**InSite: Using Video-Conferencing Applications over CA*net3 to Enhance the Collaborative Process for National Research Teams**

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**Abstract:** The InSite project aims to demonstrate how broadband video-conferencing technology can assist collaborative research goals. We propose a rigorous and thorough evaluation strategy based on a knowledge-management theoretical framework to deepen our understanding of broadband applications in a research setting. The sheer size and scope of the project will require the collective skills of a great number of technicians, researchers, and graduate students from various disciplines and institutions across Canada. In this sense the project is in itself a model for collaborative research using high-speed networking technologies. In addition to testing new broadband applications, the project will determine improvements to maximize their potential and make recommendations toward solving the “final mile” connectivity problem.

**Introduction**

The InSite project was initiated in July 2001 as a one-year project, funded jointly by the CANARIE-ANAST program and by a number of Canadian universities. ¹

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As the title above indicates, the project aims to enhance the way collaborative research teams work by using video conferencing over the CA*net3 high-speed network.

Over the past few years, major funding organizations in Canada have been encouraging R & D projects that are collaborative in nature and national or international in scope. At present, colleagues engaged in collaborative research manage their communications through e-mail, telephone, and face-to-face meetings. Often, travel budgets are small and there is little incentive to seek out alternative modes of communication to what is readily available. Recent tragic events in the United States further complicate the issue, creating an imperative for alternative solutions. Terrorism could severely impede collaborative ventures, and research in general, if organizations and individuals avoid travelling to meet and share ideas. In our view, the existing state of collaboration could be improved by:

(1) providing research teams with connectivity to Canada’s broadband research network (CA*net3); and
(2) enabling access to video-conferencing technologies suited to a research team’s particular needs. Access to CA*net3 is important because it provides access to higher bandwidth, allowing better video-conferencing quality. Broadband-network access also removes the need to use telephone lines for video-conferencing transmission, cutting down on long-distance charges.

The first objective, that of connecting researchers to the CA*net3, is far from simple. Ironically, despite the fact that the CA*net3 connects virtually every university in Canada, very few individual researchers have easy access to it. The so-called final mile problem means that the fibre optic cable stops at a centralized location at a university but does not penetrate to all points within the university’s local area network. This requires upgrading the university’s network to afford researchers high-speed access at their office or place of research. Related to this problem is the fact that many researchers, especially in the social sciences and humanities, do not know about the existence of the CA*net3 network; nor do they know how they could use this network to their advantage in their particular research settings.

The second objective entails providing research teams, whose partners are dispersed across the country, with broadband video-conferencing tools and applications that will hopefully enhance communication, collaboration, and overall management of knowledge. We feel that these tools may be able to support the co-ordination of, and communication among, collaborative research initiatives by acting as “bridge technologies.” A bridge technology, in this sense, provides a more robust, multidimensional form of communication than telephone or e-mail but not quite as effective as face-to-face interaction. The advantage of a bridge technology is that, once installed, it is far less expensive than a face-to-face meeting when distance is a factor—and potentially just as effective.

The main task is to determine whether video conferencing can improve the collaborative research process. This will involve:

- establishing benchmark communications and knowledge-flow practices before the technology is implemented;
installing and running video-conferencing applications in various research contexts (and upgrading networks where necessary); training researchers and technicians involved in the project to use the technology, evaluate their experiences, and share their knowledge gained; integrating research and analysis of “human factor” parameters with technical analysis and testing; and creating templates for knowledge-management approaches as a framing methodology.

Project design

InSite is composed of a central team, four partner projects, and a number of institutional participants.

Central team

The central team co-ordinates the collection and analysis of research data across the project as a whole. The central team also manages the project from an organizational and administrative perspective. It will be responsible for co-ordinating the project-review and evaluation process. It will ensure that the milestones are met and will compile the final project report. The central team will also organize a series of meetings at appropriate times to provide opportunities for project review. The team is comprised of a project manager, three principal investigators, two research associates, a project accountant, and a technical-support person.

Partner projects

Four collaborative research projects, or “partner projects,” will act as test cases and work with the central team to investigate video conferencing in various research settings. All but one of the projects has an ongoing collaborative history prior to this project. Each of the partner projects has a lead researcher, a research assistant, and a technician/researcher dedicated to InSite. The partner projects include:

- Policy Forums for Risk Management Project, Royal Society of Canada, Ottawa
- Innovation Systems Research Network, Simon Fraser University
- Using Access Grid to Foster National and International R & D Partnerships, Ryerson Polytechnic University and Sheridan College
- Sustainable Forestry Management Network (Centre of Excellence), University of Alberta

Each of the partner projects has a number of “nodes” across the country where researchers are located. Although the researchers at the nodes are not directly involved with InSite, they will be involved in video-conferencing sessions through which they will be encouraged to carry out their research or research-management functions.
Institutional participants
The project is supported on a national basis through its partnership with CANARIE. It is also supported by the participation of 14 Canadian universities and colleges. If necessary, the provincial ORANs (Optical Regional Advanced Networks such as Alberta’s Netera, BCNet, etc.) will also assist in network management and troubleshooting.

In addition to the analysis of the video-conferencing tools, the project functions as a sort of collaboratorium — that is, a research environment in which collaboration itself is the object of inquiry. The goal is to develop a highly supportive and innovative communication and knowledge-management structure for collaborative research projects that can be applicable across disciplines.

In addition to its central objectives InSite will also provide:

- a central Web site to co-ordinate information, publications, training, and activities for the team members and the general public;
- several opportunities for public demonstrations and information sessions; and
- collaboration between network and applications technicians and end users of the technology — in this case, researchers — to produce a comprehensive, end-to-end service via CA*net3.

