project consists of four separate activities: interviews, participant observation, observation at Ile Sans Fil hotspots, and analysis of Ile Sans Fil user logs.

1) Interviews

a. Interviews will be conducted with members of Ile Sans Fil. Four active members of Ile Sans Fil will be chosen by the research assistant and asked to participate in a single interview. The interview will be approximately an hour in length and recorded using an audio recorder. An interview guide is attached.

b. Interviews will be conducted with members of community groups who collaborate with Ile Sans Fil to develop wireless networks and deliver content over them. One member from each of these groups will be asked to participate in a single interview. The interview will be approximately an hour in length and recorded using an audio recorder. An interview guide is attached.

c. Interviews will be conducted with five to ten people who use the Ile Sans Fil wireless service. Participants will be chosen based on responses to a call for participants attached to the Ile Sans Fil home page. These interviews will be no more than twenty minutes in length and will be recorded using an audio recorder. An interview guide is attached.

d. Interviews will be conducted with business owners whose businesses use, or are considering using, Ile Sans Fil services. Participants will be chosen based on their previous relationship with Ile Sans Fil. These interviews will be no more than twenty minutes in length and will be recorded using an audio recorder. An interview guide is attached.

2) Participant obervation

The student research assistant will participate in Ile Sans Fil's bimonthly meetings from September 2004 until August 2005. Participant observation will include the student observing the normal proceedings of Ile San Fil's activities. On occasion, the student will also conduct participant observation at Ile Sans Fil sites where installation or maintenance of their services are being conducted.

3)Observation at Ile Sans Fil sites

The student researcher will also, on occasion between September 2004 and August 2005, observe people using Ile Sans Fil's services at public locations across Montréal, such as coffee shops, bars, and parks, as well as within community organizations. These observations will include a description of the physical space of the area, and a summary of how the WiFi technology has become integrated into the area. They will also include photographs of the site. Photographs will be taken making every effort to avoid identifying people. However, should this be unavoidable the person will be asked to sign a consent form. An observation guide is attached.

4) Analysis of Ile Sans Fil user logs:
Raw data collected by Ile Sans Fil describing user patterns will be analysed to determine the general use patterns for the service, including the most popular locations for access and the amount of time users spend using the services. Although there are no distinguishing characteristics within the data set that would identify particular users, there is a small possibility that individual users could be identified by their patterns of use. This will be reduced by completely randomizing the data.

2. Method of Recruitment of Participants:

Ile Sans Fil and community group interview subjects will be recruited from Ile Sans Fil meetings based on their ongoing committment to the group and role within it. Participants from other community groups and business owners will be recruited based on their relationship with work done with Ile Sans Fil. Users of Ile Sans Fil services will be recruited through an invitation to participate posted on the login page to the Ile Sans Fil wireless hotspot.

3. Treatment of Participants in the Course of the Research:
A brief summary of procedure, as well an account of the training of researchers/assistants.

Procedure to obtain informed consent

The researcher or student research assistant will:
1) State in advance of the interview that there will be an information/consent letter provided before the interview begins.
2) Present each prospective participant with the information/consent letter (attached to this application), ask them to read it, then solicit and answer comments and questions.
3) Paraphrase the section of the letter regarding participant rights.
4) Ask if the prospective participant would like to participate.

5) Remind the prospective participant of their right to decline participation without penalty. If one prospective participant declines then another one will be approached.
6) Request that the participant sign the consent form before the interview.
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8) Remind the participant, verbally, of their right to opt out before the beginning of the interview.

For observations at Ile Sans Fil locations, an information sheet will be available at the entrance to the location indicating that observations are in progress, and allowing individuals to opt out of participating in the observation process by speaking to the research assistant, who will be identified by a name tag.

Ile Sans Fil users will be informed when logging in to services that aggregate data will be collected in user logs. They will be offered the opportunity to opt out of sharing their usage data in this way.

Secondary data-gathering will include publicly available print and online sources. Secondary data-gathering will focus on describing the range of community-based WiFi groups, their aims, technical strategies, and methods for collaboration with other community groups.

Data Analysis
Data from interviews, participant observation, observation, and data log analysis, as well as from secondary sources will be compiled as a presented at various CRACIN workshops and for academic publications and academic conference presentations.

Part Three: Ethical Concerns
Indicate briefly how research plan deals with the following potential ethical concerns:

1. Informed Consent:
Written consent form or written draft of oral protocols must be attached; see instructions and sample.

