Residential Broadband Networks: Preliminary Findings from a Canadian 'Information Highway' Trial

Catherine A. Middleton
Doctoral Candidate
Schulich School of Business
York University, Toronto, Canada

cmiddlet@yorku.ca

A 'work in progress' paper accepted for the Workshop on Information Technologies and Systems (WITS '99) Conference, Charlotte, North Carolina. This is the version printed in the conference proceedings. See http://www.yorku.ca/academics/middletn/pubs/wits2.pdf for copies of slides used when presenting this paper.

Residential Broadband Networks: Preliminary Findings from a Canadian 'Information Highway' Trial

Catherine A. Middleton
Schulich School of Business • York University • Toronto • Canada
cmiddlet@yorku.ca • www.yorku.ca/academics/middletn

Abstract. There were many broadband network trials in the mid 1990s, but most of them were proprietary undertakings with research results available only to those corporations who participated in the trials. As such, there has been little public or academic discourse about the outcomes of these trials. With consumer access to broadband networks becoming more widespread however, it is important for industry and consumers to learn from the experiences of previous network deployments. This paper presents research results from a Canadian broadband trial. Three key themes are outlined: i) innovative content was developed for this trial, but there was a tradeoff between continued innovation and the necessary stability for the roll out of content; although innovation did not require huge resources, it was not something corporate consortium members did well; ii) getting content to supplement what was developed in-house was extremely difficult, and users' needs were not always considered when external content was provided; and iii) the killer application was e-mail and the community-based listserv it enabled. The implications of these themes are discussed briefly and future research directions are outlined.

Introduction. In 1993 a consortium of public and private sector organizations established Netcom. Netcom developed and operated a residential broadband network trial, based in Canada. This trial was from its inception non-proprietary and research-oriented in nature. Following several years of planning and preliminary testing of networks and applications, the trial successfully delivered a variety of broadband services to consumers in their homes, homes that were specially wired for this purpose. This paper focuses on the development, provision and usage of content within this trial, offering findings drawn from in-depth qualitative interviews with infrastructure and content providers. It should be noted that the results presented here are preliminary and primarily descriptive, reflecting the 'work in progress' status of this research.

Broadband Network Trials. In the early to mid 1990s, fueled by visions of the "information superhighway" and the "500 channel universe", cable and telecommunications companies across North America started experimenting with consumer broadband services. These experiments have been described as broadband network trials, interactive television trials and information highway trials. The terminology describing the trials varies but the basic objectives were to test new means of delivering digital information and entertainment services (e.g. movies on demand, e-commerce, games, educational materials) into consumers' homes.

Trials were conceived of as test beds where normal market conditions did not apply. The trials allowed for experimentation with pricing models and different means of delivering content (e.g. via TV or computer). In return for their participation, the users of the technology in these trials were given access to new services at reduced or no cost, and more importantly for some, an opportunity to influence and shape the future of interactive telecommunications and electronic commerce. It was expected that the technology and content providers would draw from their findings and experiences gained in the broadband network trials and join forces to offer broadband connectivity and services to consumers on a commercial basis. Although commercial residential broadband services are now quite widely available (e.g. @home cable services, ADSL internet access), it is not clear that such offerings have incorporated any of the findings of the mid-90s broadband trials.

Research Question. Executives involved in these trials indicated that they learned a great deal from their experiences, and it is likely that the trials offered valuable learning environments for all participants. But a literature search[1] does not offer much in the way of commentary or analysis on any of the trials. (One notable exception is Kraut et al., 1996.) There is literature that addresses technological and economic issues related to developing an appropriate infrastructure for residential broadband networks (e.g. Ims, Myhre & Olsen, 1997; Kwok, 1997; Noll, 1996; Wright, 1997), but consumer-oriented results from the trials have not been disseminated. Such information is considered proprietary by the companies that participated in the trials, even though its release would be of value to consumers. It is this lack of information that motivates the research question explored in this paper.

The research question addressed in this paper then is as follows: From the perspective of content and infrastructure providers, what issues should be considered when developing and obtaining content for residential broadband services? This question is of particular importance now, as many current initiatives are being driven by infrastructure providers who do not have a ready supply of content appropriate for broadband delivery[2]. Answers to this question are necessary as a precursor to understanding the role of network content in encouraging user adoption of broadband networks, and in understanding how broadband networks can be implemented in consumer settings. In turn, these issues will inform a broader understanding of how the marketplace for business to consumer electronic commerce is developing.

