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# Video Communication Roadblocks Facing Remote Indigenous Communities

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## Introduction

Increasingly, remote and rural communities have pursued access to broadband networks. The networks provide new opportunities for advantageous video communications. In Canada, both organizations and individuals in these communities exchange audio-visual data via broadband networks. They use videoconferencing, multi-site videoconferencing, and video sharing online. However, social and technical challenges arise to constrain the growth of such uses in these communities.

Canada's population density is one of the lowest in the world, and its north and most rural areas support small Indigenous communities. Populations in these communities range from a few hundred to a few thousand residents. The communities are situated among rich wildlife and natural resources, and are often separated from one another by vast areas of boreal forest, tundra, and large lakes and rivers. Furthermore, travel to and from the most isolated communities is only possible via air because they lack permanent roads.

Video communications provide vital opportunities for these remote and rural communities to share resources and knowledge with one another. In addition, broadband networks also afford such communities access to services only available in urban centers.

Videoconferencing can already effectively deliver both telehealth (which allows remote diagnoses and the exchange of medical images between urban hospitals and remote communities) and distance education (which supplies opportunities for students to complete secondary, college, and university courses, as well as professional development training). But our research to date [1] finds that Indigenous communities also use videoconferencing to share financial and human resources and to foster inter-community event participation without sacrificing money and time for travel. Connections blossom that would otherwise prove impossible: organizing region-wide meetings and social events becomes viable, and interactive learning beyond formal education provides opportunities for personal, professional, and community development.

Significant opportunities exist for engineers and technology developers to develop appropriate broadband networks, services and applications for remote and rural Indigenous communities in Canada. The need is clearly there, and the communities are keenly interested to make the most of the possibilities afforded by broadband. This article outlines the technical and social roadblocks to broadband development in these communities. Like any roadblocks, however, these are also challenges that can be overcome with the right approaches, perspectives, policies and tools.

**Contextualizing the Current Study**

Video technologies ideally furnish communities with equalizing opportunities and broad access to resources, services, and knowledge. However the initial challenges of introducing new information and communication technologies (ICT) [2][3][4] might defer positive outcomes. In order to effectively evaluate communications challenges, our study relies on the participation of remote and rural Indigenous research partners. We believe that collaborative relationships with research partners are the best way to incorporate the experiential knowledge of community-based organizations and community members. Our research partners' input informs our assessments, interventions and analyses.

We are thus guided by several research frameworks that fundamentally value community contribution. The first is a Community Informatics approach [5] which advocates that first-hand experiences of both community-based organizations and community members should be central to any analyses of ICT. Closely aligned is the Social Informatics approach. Actor Network Theory and the Social Actor concept see the technical and the social as inseparable - people and their technologies comprise social networks. Social actors are both enabled and constrained by socio-technical environments [6][7][8]. According to theorist Rob Kling, a complex web of context mediates the relationship between the social and the technical, including structure and agency; history; culture and meaning systems; political and social processes; and symbolic and material interests and resources [9][10][11].

Our own previous research also informs the project. We developed a framework [12] for analyzing video communications that includes four categories, and our current study examines challenges to each: 1) technical infrastructure; 2) community members interacting with technology; 3) production and reception of audio-visual content; 4) and social and organizational relations.

**Collecting Data**

This study falls under a larger research project called VideoCom, which attempts to broadly investigate the ways in which remote and rural Indigenous communities use video communications to bolster both social and economic development. Currently we partner with three Indigenous organizations - Keewaytinook Okimakanak in northern Ontario (both K-Net its telecommunications division based in Sioux Lookout and KORI its research institute in Thunder Bay), the First Nations Education Council based in Wendake, Quebec; and Atlantic Canada's First Nation Help Desk in Membertou, Cape Breton, Nova Scotia. All three organizations provide video communications services and support to Indigenous communities in their respective regions, and each is somewhat unique in the IT world, operating as not-for-profit, second-level support agencies established by the

communities themselves. Four other Indigenous organizations in other regions of Canada are able to provide similar services, and all six organizations are possible primarily because of the flexibility provided by First Nations SchoolNet, a federal government program in Indian and Northern Affairs Canada (INAC).
We have argued for the need for partnership approaches when doing technology research with Indigenous communities [13][14] and recently Canadian federal research ethics guidelines require forging and maintaining partnerships as an essential component of conducting research with Indigenous communities [15]. The current study furthers our relationship with our research partners, relying on their input, interest, and investment in the research questions. Our Indigenous partners provided feedback on an earlier version of this paper, ensuring a check on our research findings and researchers' perspectives. The research protocols were approved by the research ethics boards of the University of New Brunswick and the National Research Council of Canada.