See attached.

2. Deception:
The researcher must both describe the nature of any deception and provide a rationale regarding why it must be used to address the research question – i.e., is it absolutely necessary for the design? Deception may include the following: deliberate presentation of false information; suppression of material information; selection of information designed to mislead; and selective disclosure.

N/A.

3. Freedom to Discontinue:

See Procedure to Obtain Informed Consent. Participants will be reminded, verbally, of their right to opt out before the beginning of the interview.

4. Assessment of Risks to Subjects' Physical Wellbeing, Psychological Welfare, and/or Reputation:

This includes low-level risk or any form of discomfort resulting from the research procedure and how it will be dealt with. When it is called for, you should indicate arrangements that have been made to ascertain that subjects are in "healthy" enough condition to undergo the intended research procedures. You should be able to indicate clearly the kinds of risks that may be involved and the action to be taken if someone is unexpectedly put at risk as part of the research efforts.

It is unlikely that anyone will be put at risk in the course of this research. There is a slight risk that users of the Ile Sans Fil services might be identified based on their usage patterns or their user logs. However this is not a major risk as the data used will be entirely anonymized.

5. Protecting and/or Addressing Participant "At Risk" Situations:

N/A

6. Post-Research Explanation and/or Debriefing:

We will continue to work with the Ile Sans Fil and other community groups to present usful results. Research results will also be presented at CRACIN workshops and at national and international conferences.

7. Confidentiality of Results:

Individuals' names will not be used in data-collection or in reports or articles. Names will be coded for use during analysis. All data collected from any participant who decides to opt out will be destroyed. Any data collected from observations will include coded names so as not to identify any members of the public.

Data analysis logs will be coded using random numbers so as not to identify any individual Ile Sans Fil users.

Audiotapes and transcriptions from interviews will be kept in a locked cabinet in the Principal Investigator's office for five years following the project.

8. <u>Data Handling:</u>

Please describe the path of your data from collection to storage to its eventual destruction/disposal. Include specific details on data handling, data storage (format and location), who will have access, and disposal/destruction method.

Audiotape recordings, transcript disks, hardcopies, and working documents will be kept in a locked filing cabinet in the principal investigator's office for 5 years after collection and then destroyed. The research assistant will deliver recordings to the principal investigator's office for transcription. Research assistant(s) will be trained in appropriate procedures and will need to agree to and sign a Transcriber Confidentiality Agreement (see attached).

9. <u>Other Comments</u>:

Bearing in mind the ethical guidelines of your academic and/or professional association, please comment on any other ethical concerns which may arise in the course of this research (e.g., responsibility to subjects beyond the purposes of this study).

N/A

Signature of Principal Investigator:

____

Date: **August 24, 2004**

Concordia
UNIVERSITY

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SGW Campus - GM 1000
t 514.848.2424x4888 • f 514.848.4290

SUMMARY PROTOCOL FORM
UNIVERSITY HUMAN RESEARCH ETHICS COMMITTEE

IMPORTANT:
Approval of a *Summary Protocol Form* (SPF) must be issued by the applicable Human Research Ethics Committee prior to beginning any research project using human participants.
Research funds cannot be released until appropriate certification has been obtained.

FOR FACULTY AND STAFF RESEARCH:
Please submit a signed original plus THREE copies of this form to the UHREC c/o the Office of Research, GM-1000. Allow one month for the UHREC to complete the review.

FOR GRADUATE or UNDERGRADUATE STUDENT RESEARCH:
- if your project is included in your supervising faculty member's SPF, no new SPF is required
- if your project is supported by external (e.g. CIHR, FQRSC) or internal (e.g. CASA, FRDP) funds, the supervising faculty member must submit a new SPF on behalf of the student as per faculty research above. The supervising faculty member MUST be listed as the PI.
- if your project is NOT supported by external (e.g. CIHR, FQRSC) or internal (e.g. CASA, FRDP) funds, the student must submit a new SPF to the relevant departmental committee. Contact your department for specific details.

INSTRUCTIONS:
This document is a form-fillable word document. Please open in Microsoft Word, and tab through the sections, clicking on checkboxes and typing your responses. The form will expand to fit your text. Handwritten forms will not be accepted. If you have technical difficulties with this document, you may type your responses and submit them on another sheet. Incomplete or omitted responses may cause delays in the processing of your protocol.

1. SUBMISSION INFORMATION
Please provide the requested contact information in the table below:

Please check ONE of the boxes below :

☒ This application is for a new protocol..