Research Site and Methodology. This research is based on the Netcom trial, which was situated in a new subdivision of a town about 30 miles from a large Canadian city. Planning for the trial began in 1993, and the trial delivered services to residential users[3] from late 1996 until the end of 1998. As the trial plan states:

> "Netcom is a consortium of public and private organizations who share the goal of shortening the implementation time for full service broadband networks in [Canada]. Netcom is testing the city of tomorrow today. It's a broad bandwidth network complete with user access appliances, multimedia content and servers and information gathering that will result in a blueprint for living and working in a connected community." (Netcom, 1994: 4)

The Netcom consortium included telecommunications companies, computer companies, systems integrators, health care providers, real estate developers, multimedia content developers, and universities, all committed to the idea of a user-centred trial. A symmetrical HFC (hybrid fibre coax) network delivered broadband connectivity and services (at speeds up to 10 Mbps) to approximately 200 hundred users, all of whom lived in specially wired homes.

There were several research initiatives associated with the trial, and data were gathered in a variety of forms for different purposes. The results presented here are drawn from a series of 19 in-depth interviews with infrastructure providers, content developers and others involved in establishing and operating the trial. These interviews were carried out in late 1998 and early 1999, as the trial was winding down. All interviews were conducted and transcribed by the author. A preliminary set of descriptive codes was developed to sort and categorize the data. Using NUD•IST software (QSR, 1997), the coding system was refined to identify the key categories within the data. A central theme emerging from the data relates to the development, provision and usage of content, and it is this general theme that is investigated here. A thorough analysis of these data produced key findings in three specific areas. These findings are presented below.

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[1] Due to space limitations a literature review is not included here.

[2] On its own, the technical infrastructure that enables high bandwidth connectivity is of little value to users. The delivery of content and services (e.g. electronic commerce, healthcare information, government services, financial transaction processing) is essential to make a network's broadband infrastructure valuable to prospective users. Note that the term 'application' is used here in conjunction with content and services, and refers to the means by which services are, or specific content is, accessed.

[3] The terms user and home owner refer to consumers who had residential access to the Netcom network. The terms member, partner, provider and developer refer to the individuals and corporations in the Netcom consortium who built and operated the Netcom network.

Results

1. Innovation. Netcom had a team of developers working on new applications for use with broadband networks. All the applications had to be developed by the Netcom team, as there were no commercially available products at that time. Applications developed by the team enabled video phone and video mail services, CD-ROM serving (e.g. games, entertainment CDs) over the network, and music on demand. Before these applications were made available to the users in their homes there were several public demonstrations of the applications, intended to generate positive press coverage for the trial and to encourage corporations to join Netcom. As is often the case with demonstrations of new technologies (see Rubin, 1999 for example), the applications that were demonstrated were prototypes. One of the developers describes these applications:

> When we first started out, this was all demo stuff … it was hanging together by a thread … I was given a week or two for this new product and it involved learning a new language, a new programming language, and so this would go on all the time, from two weeks to a month lead time you'd have to create this whole new product, program it and do all the things, so it wasn't really a commercial product, it was more like a demo, so it had kind of hung together, almost like smoke and mirrors. There was some functionality that was supposed to be there but it was in the demos, we would just demonstrate it kind of thing, but it wasn't actually there.

The content developers found it frustrating to build content that was designed to look good for televised press coverage without being robust enough for regular usage. Interestingly though, they also noted that once more fully developed applications were required, their ability to be innovative and creative in application design was curtailed.

> When I think about where we started, we were always pushing the envelope and always breaking things, we were right on the edge, and now I don't think we're there, I think we're on sort of the mid to back-end of things in terms of putting stuff out. …before there was a real sense of experimentation, but once we hammered down what we needed, and it's the catch, we said "well we hated the smoke and mirrors because, for [a developer] it drove him nuts" he'd start something, see a little problem, he'd get it working and then before, and he would hack things together and then he'd stop, he could never go back and clean it up, and do it properly. Now, … we need a real videophone, then he actually had to create a real update, he couldn't just hack it together, it had to be robust, and so all the experimentation stopped. And so we stopped learning new tools all the time, and just dealt with Netcom.

Even though the developers felt that the actual content used in the trial was less innovative than some of the content used for demonstration purposes before the trial was fully operational, there was still a real sense of excitement and pride regarding achievements in content and application development. Netcom developers were the first to roll out video mail and video answering machines, CD-ROM serving, and music on demand, all achieved with limited staff and financial resources. A researcher comments on this success.

> Some tools, they'll kill you. Because you'll end up investing so much money, including the purchase of the tool, and the training of the tool and then outputs of the tool are just not worth it. Other tools are great enablers. You've got technical enablers which enable services to be created and delivered. And the key question is, can you find enablers that are low cost, low maintenance and yet really effective? And there again, it's interesting. The corporate world as such, we didn't, I did not detect that there was a great deal of understanding of this in among the technical people, in general, that we dealt with. They don't know, they don't have the skill set or whatever to evaluate software development tools and so on. So I think they find it very difficult to develop the software that we think is fairly easy to develop.

