Social Issues in Self–Provisioned Metropolitan Area Networks

David W. McDonald
University of Washington
The Information School, Box 352840
Suite 370 Mary Gates Hall
Seattle, WA 98195
dwmc@u.washington.edu

Abstract
This position paper frames a set of issues in the collaborative development of self–provisioned metropolitan area networks (MANs). The tantalizing promise of this infrastructure is free access to other people, computing resources and information at any time in a reasonably large metropolitan area. The paper reviews literature in Computer Supported Cooperative Work (CSCW) and relates notions of ad–hoc collaboration to existing notions of opportunistic collaboration in CSCW. The paper briefly describes studies of networking in CSCW and preliminary investigation of a group that is developing a MAN. The paper closes by introducing several social and technical issues that will be of interest to the CSCW community.

Introduction
Inexpensive wireless technology based around the 802.11b (Wi–Fi) standard has enabled many organizations and individuals to adopt wireless networking. Smaller organizations that could not afford the infrastructure costs of rewiring their facilities to support wire based networks can now easily network small physical spaces. As well, individuals who could not or did not want to physically alter their living space now use wireless networks to share computing resources.

The same small area wireless technology is now being used to create wireless networks that cover entire cities. These metropolitan area networks (MANs) are not being created by large organizations that specialize in the development and installation of large infrastructure. Instead they are being created by groups of concerned individuals. These MANs stretch the technical limitations of the Wi–Fi standard and raise interesting social issues as they grow and develop.

This position paper raises several issues relevant to the possible rise of a low cost ubiquitous, wireless infrastructure. The first section considers several issues of ad–hoc collaboration and Computer Supported Cooperative Work (CSCW) research. The second section briefly describes self–provisioned metropolitan area networks. The paper closes by raising several social issues for large–scale development of self–provisioned MANs.

CSCW and Ad–hoc Collaboration

The field of Computer-Supported Cooperative Work (CSCW) encompasses many perspectives. The research which finds a place in the CSCW community is derived broadly from the social sciences including anthropology, psychology and sociology. But as well, the community has a strong tradition of software and infrastructure development. Bringing social research and technical research together is one aspect that makes the CSCW community diverse and rich. As such, there is not one CSCW perspective [2]. Instead, CSCW is a loose confederation of perspectives that share common interests in people, group activity and technologies that support human-human interaction – often broadly construed.

The critical problem with the term 'ad–hoc collaboration' is whether it is considered from a technological (device) perspective or whether a social perspective is applied. Literature in CSCW speaks to this issue by considering both perspectives. CSCW research attempts to avoid disassociating a given technology from the social context of use. In the CSCW literature, the notions of opportunism and opportunistic collaboration mirror much of what is meant by the term ad–hoc. Mobility or being on the move is not an essential component of either ad–hoc nor of opportunistic collaborations. Mobility may be a forcing function for many technological considerations, but there are still critical social aspects which are evident from existing CSCW literature. Several assertions can be made about ad–hoc collaborative activity based on previous CSCW research:

- **Ad–hoc collaborations are social, human to human activity.** This is fundamental to collaboration studies and technologies that find a place in CSCW. Do not lose sight that collaboration is a fundamentally human activity.
- **Ad–hoc collaboration may be unplanned activity, but it is purposeful activity**. Field studies of collaborative activity in CSCW often identify opportunistic collaborations and describe how those collaborations arise and evolve. It is important to question whether a human-human collaboration is ad–hoc or opportunistic and whether there is any difference at all.
- **Ad–hoc collaboration may actually be "just" coordination**. Telephony studies demonstrate that one major use of mobile communications is to facilitate coordination tasks. Coordination is a difficult activity to support. If the majority of ad–hoc collaboration is actually coordination, then the technologies that support coordination activity are still engaging a deep problem.
- **Aspects of ad–hoc collaborations can be well defined**. Because ad–hoc collaborations are purposeful, there are some aspects of the collaboration that can be well known. Either the people involved are known, or the content of the collaboration is known, or the technology that facilitates the collaboration is known.
- **Every ad–hoc collaboration is unique; ad–hoc collaboration is still situated action**. This statement, when take with the one above, is not meant to convey some deep paradox. Instead, it points to the rich differences among human-human activity even when it is supported by the same technology.