This study was conducted using mixed methods during three rounds of data collection. In April and July 2007, 18 in-depth interviews were conducted, 14 in person and four by telephone. Interview respondents (two of whom were interviewed twice) included nine men and seven women in various roles. We spoke with technicians, administrators, managers, and support staff working with two research partner organizations and their community partners. All interviews were recorded and transcribed and were confidential. We analyzed this qualitative data with N-Vivo software and coded according to our research frameworks and our four-category structure for analyzing video communications. A more detailed discussion of this interview process is available in an earlier publication [1].

The second round of data collection followed two public meetings held by multi-site videoconference that the research team organized in July 2007. Both meetings were advertised on our project's online meeting space and on our partners' websites and mailing lists. K-Net provided the videoconferencing bridge (MCU) linking the different sites; maintained the live webstream to the project webpage; and coordinated all technical aspects of the events. The Help Desk provided a videoconference bridge to communities in the Atlantic region. The meetings were held a week apart and each lasted 1.5 hours. We recorded and transcribed the meetings, analyzing this qualitative data with N-Vivo software and coding it using the same criteria as those used for the interview transcripts. Each meeting focused on a theme. The first was called "Advancing the Green Agenda with Videoconferencing" and connected 23 sites with more than 40 participants belonging to 12 Indigenous communities; the second was called "Digital Storytelling" and connected 10 sites with more than 20 participants belonging to four Indigenous communities. The first meeting is discussed in more detail in a separate research paper exploring the link between multi-site videoconferencing and the public sphere [16].

The final data collection for this study was held in October 2007. Questionnaires were administered during an ICT Symposium organized by the Atlantic Help Desk. Connected via videoconference, approximately 50 educators from Indigenous schools in Atlantic Canada attended the daylong event in two locations - Burnt Church First Nation, New Brunswick and Membertou First Nation, Nova Scotia. The study collected 43 completed questionnaires from the participants. We analyzed this quantitative data with SPSS to explore the items related to video communication technology use and used advanced statistical procedures to examine the differing use-frequencies of specific technologies

as a function of gender and first language. A complete analysis of this data collection is also available as a published report [17].

Our study's mixed method approach – qualitative data from transcripts of recordings of one-on-one in-depth interviews and group public discussions held by multi-site videoconference, and quantitative data gathered from surveys of Indigenous community educators – follows established approaches for conducting communication research. [18] [19]. Mixed methods allow data triangulation – each of the data collections was analyzed individually and the results compared to verify, challenge or explain the respective findings.

## Assessing the Challenges

### *1. Technical Infrastructure*

1.1 Network and Bandwidth Constraints: Remote and rural Indigenous communities Canada variously use T1 connections, cable, fiber, microwave, or, in some northern communities, satellite connections. In northern Ontario, the latter are managed by K-Net through the Northern Indigenous Community Satellite Network. Bandwidth is far more accessible in Canadian cities than it is in remote and rural communities that do not have the population density to attract commercial providers' competition; consequently, developing network infrastructure in remote areas is expensive and takes considerable time.

The type of connection determines bandwidth capacities; according to one interview respondent, "The T-1 is . . . certainly [better than] dial-up and DSL, . . . [but] it's not adequate for burgeoning needs. . . . [W]hen they have to go from 2 megs, to 5 megs to 10 megs to 100 megs, then the way you have to do it is with fiber." Another participant detailed the need for, and the difficulties of acquiring, more bandwidth: "We have these service industries knocking on our door . . . want[ing] to have these [videoconference] sessions in communities, . . . but all the bandwidth is taken up in the community… That's why we're working with Bell to plan to increase the T1s to 10 megs, which means a $6-million infrastructure build to Red Lake and Pickle Lake. . . . It'll take a couple of years. That doesn't help us right now."