The researcher indicates some frustration with the corporate world. Others echo this sentiment, noting that despite large corporate research budgets the corporations involved in the trial simply did not have the same ability to innovate as did the small Netcom research and development team. Not only did the corporations not develop innovative content, they chose not to use Netcom content in other trials they were involved with, preferring instead to build their own. The telco involved in the trial was operating

several other trials simultaneously, relying upon its own team for content development. A Netcom member describes demonstrating Netcom content for the telco managers.

> We'd showed them cool things, video telephony, CD-ROM delivery, music, videos for help. They had none of that stuff in [their other trials] and we really wanted to see them, and we had all the people who were responsible for all the [telco] trials in that room. I found out months later, from [a telco manager], that he got in a lot of trouble after that demonstration, because why didn't we have stuff like this at [the telco trials]. This was what he told me. And yet no one made moves to do that. It was very typical. So there he gets into trouble for not getting it, but no one made any moves to get it. And that was just, I think, a very classical example. …I was surprised by how much not invented here/indifference/uninterest we had for some of the stuff. That was a big surprise. We were making it so easy for those guys to have that. They could have had CD-ROM serving at [their trials]. We would have got that right to them in two weeks.

Summarizing the findings about innovation around content and application development then, the data show that real innovation can take place with limited resources, that the corporate participants in the trial were not successful innovators yet did not want to adopt innovative applications developed within the consortium, and that there is a trade off between innovation at the development stage and the levels of robustness required for applications to be deployed for real users.

2. Lack of content. Content previously developed by consortium members was available to home owners, supplementing content designed specifically for the trial. This content included educational and entertainment CD-ROM titles, and health and wellness resources. Children's CD-ROMs were accessed most frequently, although there was little content for children of primary school age. There were only a few CD-ROM titles that appealed to adults. Other than e-mail and web surfing, neither of which relied upon the provision of content by the trial, the most popular application among the adults in the community was music on demand. Users enjoyed the content they did have access to, but it was not updated frequently and consortium members felt that the overall content range and selection was weak. As the trial manager said:

> The content sucked, it was big disappointment, I really wish we could have got some other stuff, especially in entertainment areas because I think the adults would have used the CD-ROM's a lot more than they have. I have to say, I don't think they've done a good job of exploiting what's there, but if there was more content they might spend more time sort of reading through it.

A consortium member describes content acquisition efforts.

> We tried like crazy to get more content, more CD-ROM titles, we were promised many things, but in the end, even though we were promised things locally … we were promised from prominent CD-ROM distributors, and they had the stuff sitting behind them, and they said … we'll give it to you, and all we'd need to do is just pick up a truck, and somehow it just never materialized, and only little drops of it came.

Furthermore, when content was provided, it was often content that the distributor wanted to offload, rather than content that the trial really wanted.

> [the provider had] some of this other stuff that we could really use, which would be really useful to us, and I think their answer was "well it sells already". They didn't say it directly, but the impression I got was if "that already sells, we don't need to give you anymore of that, we want to push, we're in it for what we want to see successful, and so we're going to put what we want on the network". So the content developers were driving what they thought was important.

The difficulties in acquiring appropriate, relevant and dynamic content, content that fit with the innovative nature of the trial, were not anticipated by trial management. However, the data show that there were real problems in obtaining content, and that the objectives of the content providers, both consortium members and those external to the trial, were not always consistent with the user-centred philosophy guiding the trial.

3. The killer 'app'. Trial management would have liked to provide more content for users, but there was certainly enough content available to give users the experience of broadband connectivity. But the

data indicate that most users did not take full advantage of services that required broadband network capacity. As a content developer noted, "In the end, I would say that we didn't make full use of the bandwidth. We provided some cool things at the time, but I believe we could have done more." This sentiment was echoed by another member, who commented that "the high speed thing was all just window dressing".

Users did enjoy the fast internet access and perpetual connectivity Netcom provided, but it was widely agreed that the 'killer application' was e-mail. Consortium members were surprised by how quickly e-mail helped families get to know their neighbours, and how it helped developed a strong sense of community.

> The people used it [the listserv] to arrange more parties and to get somebody else to be a babysitter within their neighbourhood rather than going out. So it enhances -- I think -- but who knows -- but from an outsider's point of view, the quality of the relationships and perhaps there is a tighter knit community because of it.