These general assertions are supported through existing CSCW research that has considered various aspects collaborative activity in media spaces, chat spaces, mobility, mobile work and mobile telephony [1, 3-6, 8, 10]. But as for the specifics of any individual ad–hoc collaboration there is still much to be learned.

CSCW and Self–Provisioned MANs

Networking, perhaps more than any other single technology, as facilitated an explosion of collaborative activity. Networks of shared computing resources provide important infrastructure that facilitates human interaction and information sharing. The CSCW community has considered many aspects of collaboration that is facilitated by networks, networking, networked information and networked communities [7, 9, 11, 12].

The introduction of the 802.11b (Wi–Fi) wireless networking standard has created a surge in the number of organizations and individuals who can easily share computing and information resources. The goal of this standard is to facilitate networking in small, reasonably well defined physical spaces. However, Wi–Fi technology is being used to create wireless networks that cover entire cities. These Metropolitan Area Network (MANs) are not being created by large organizations that specialize in the development and installation of large-scale infrastructure. Instead, these Wi–Fi MANs are being developed by small groups who provide and maintain the equipment on their own time, at their own expense. The term self–provisioned is used to describe these MANs because the infrastructure is paid for by individuals who participate in the construction and on-going development of the network and its services.

The tantalizing promise of a self–provisioned MAN is free access to other people, computing resources and information at any time in a reasonably large metropolitan area. This promise mirrors many of the promises made about ubiquitous computing infrastructures. However, in the case of the self–provisioned MAN, costs of the infrastructure are not borne by a single organization. Instead, collective action by concerned individuals gives rise to the necessary infrastructure to support and maintain access for all. The services that are envisioned by the participants will provide the opportunity to consider mobile, ad–hoc collaboration in the large.

The development of self–provisioned MANs is interesting to the CSCW community for several reasons. In the current phase of infrastructure development, the collective action and co–development of the infrastructure is an interesting social and technical phenomenon. In the emergence of these MAN projects the social and the technical issues are rather tightly intertwined, with neither aspect completely determining the course and evolution of MAN development.

The technical limits of the standard are being pushed by the participants. The Wi–Fi standard has specific limits on the strength of the signal that can be broadcast by any individual access point. In general, physical obstructions such as tall buildings, trees, and hills, severely limit the effective range of a given signal. These limitations are a challenge to the participants who need to create both areas that have blanket coverage and connect disjoint coverage areas.

Social interaction, through public meetings and one-on-one collaboration, is beginning to overcome many of the problems created by the limits of the wireless standard. Creative antenna designs, methods of weatherizing access points, techniques for delivering power, have all been derived through social interaction and the exchange of ideas. As well, the known problems with WEP encryption has required that old-timers educate newcomers about security problems when a new person volunteers to host a public access point.

In CSCW this type of collective action is interesting as collaborative group activity. Important initial questions about the group include; who participates, what is their motivation, does participation grow or shrink, how does the group communicate, and how does the collaboration evolve overtime. The individuals who participate in these groups are often technically adept, but that is beginning to change. Indeed, the overall technical sophistication of the participants must change before a self–provisioned MAN can actually succeed.

Researchers in CSCW will also be interested in the broader social impacts of MAN development. The groups that are developing these MANs are aware of some of the social issues. They are not just concerned about their own access, but are also interested in free public access for technological have-nots. Institutional issues are also important. The groups developing MANs provide technical feedback to the corporations that develop and sell Wi–Fi equipment. As well, there are impending conflicts with large commercial service providers which may have a detrimental influence on the eventual success of self–provisioned MANs.