1.2 Network Management and Quality of Service: In communities with restricted bandwidth availability, it must be managed for live video communications. Networks need managers to ensure that videoconferencing sessions are not degraded due to bandwidth exhaustion, often caused by downloading and sharing large music or video files. Networks also require human and technical resources in order to maintain videoconferencing quality. K-Net ensures quality by allocating bandwidth on a first-come-first-served basis. K-Net's web-based videoconference booking software checks for scheduled events every 15 minutes. When a videoconference begins, the software opens a path and configures all other routers to channel the bandwidth required for that particular meeting.

1.3 Equipment Quality, Cost, and Availability: Equipment availability determines the evolution of use - many northern Ontario communities have only three videoconferencing units (one in the school, one in the health centre, and one in the band office), and, in the Atlantic region, many communities have only one unit (in the school). Furthermore, partners and suppliers do not often have

videoconferencing units at all and so cannot yet communicate with remote communities via this technology. One interview respondent nicely summed up the importance of equipment availability: "It's like a fax machine, how far are you going to walk to send a fax? . . . [and also] the first fax didn't make a lot of sense, who are you sending it to? . . . Videoconferencing has to be commonplace. It has to be on people's desks. It's got to be in people's offices. It's got to be easy to use, easy to access, and people have to have that good quality, two-way symmetrical [bandwidth] with quality of service." Ensuring quality of service requires appropriate videoconferencing systems, and the cost of good products also limits availability.

1.4 Technical Limitations for Sharing Online Videos: Making and viewing videos requires proper equipment and access to adequate bandwidth. Network constraints sometimes rule out watching large video files online. Simple videos can be uploaded and shared as long as the network is adequate. However to share videos with higher production a good computer with FireWire, a DVD burner, and editing software is necessary. Computer restrictions on codec downloads (for instance, firewall protection that prohibits codec downloads to government computers) often limit the distribution of K-Net's archived webcast videoconferences, particularly to government partners or to civil servants. Additionally, the aging Starbak server, which K-Net uses for sharing archived videos, requires careful management of its small remaining storage space. The server lacks a search function, so users find archived video with some difficulty. What's more, Starbak's video codec cannot be used with MS Vista or Mac operating systems. K-Net recently acquired a new video storage (content) server that allows easier access to archived video materal; however most proprietary solutions still require the use of their own codecs to view the material.

***2. Community Members Interacting with Technology***

2.1 Levels of Awareness and Comfort: Interview participants identified lack of awareness as the biggest challenge in this category - neither community members nor community-based organizations sufficiently realize that the technology is available and that it could be useful. Both K-Net and the Atlantic Help Desk find that, even after years of promotion, video communications remain intimidating and many staff members resist changing their delivery processes in favor of traditional ways. Advocates of the technology believe that videoconferencing could nicely complement existing work processes. One of our interview respondents argued that "People hold this mindset that, oh no, we can't deliver a session or we can't have a meeting by video because . . . it doesn't fit into our methods. But when you say to them, 'well, okay, what do you do?' . . . [and ask] what they require, then they start to learn that there's tools. . . . You can hook a PowerPoint presentation up to the video. You can run a VCR and record stuff. You can show a tape. I think people don't see [the opportunities]."

2.2 Limited Community Training and Few Champions: Remote and rural communities need personnel who know how to use videoconferencing equipment and they also need champions willing to organize videoconference sessions and to support and guide users through the sessions. Particularly in the case of special events, someone needs to handle room and technology bookings as well as invitations to remote participants. Identifying and recruiting such champions is another challenge. Money is always an issue. As one interview participant mused, "I don't think people want to work for free." On the other hand, some community members might raise awareness and act as champions by

chance. Both teachers and young people are often adept at using technology - 64% of teachers in Indigenous schools polled in the Atlantic region said they could easily make a video and share it online, and several of our interview respondents said that young people in the remote and rural communities often upload videos they've made using small cameras and cell phones. School environments might thus increasingly foster keen interest in, and peer-support for, learning video technologies.