The real estate developer noted that a lobbying group was mobilized much more quickly in this community than in other similar new developments, a move attributed to e-mail and the community listserv. When interviewed, trial members repeatedly told the story of how an informal neighbourhood watch was established using the listserv, after a series of break-ins in the area. The importance of the community aspect of the trial, enabled by simple e-mail, was not anticipated.

> I actually think we succeeded in community and that wasn't part of what we had planned. At least it wasn't something that I had really thought about. And so, for me, just to realize that the basic connectivity, just being connected and having an easy way to reach one another was really important, and really allowed, and mundane stuff, I'm surprised at what goes on in those e-mails but it is everyday, mundane stuff but it's really important, compared to some of the other stuff.

This is an interesting finding, as it calls into question the value of broadband services. Perhaps it is simple interactivity that is important in a community, rather than high cost, high bandwidth services.

Discussion and Conclusions. What lessons can be drawn from the Netcom experience? The table below offers brief analysis of each issue.

Preliminary Analysis and Implications	Future Research Questions
Innovation. There appears to be real value in a consortium approach to application and content development, one that includes a non-corporate research and development team. Corporations could learn from research partners how to develop more innovative content, abandoning the 'not invented here' syndrome in order to acquire content that is developed around user needs instead of corporate requirements. The tradeoff between content robustness and stability needs to be understood and carefully managed, so that innovation and experimentation does not stop when services are rolled out to users.	• Why is it that corporations are not good at true innovation? • Does the 'not invented here' syndrome reduce the availability of good network content? How can this be overcome? • What is an appropriate balance between innovation and stability when developing new broadband applications?
Lack of Content. Good content is difficult to acquire. The Netcom trial management believed that some of the difficulty experienced in getting content was due to the small size of the trial, and its location in Canada. As such, larger scale initiatives that form partnerships with US based organizations may have less trouble obtaining content. Engaging content is essential if a broadband service is to be anything more than a high speed internet provider. Adequate funding for content development is important. Content must provide services users will find useful, not just services that are easily developed.	• How are users' needs determined when developing content? • What is the role of content in consumer adoption of broadband technologies?

The Killer App. The Netcom trial results show that low bandwidth services can provide value to consumers, in ways not initially anticipated. The range of high bandwidth services available to users in this trial was limited, but it is not clear that there is a high demand for broadband services. As a concept, broadband is appealing, and users do appreciate having high speed internet access, but it seems that many users don't have compelling reasons to adopt broadband services. The real issue here relates to consumer propensity to pay. The cost of developing broadband services like movies on demand or interactive television is high, and these costs will be passed along to the users.	• What services are of real value to consumers? • How much will consumers pay for broadband connectivity if their main needs can be satisfied with low bandwidth technologies and services? • What is the real driver of consumer adoption of broadband services?

This research offers some insights from a trial of residential broadband services. These findings are important because the outcomes of most similar trials have not been made available to the public. Of particular interest is the finding that low bandwidth services like e-mail and the community listserv were highly valued by the users, as this is contrary to the widely held assumption that high bandwidth is what consumers want. What these findings show is that consumers want services that provide value to them, independent of the nature of the service. Although there are still many unanswered questions, there is no doubt that the issue of development and acquisition of compelling, engaging, useful content is key to the success or failure of any consumer oriented broadband service offering.

This paper has described some of the issues facing content and service providers as they move toward commercial roll out of broadband networks. It has outlined some practical implications of these findings, but not explored them from an analytical or theoretical perspective. The next stage of this project will focus on gaining an understanding of the factors driving broadband content development and consumer adoption of broadband network services, drawing upon and contributing to theories of information systems implementation and user adoption of technologies.

References

Ims, L. A., Myhre, D., & Olsen, B. T. 1997. "Economics of residential broadband access network technologies and strategies." IEEE Network 11(1): 51-58.

Kraut, R., Scherlis, W., Mukhodaphyay, T., Manning, J. & Kiesler, S. 1996. "The HomeNet Field Trial of Residential Internet Services." Communications of the ACM 39(12): 55-63.

Kwok, T. C. 1997. "Residential broadband Internet services and applications requirements." IEEE Communications Magazine 35(6): 76-84.

Netcom. 1994. Trial Plan.

Noll, A. M. 1996. "CyberNetwork Technology: Issues and Uncertainties." Communications of the ACM 39(12): 27-31.

QSR. 1997. NUD•IST4 Software. Qualitative Solutions and Research Pty Ltd, Melbourne.

Rubin, E. (1999). Bulldog: Spirit of the New Entrepreneur. Toronto: HarperCollins.

Wright, D. J. 1997. "Assessment of alternative transport options for video distribution and retrieval over ATM in residential broadband." IEEE Communications Magazine 35(12): 78-84.