From a theoretical standpoint, the development of self–provisioned MANs can be described as the *appropriation* of Wi–Fi technology. In this sense the term appropriation conveys the way in which individuals or groups adopt and use a technology differently than the way it was initially conceptualized. In this case, the groups who are developing MANs must find creative solutions that satisfy governmental regulation and still provide access to the public at large.

Summary

Self–provisioned metropolitan area networks promise to provide infrastructure that will support relatively ubiquitous access over a reasonably large metropolitan area. The development of these networks is an example of large scale collective action on the part of concerned individuals. This collective action raises several important technical and social issues.

The CSCW community is interested in both the technical and social issues of collaboration. It has a history of interest in networking and how networks have facilitated different forms of collaboration and sharing. Self–provisioned MANs bring together issues of mobility, opportunistic collaboration, and networking to provide an additional picture of how individuals and groups collaborate.

References

1. Ackerman, M.S. and Palen, L., The Zephyr Help Instance: Promoting Ongoing Activity in a CSCW System. in *ACM Conference on Human Factors in Computing Systems (CHI'96)*, (1996), ACM Press.
2. Bannon, L.J. and Schmidt, K., CSCW: Four Characters in Search of a Context. in *Studies in Computer Supported Cooperative Work: Theory, Practice, and Design. Proceedings of the First European Conference on Computer Supported Cooperative Work.*, (1989), Elsevier Science, 3-16.
3. Bellotti, V. and Bly, S., Walking Away from the Desktop Computer: Distributed Collaboration and Mobility in a Product Design Team. in *The 1996 ACM Conference on Computer-Supported Cooperative Work (CSCW '96)*, (Cambridge, MA, 1996), ACM Press, 209 - 218.
4. Bradner, E., Kellog, W.A. and Erickson, T., The adoption and use of BABBLE: A field study of chat in the workplace. in *Proceedings of the Sixth European Conference on Computer Supported Cooperative Work (ECSCW'99)*, (Copenhagen, Denmark, 1999), Kluwer Academic, 139-158.
5. Dourish, P. and Bellotti, V., Awareness and Coordination in Shared Workspaces. in *The 1992 ACM Conference on Computer-Supported Cooperative Work (CSCW '92)*, (Toronto, Canada, 1992), ACM Press, 107 - 114.
6. Grinter, R.E. and Eldridge, M., y do tngers luv 2 txt msg? in *Proceedings of the Seventh European Conference on Computer Supported Cooperative Work (ECSCW 2001)*, (Bonn, Germany, 2001), Kluwer Academic, 219-238.
7. Hesse, B.W., Sproull, L.S., Kiesler, S.B. and Walsh, J.P. Returns to Science: Computer Networks in Oceanography. *Communications of the ACM*, *36* (8). (1993). 90 - 101.
8. Luff, P. and Heath, C., Mobility in Collaboration. in *Proceedings of the ACM 1998 Conference on Computer Supported Cooperative Work (CSCW'98)*, (Seattle, WA, 1998), ACM Press, 305-314.
9. O'Day, V.L., Bobrow, D.G. and Shirley, M., The Social-Technical Design Circle. in *The 1996 ACM Conference on Computer-Supported Cooperative Work (CSCW'96)*, (Cambridge, MA, 1996), ACM Press, 160 - 169.
10. Palen, L., Salzman, M. and Youngs, E., Going Wireless: Behavior & Practice of New Mobile Phone Users. in *Proceedings of the ACM 2000 Conferenc on Computer Supported Cooperative Work (CSCW'00)*, (Philadelphia, PA, 2000), ACM Press, 201-210.
11. Rogers, Y., Ghosts in the Network: Distributed Trouble shooting in a Shared Working Environment. in *The 1992 ACM Conference on Computer-Supported Cooperative Work (CSCW '92)*, (Toronto, Canada, 1992), ACM Press, 346 - 355.
12. Sproull, L. and Kiesler, S. *Connections: New Ways of Working in the Networked Organization*. MIT Press, Cambridge, MA, 1991.