Effects of Reduced Connectivity in Rural and Remote Communities

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Abstract
In this paper we describe our ongoing work on the impact of limited or lack of connectivity in rural and remote environments. We describe the nature of the problem and its potential impact on local and global sustainability. We then present our current and future plans for collecting data to better understand the needs of this often ignored yet important user population.

Keywords
Remote and rural communities, connectivity, qualitative studies

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction
For rural and remote locations to be sustainable in the sense of remaining viable communities, users in these locations need access to communication tools. They need access to education, to healthcare information, to media, to software, to consumer goods, and to customers. Today, much of these resources are available on the internet and a great deal of personal and professional transactions happen electronically.

Despite their importance, access to communication tools and electronic information is limited in many rural and remote locations. For example, according to the CRTC Communications Monitoring Report July 2010 [3], 16% of rural Canadians are without access to broadband internet. Comparably, 100% of urban Canadians have access to at least one type of broadband internet option. In the North of the country the availability is even poorer, where over 40% of rural northern residents are without broadband internet access.

The types of content routinely included in typical websites and web 2.0 tools do not take into account reduced connectivity, in turn limiting and/or hampering user's access to critical electronic services and resources in remote and rural locations. At the extreme end of the spectrum, some websites will not load at all in locations that do not have broadband internet access. Wolff and Andrews [6] reviewed the availability of government and community website services in Montana. They found that, of the 19 services examined, only 12 had been implemented at all by rural counties reviewed.

While there are governmental initiatives designed to increase rural access to broadband [1], progress is slow. In the meantime, the types of access available in rural and remote areas are often satellite and wireless based which can be disrupted by weather and geography. In short, rural constituents will likely be dealing with reduced connectivity well into the future.

The HCI research community has begun to explore the needs of users in rural and remote locations. For example, Gilbert et al. [4] compared social media use of rural residents to urban residents revealing interesting cultural differences. Their study showed that unlike urban residents, rural users do not become online friends unless they are already a friend offline, implying that they have already built a level of trust.

In a similar vein, our works seeks to better understand user needs in rural and remote communities and what impact lack of connectivity has on users' lives. We are particularly interested in understanding the effects of lack of, or intermittent, connectivity on users' professional lives, i.e., their ability to *work* in these environments. We are also interested in exploring whether it is possible to mitigate some of these connectivity challenges by providing the right kind of interactive software design.

Answering these questions requires going out in rural and remote communities since the needs and experiences of urban users are not necessarily representative of those in a rural cultural environment. As Brynjarsdóttir and Sengers [2] point out, it is the rural residents themselves that are the experts in what tools they need. We believe that a formal qualitative study working with the businesses and community members in the rural and remote areas affected by reduced connectivity can best set design goals.

The structure of the remainder of the paper is as follows: We begin by discussing the relationship between connectivity issues in rural and remote locations and global sustainability. We then discuss the results of a pilot study we conducted to examine the impact of limited connectivity in rural and remote locations and our plans for future studies.

Impact of Connected Rural and Remote Communities on Global Sustainability

Lack of connectivity in rural and remote communities not only impacts the viability of these communities, but also constitutes an unsustainable environmental practice. These environments are often rich with natural resources, including hydro electricity, sustainable forestry, and land for farming. Access to these natural resources depends on our ability to support those harvesting and maintaining the resources with adequate communication technology. Without this support, people in these regions are likely to have difficulty accessing both critical personal tools (e.g., ability to access education and healthcare information) and critical professional ones (e.g., ability to market products effectively). Other global sustainability practices that could take place in remote locations include nuclear waste management, large-scale composting, and urban-waste management. Leaving a subset of the population with hobbled sets of tools, leaves untapped potential on the table.

Impact of Reduced Connectivity in Rural and Remote Areas

Pilot Study

To begin exploring the impact of reduced connectivity in rural and remote regions, we conducted a set of semi-structure interviews with 15 University of Manitoba students. During our interviews, we asked the students to compare the "always on, ubiquitous, connectivity" they experience in the urban environment with any experiences they have had in rural and remote locations.

We have begun to analyze the data gathered. Some participant reactions to reduced connectivity they encountered in rural and remote regions included:

- "not nearly as good as I'd like it to be"
- "routine is broken"
- "feel out of the loop"
- "ruins the whole experience"

Participants reported that the reliability of connectivity drops considerably outside urban centres for both standard types of internet access and cellular service. This drop in connectivity is perceived to have a noticeable, negative and disruptive impact.

Based on our interviews, it seems as though connection type (e.g. dialup, DSL, cable, antenna, and satellite) has an impact on user experience. In particular the volatile connection types may be more disruptive to users than other more constant even if lower bandwidth types. Thus, future studies should ensure that opinions are gathered from participants using a range of different connection types.

The analysis of both the pilot study and government broadband initiatives will inform the design of a more detailed evaluation, which we describe next.

Going Remote

The next step in our research will be to conduct a large-scale qualitative study targeting the residents of rural and remote communities in Manitoba, where residents are directly and continually impacted by reduced

connectivity. This next study will involve interviewing people in these communities about their experiences and expectations as well as observing the environment in which their work is taking place. We plan to spend a significant amount time in these communities, working to identify key challenges from the residents' perspectives. To complement our interview data from the above qualitative study, we are also planning to instrument participants' web browsers to collect quantitative meta data related to participant web browsing experiences and compare their data to those in urban settings. This data will provide insight into which types of pages users are able to browse in each of the settings. The aim is not to record which sites the participants browse but rather how complex those pages are based on how many images, css, Flash, scripts, and forms are involved. This can be used to specifically describe the type of content that users are trying to access and allow us to associate this information with their reported experiences.

We expect to learn a great deal from the people in remote communities by examining what they wish to accomplish and what communications are facilitated by the currently available connections and tools.

Tool Support

Once we've identified what challenges participants face in rural and remote regions, we'll look at how to make improvements. These improvements may come in the form of a set of design guidelines for including low bandwidth or reduced connectivity accessibility within web tools as they are being built. Alternatively, these improvements may involve designing tools to support accessing sites that already exist.

An example of an existing support tool is Loband [5]. Loband allows you to access a website from a location with low bandwidth and download only the text. Loband's server filters out all images and other heavy content allowing the page to load much more quickly. Loband is open software that can be downloaded and hosted locally. While the loband tool can provide some help with accessing raw text data it does not support interactive tools or websites for which images are critical components. In other words, there are many challenges still unaddressed, with the best solutions depending on the needs identified by the residents.

Summary

Rural and remote communities require communication tools to remain sustainable themselves and to be productive members of global sustainability. Currently, however, broadband internet is unavailable to a significant number of rural and remote residents. Our work seeks to identify how user interaction with complex internet tools used for business productivity is affected when broadband internet is not available or inconsistent. Finally, can software techniques be developed to mitigate the adverse affects of reduced connectivity and promote the ongoing viability of remote and rural communities?

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