☐ This application is a modification or an update of an existing protocol:
Previous protocol number (s): ______________

2. CONTACT INFORMATION
Please provide the requested contact information in the table below:

Principal Investigator/ Instructor (must be Concordia faculty	Department	Internal Address	Phone Number	E-mail

or staff member)				
Alison Powell	Communications	CJ 4-212	514-582-4942	a_powell@alcor.concordia.ca

Co-Investigators / Collaborators	University / Department	E-mail

Research Assistants	Department / Program	E-mail

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3. PROJECT AND FUNDING SOURCES

Project Title:	Imagining and Building WiFi: How community and municipal networking projects configure new technology and policy

In the table below, please list all existing internal and external sources of research funding, and associated information, which will be used to support this project. Please include anticipated start and finish dates for the project(s). Note that for awarded grants, the grant number is REQUIRED. If a grant is an application only, list APPLIED instead.

Funding Source	Project Title	Grant Number	Award Period	
			Start	End
Infrastructure Canada	Canadian Wireless Infrastructure Research Project (*NOTE* The prinicipal investigator of this project is Dr. Catherine Middleton of Ryerson University. The project has cleared ethics at Ryerson)	N/A		

BRIEF DESCRIPTION OF RESEARCH OR ACTIVITY

Please provide a brief overall description of the project or research activity. Include a description of the benefits which are likely to be derived from the project. Alternatively, you may attach an existing project description (e.g. from a grant proposal).

This research forms one case study for my thesis project. The thesis examines cases of technical development occurring outside of corporate institutional structures, like the development of wireless networking projects by community groups and governments. These projects, which use cheap, flexible Wi-Fi technology to create local information networks and connect to the internet, are often perceived as being progressive alternatives to other communication infrastructures. My thesis analyses how these "alternative" network forms are conceived as social, cultural, and technical advances by the individuals and groups who help to construct them, and questions the relationship between these alternatives and the increasingly stabilized and regulated wireless communications industry. The project analyses the cultural process whereby actors construct shared social imaginaries through the building of different Wi-Fi experiments, and the integration of these imaginaries (and their tehcnical components) into a market system.

This project fits into the historical study of communication infrastructure as a component of a shared social imaginary, and also considers the role of "alternative" or experimental infrastructures as catalyts for policy change. My thesis examines the process of desigining and building "alternative" (non-commercial, locally-owned, or technologically innovative) Wi-Fi infrastructures, and investigates the way that these projects create local contexts for these infrastructures. It also examines the situation of these projects within the national telecommunications policy context, and their contribution to changes in policies related to free and open access to communication networks.

The research conducted in Fredericton will analyse the development of the Fred E-zone, a municipal broadband project with a wireless component. This is the first municipal wireless network in North America and represents a successful experiment in developing alternative communications infrastructure. An understanding of the process of developing this project is important in the contextInterviews will be conducted with various stakeholders, including city council members, developers of the network, and various users of the network (for example, the two universities, the business community, and citizens of Fredericton). Site visits to installation sites are also planned. The research is participatory, in the sense that the Fred E-zone members are involved in the definition of the research questions, and will receive reports on the data accumulated

Part of the data collection in Fredericton is supported by and thus forms part of the Canadian Wireless Infrastructure Project (CWIRP), directed by Dr. Catherine Middleton of Ryerson University. Like the thesis project, this project examines the potential benefits of public ownership of communications infrastructure. The Fred E-zone is one of the project partners and case studies of the CWIRP project, which has been designed to share information about publicly-owned information infrastructure between practitioners.

SCHOLARLY REVIEW / MERIT

Has this research been funded by a peer-reviewed granting agency (e.g. CIHR, FQRSC, Hexagram)?

☐ Yes Agency: ______________

☒ No If your research is beyond minimal risk, please complete and attach the Scholarly Review Form, available here: http://oor.concordia.ca/REC/forms.shtml

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6. RESEARCH PARTICIPANTS

Please describe the group of people who will participate in this project.
The participants are stakeholders in the development of the broadband and Wi-Fi project. There are three people who are identified as being primarily responsible for this project. They are municipal employees in Fredericton. City council members past and present, university technology officers, small business owners and other users of broadband and Wi-Fi will also participate in the project.

Please describe in detail how participants will be recruited to participate. Please attach to this protocol draft versions of any recruitment advertising, letters, etcetera which will be used.