2.3 Capacity for Technical Support: Technical support was identified in our interviews, meetings, and surveys as severely lacking in remote communities. Not only can tech support staff provide the kind of assistance that remedies lack of awareness and boosts comfort levels, but such staff members also maintain smooth functioning, ensuring that the technology is reliable. As one interview respondent explained, "If the video system gets disassembled somewhere, and there's nobody that knows how it's all put back together, well, then there's no video happening anymore with that community until somebody goes there or somebody local is found that can do it." Even when remote and rural communities can fund tech support, keeping trained staff is difficult when tech experts can find more lucrative work in urban centers.

2.4 Access to Equipment: Videoconferencing technology needs to be readily available to community members in order to maximize its effectiveness. Often community members do not know where they can find the equipment; once they do find it, they may not be able to book it because of high demands—units in band offices, for instance, are heavily booked and often located in solidly reserved rooms, whereas the equipment in schools and health centers is not usually set up for general use. Related to these difficulties, units in staffed institutions tend not to be available after 4pm or on weekends.

Our interview respondents voiced a desire to bridge this gap between band offices, schools, health centers, and general community members. In particular, educational events hosted by institutions could be advertised in order to share resources broadly within the community. One respondent described the situation: "We're in the process of trying to get the telehealth folks to get some of their events . . . off their network video units and out into more of a public domain, whether it be the band office board room, or the public health room of the clinic, or the library of the school, or wherever, away from the behind-closed-doors of the clinical equipment and mystique of the nursing station. . . . We'd like to see . . . video being an everyday thing. So that when you walk by you will see a videoconference [is] going on and you'll think: 'Hey, that's cool, how can I do that?'"

The research partners are already working to make technology more available in Indigenous communities, but schools might also be able to address this challenge. Many schools have procured good-quality video production equipment through various funding programs. One respondent estimated that "the majority of schools have the capacity to produce videos—that would be 180 Indigenous schools in Ontario." If students are encouraged to use the equipment, they will become skillful themselves and might help community members to use and learn the technology, especially if both students and community members can book equipment for use after school hours.

***3. Production and Reception of Audio-Visual Content***

3.1 Time, Interest, and Motivation: Many skilled people find little time to make videos, and community members who might be interested in organizing or participating in videoconferences are those most likely to be busy with other projects. Again, community champions willing to facilitate the development of videoconferencing - by challenging perceptions that people prefer to travel to meetings, by identifying likely and interested participants, by inviting participants, by booking rooms, and so on - are fundamental to furthering the effective uses of the technology.

The research partners promote and support community development of videos and videoconferences. It is up to the communities to identify pertinent subject matter, organize ideas into video form, and determine how videos should be used and distributed. Our interview participants indicated that it can be difficult to find motivated producers because, culturally, Indigenous people tend not to promote themselves or show off their talents. Questionnaire responses suggested that people may not feel comfortable deciding what issues will interest community members, and, further, respondents reported that they do not know how to find interested members of other communities in order to collaborate on video projects or hold videoconferences.

More and more young people, however, use social networks to make and share videos and they feel more comfortable meeting with one another online. Young people are also more likely to feel comfortable on camera, so they less often balk at appearing onscreen in videoconferencing, or at appearing in their own or their friends' videos.

3.2 Gender and Language Barriers: Our analysis of the survey from the Atlantic communities indicates that men engage more often with technology and with more varieties of technology than do women. Men are also more likely to report an intention to make a video and put it online. First-language English speakers also report more frequent engagement with various technologies than do those who speak an Aboriginal language as a first language. These results are in marked contrast to those of our previous study of archived video material online, in which we found that women used videoconferencing more than men in the remote Indigenous communities in northern Ontario [1]. It is possible that, compared with Atlantic communities, northern Ontario communities have more videoconference units in health centers, where generally the workers are women rather than men. Another possibility is that women in Atlantic Canada drive rather than using video for attending events because they have road access (whereas women in northern Ontario do not always have road access and so become comfortable sharing resources via video technology).

3.3 Visibility of Existing Content: Those teachers who filled out our questionnaire often reported that they do not know where to view online videos made by their students or by fellow community members. K-Net archives videos and videoconferences, including public videoconferences hosted by the Atlantic Help Desk, but the archives are not easy to find or to sift through. The study participants suggested that video content might be annotated, but organizing annotations would take considerable time and skilled human resources.