Participants not already identified as stakeholders will be identified through interviews with exisiting stakeholders. The research is intended to cover all potential stakeholders involved in designing, managing, constructing, and using the municipal wireless network. The study is meant to be inclusive; no one who is interesting in participating will be excluded from the study.

Please describe in detail how participants will be treated throughout the course of the research project. Include a summary of research procedures, and information regarding the training of researchers and assistants. Include sample interview questions, draft questionnaires, etcetera, as appropriate.

Participants will be interviewed about their role in planning, desigining, constructing, implementing, and using a muncipal broadband and wireless service. Sample interview questions are attached as Appendix 1.

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7. INFORMED CONSENT

Please describe how you will obtain informed consent from your participants. A copy of your written consent form or your oral consent script must be attached to this protocol. *Please note: written consent forms must follow the format of the template included at the end of this document.*

Since this project uses participatory methodologies, the people who are participating in this project are research partners, and will be helping to determine the research agenda and sharing the research results. All participation is voluntary, and requests for participation will be made by the case study partners. Informed consent will follow the standard practice, i.e. participants will be informed of the objectives and benefits of the study, and told that it is a minimal risk study. They will be informed that their participation is voluntary, and that they can withdraw consent/exit the study at any time. All participants will sign an informed consent agreement that mentions that data collected as part of this project is used both as part of a thesis at Concordia University and as part of the CWIRP research project directed at Ryerson University. A written consent form is attached as Appendix 2.

In some cultural traditions, individualized consent as implied above may not be appropriate, or additional consent (e.g. group consent; consent from community leaders) may be required. If this is the case with your sample population, please describe the appropriate format of consent and how you will obtain it.

This does not apply to this project

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8. DECEPTION AND FREEDOM TO DISCONTINUE

Please describe the nature of any deception, and provide a rationale regarding why it must be used in your protocol. Is deception absolutely necessary for your research design? Please note that deception includes, but is not limited to, the following: deliberate presentation of false information; suppression of material information; selection of information designed to mislead; selective disclosure of information.

There is no deception involved in this project.

How will participants be informed that they are free to discontinue at any time? Will the nature of the project place any limitations on this freedom (e.g. documentary film)?

Participants will be informed at the beginning of their interviews that they are free to discontinue at any time. There are no limitations on their freedom to discontinue imposed by the project

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9. RISKS AND BENEFITS

Please identify any foreseeable risks or potential harms to participants. This includes low-level risk or any form of discomfort resulting from the research procedure. When appropriate, indicate arrangements that have been made to ascertain that subjects are in "healthy" enough condition to undergo the intended research procedures. Include any "withdrawal" criteria.

There are no foreseeable risks in this study

Please indicate how the risks identified above will be minimized. Also, if a potential risk or harm should be realized, what action will be taken? Please attach any available list of referral resources, if applicable.

This question does not apply to this project.

Is there a likelihood of a particular sort of "heinous discovery" with your project (e.g. disclosure of child abuse; discovery of an unknown illness or condition; etcetera)? If so, how will such a discovery be handled?

This question does not apply to this project

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10. DATA ACCESS AND STORAGE

Please describe what access research participants will have to study results, and any debriefing information that will be provided to participants post-participation.

Stakeholders in the project will have access to the case study reports prepared as part of the CWIRP project and based on the data collected as part of this project. The participants will also have access to the final thesis project once it is completed, if they wish.

Please describe the path of your data from collection to storage to its eventual archiving or disposal. Include specific details on short and long-term storage (format and location), who will have access, and final destination (including archiving, or any other disposal or destruction methods).

Data will consist of interview transcripts and field notes. These data will be accessible to the Fred E-zone organization members and members of the CWIRP project (as defined by Dr. Middleton).

Interview transcripts will be stored in electronic format. It is anticipated that the audio files will also be digital. At the end of the project, all files will be archived electronically (e.g. on a CD-ROM), and kept in a secure location for five years. Field notes will be stored securely for a five year period. Field notes are likely to be electronic, and will be archived in the same way as the transcript data.

An issue for discussion at the first meeting with stakeholders will be whether they wish to remain anonymous when data are reported. I will respect the wishes of each participant in this regard, but it is anticipated that respondents will not request anonymity.