3.4 Cultural Exploitation Issues: In general, there is anxiety around sharing video content with those outside the community. Broad dissemination can expose the community to potential exploitation of its intellectual property. A history of such exploitation, in which outsiders have profited from Indigenous knowledge without sharing those profits with the Indigenous community, means that

community members feel cautious about video production and online distribution. One interview participant said that her community requires that video-makers acquire permission from community leaders to ensure that potential videos will benefit the community. Innovative technological strategies might also protect ownership and information.

### *4. Social and Organizational Relations*

4.1 Funding Programs and Social Development Targets: While Canadian governments provide various (but limited) funding programs for remote and rural communities to develop networks and to buy equipment, it is often difficult for organizations to find money to maintain equipment or to train people to use it. Most funding sources do not have a community or social development focus or provide for sustainable development in communities. The research partners have experienced considerable difficulty securing ongoing public funding to support video communications in the communities they serve.

In northern Ontario, K-Net meets this challenge by supporting services like telehealth, which can sometimes pay for networks that the entire community can use. K-Net has also started to invoice outsiders for use of their videoconferencing bridge and network, in order to support community ICT activities. One of our interview respondents commented on this development: "We've begun to build in the community-support component for these services. Another thing that we've also been adding is compensation for local technicians to help out."

4.2 Urban Participation: Our interview respondents identified that urban professionals and urban institutions generally lack awareness of the communication needs of rural and remote communities. People working in urban organizations have ready access to communication links and many do not understand the importance of videoconferencing as a tool for connecting rural and remote communities. In some cases, government and other outside partner organizations in urban areas do not have adequate support for videoconferencing in their own organizations and need K-Net and the Atlantic Help Desk to support their use of video. At the public videoconference held for this study, several government participants said that many bureaucrats in Ottawa and other urban centers are not aware of videoconferencing and the government lacks champions to promote videoconferencing to reach out to Indigenous communities.

4.3 Marketing Local Services and Information: Videoconferencing is an effective two-way or multi-site communication tool that provides local entrepreneurs, businesses, and organizations with the means to deliver quality programs and services from the remote and rural communities in a cost-effective manner. Telework is possible where the infrastructure and the corporate culture exist to support this non-traditional means of employment. With these communication tools, the possibilities for economic and social development and sharing of expertise are potentially endless. However mitigating these possibilities are traditional programs and management styles within institutions, businesses, government, and corporate environments.

## Conclusions

Our findings highlight at least two common themes among the various challenges. First, remote and rural Indigenous communities need capacity-building initiatives to develop video technology systems that can accommodate diverse needs. Second, urban organizations and institutions, particularly government agencies, need to validate video communications in these communities by supporting more widespread diffusion of broadband networks and engaging themselves via video technology with remote and rural Indigenous communities.

In spite of challenges, Indigenous communities already use video communications widely and effectively, rising to the challenges discussed in this paper. K-Net, Atlantic Canada's First Nation Help Desk, the First Nation Education Council (FNEC) and the other community-based organizations across Canada are international leaders, demonstrating the ways in which marginalized populations can use advanced communications technology to develop and sustain their communities. Perhaps the largest question this paper raises is the extent to which K-Net, the Atlantic Help Desk, FNEC, their funders and government partners, and researchers will be able to work together to continue developing strategies to improve videoconferencing access and quality in rural and remote Indigenous communities.

This study pointed to many broad and some specific opportunities for research and technology development for appropriate services and applications for remote and rural Indigenous communities in Canada. Based on our experiences working in this area, we can conclude that any research or R&D projects need to be conducted in full collaborative partnerships with Indigenous organizations and communities. They have the interest and know-how and can contribute valuable insights into the needs of the communities and how technologies and applications can be shaped to meet those needs. The theoretical approaches we mentioned earlier – the Community Informatics approach and the Social Informatics approach - both see the technical and the social as inseparable. Researchers, engineers and technology developers will need to consider both the technical and social aspects of video communications using broadband networks in this context. The challenges are considerable but the potential is unlimited for more effective and widespread use of video communications for rural and remote Indigenous communities.

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