---

11. CONFIDENTIALITY OF RESULTS

Please identify what access you, as a researcher, will have to your participant(s) identity(ies):

☐	Fully Anonymous	Researcher will not be able to identify who participated at all. Demographic information collected will be insufficient to identify individuals.
☐	Anonymous results, but identify who participated	The participation of individuals will be tracked (e.g. to provide course credit, chance for prize, etc) but it would be impossible for collected data to be linked to individuals.
☐	Pseudonym	Data collected will be linked to an individual who will only be identified by a fictitious name / code. The researcher will not know the "real" identity of the participant.
☐	Confidential	Researcher will know "real" identity of participant, but this identity will not be disclosed.
☐	Disclosed	Researcher will know and will reveal "real" identity of participants in results / published material.
☒	Participant Choice	Participant will have the option of choosing which level of disclosure they wish for their "real" identity.
☐	Other (please describe)	

If your sample group is a particularly vulnerable population, in which the revelation of their identity could be particularly sensitive, please describe any special measures that you will take to respect the wishes of your participants regarding the disclosure of their identity.

This question does not apply to this project.

In some research traditions (e.g. action research, research of a socio-political nature) there can be concerns about giving participant groups a "voice". This is especially the case with groups that have been oppressed or whose views have been suppressed in their cultural location. If these concerns are relevant for your participant group, please describe how you will address them in your project.

While this is a participatory research project, the role of the research team is not to give voice to the community but rather to analyse the process of infrastructure development. Thus, it is not anticipated that questions of voice will be concerns.

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12. ADDITIONAL COMMENTS

Bearing in mind the ethical guidelines of your academic and/or professional association, please comment on any other ethical concerns which may arise in the conduct of this protocol (e.g. responsibility to subjects beyond the purposes of this study).

This is a low-risk study. I do not anticipate any other ethical concerns.

If you have feedback about this form, please provide it here.

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13. SIGNATURE AND DECLARATION

Following approval from the UHREC, a protocol number will be assigned. This number must be used when giving any follow-up information or when requesting modifications to this protocol.

The UHREC will request annual status reports for all protocols, one year after the last approval date. Modification requests can be submitted as required, by submitting to the UHREC a memo describing any changes, and an updated copy of this document.

I hereby declare that this Summary Protocol Form accurately describes the research project or scholarly activity that I plan to conduct. Should I wish to add elements to my research program or make changes, I will edit this document accordingly and submit it to the University Human Research Ethics Committee for Approval.

ALL activity conducted in relation to this project will be in compliance with :

***The Tri Council Policy Statement: Ethical Conduct for Research Involving Human Subjects*, available here:**

http://www.pre.ethics.gc.ca/english/policystatement/policystatement.cfm

The Concordia University Code of Ethics: Guidelines for Ethical Actions

Signature of Principal Investigator: ______________________

Date: January 8, 2007

APPENDIX 1: SAMPLE CONSENT FORM TO PARTICIPATE IN RESEARCH

Consent must be obtained from any study participant. Written consent forms must follow the format of this form (exceptions may be given to multi-institutional projects). Oral consent scripts should include the same information. Please adapt this template to suit your project. Language should be at no more than a grade eight reading level. If you are using written consent forms, note that participants should be given two copies of the consent form – one to keep, and one to sign and return to the researcher.

CONSENT TO PARTICIPATE IN (*RESEARCH PROJECT TITLE*)

This is to state that I agree to participate in a program of research being conducted by (*Name of Researcher*) of (*Name of Department*) of Concordia University (*contact info including phone and e-mail).*

A. PURPOSE

I have been informed that the purpose of the research is as follows ... (*Please state the purpose of the research clearly and concisely, in no more than one or two sentences).*

B. PROCEDURES

Indicate in this section where the research will be conducted and describe in non-technical terms what the subjects will be required to do, the time required to do it, and any special safeguards being taken to protect the confidentiality or well being of the subject.

C. RISKS AND BENEFITS

Indicate in this section all potential risks of participation, and any benefits of participation.

D. CONDITIONS OF PARTICIPATION

- I understand that I am free to withdraw my consent and discontinue my participation at anytime without negative consequences.

- I understand that my participation in this study is (*pick appropriate word*):

  CONFIDENTIAL (i.e., the researcher will know, but will not disclose my identity)
  OR
  NON-CONFIDENTIAL (i.e., my identity will be revealed in study results)

- I understand that the data from this study may be published.
  OR
  I understand that the data from this study will not be published.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

NAME (please print)

____

SIGNATURE

____

If at any time you have questions about your rights as a research participant, please contact Adela Reid, Research Ethics and Compliance Officer, Concordia University, at (514) 848-2424 x7481 or by email at areid@alcor.concordia.ca.