Finally, the project will facilitate its knowledge-management activities through a collaborative communication-software package. This comprises Web-based collaborative tools such as a white-board shared application, synchronous and asynchronous discussion space as well as a user log and data-recording functions. The knowledge-management aspect of the project will be discussed in a later section.

Research and evaluation
Each partner project will use some form of video-conferencing technology in its research communication process. Choices for video conferencing depend on the needs of the researchers and fall into three categories:

1. Desktop-to-desktop: Desktop-to-desktop video conferencing is best suited to person-to-person communications. The video-conferencing tools are easily installed on the researcher’s own computer, providing immediate access to research colleagues who are connected across the country. The video-conferencing suite includes a small camera, microphone, a CPU, and software. Transmission is over the Internet using H.323 standard. The user simply inputs their colleague’s IP address to make the connection. The package is relatively inexpensive. Sound and video quality is the lowest out of the three video-conferencing options.

2. Small-group-to-small-group: The second category of video conferencing is more expensive than the first but provides better quality and more flexible components. A video-conferencing package in this category might incorporate a remote control or voice-activated camera, better-quality microphones,
and a greater field of vision, allowing more people to be seen by the camera. Although the technology can be used for person-to-person communications, it is also suited for a small-group setting such as a meeting. We will be using mid-end Polycom units for this kind of video conferencing. The Polycom units transfer data over the Internet using H.323 IP standard as well as ISDN (telephone lines). For the purposes of this project, we will use H.323.  

3. **Large-group-to-large-group**: This video-conferencing suite requires the greatest investment but allows the most flexibility. The Access Grid video-conferencing suite developed out of IP multicast technology and has been refined by Argonne Labs out of Chicago. If enough bandwidth is available, this suite will allow up to 60 active sites to appear on a large screen at one time. This application is suited for large meetings, conferences, symposia, etc. where large groups in many different locations need to be involved. The partner projects will use the applications in their day-to-day research, for research management, for training, and for other assorted research functions. Each video-conferencing “event” will be recorded and evaluated in terms of the quality of the video-conferencing event from a technical perspective and the effectiveness of the communication from a “user” or “human factor” perspective. Each of the partner project’s lead researchers will also be required to provide interim reports (referencing milestones) as well as a final report. Each partner project will be asked to evaluate whether and to what extent the software and support provided actually enhanced their collaborative research processes. The central research team will integrate the partner project reports into the final report and provide an overall evaluation.

To complement our evaluation of “human factor” operational details of the applications, *InSite* is also undertaking some parallel technical research. *InSite’s* preliminary indications for potential uses of the software are:

- multicast scheduling/calendaring system (using multicast to “synch” a massive calendar database)
- encapsulated digital video over Internet protocol (DVIP) used for “high-end” video conferences
- digital video broadcasting over IP for video conferencing (Mpeg2 video stream) and datasharing (Mpeg2 data stream)
- colour video or other markers to indicate active speaker (e.g., all other non-active sites send greyscale video only)
- compatibility between H.323 and access grid platforms

**Knowledge management**

The project has adopted a knowledge-management approach to frame its overall aims and analysis (see Wolfe, 2000). This is appropriate given that research is first and foremost about knowledge production; using a knowledge-management framework provides key guiding parameters for operations and assessment. Implementing tools such as video conferencing, intranets, and other forms of
internal communication changes the knowledge-management process. Adopting this approach involves a number of assumptions, including:

- Everyone involved in the project is also involved in the knowledge output of the project;
- Creating cultural/social space for the technology happens when project participants reflect on their experiences and share and capture those reflections; and
- Knowledge-management enablers— which can be people or technology—are central conduits for knowledge capture and facilitation. They are also critical feedback mechanisms for the knowledge-management process itself.

Historically, knowledge-management theory has taken a functionalist approach that focused on business models. In the context of InSite, knowledge management is understood more simply as a broadening and deepening of knowledge resources through the collaborative group dynamic. Some of the partner projects can be characterized as “organizations” in terms of their management and size. Others are informal small groups that are less easily characterized. The motivation for adopting this perspective lies in the promise it holds for:

- greater efficiencies
- a more engaged and creative workforce
- an expanded range of knowledge resources
- a culture of knowledge sharing
- enhanced learning through knowledge acquisition/re-use (the “knowledge spiral”)
- a more competitive or innovative research, production, or services environment
- legacy systems to capture and encode knowledge for future application (see Wolfe, 2000).

Finally, a knowledge-management approach provides a rigorous framework for project evaluation and technology assessment, distinguishing InSite as more than simply a technology “trial.”

**Evaluation plan**

In the first milestone phase, the evaluation team (part of the central team) will gather preliminary data to establish how each partner project collaborates. This “Communications and Knowledge Audit” will be linked to a Perception Assessment that will also be unique to each of the partner projects. These documents will provide a baseline for comparison. Also in the first milestone phase, the evaluation team will compile a research-evaluation and overall knowledge-management strategy.

Ongoing data collection will comprise technical and user logs after each video-conference “event,” moderated chats, and asynchronous discussion groups using the collaboration software, and specific instruments for uses unique to each
project that will flow from each perception assessment. Researchers will also be sensitive to not overburdening project participants with too many evaluative requirements. The intention is to provide formal and informal ways for participants to share lessons learned, experiences, and queries while capturing this data for purposes of analysis.

The partner projects

Policy Forums for Risk Management Project

Risk issue management (RIM) deals with health and environmental risks that generate controversy in society. At the heart of RIM is the interplay between scientific risk assessment and the responsible management of risk factors. To date, the Canadian government has provided support to the Royal Society of Canada to hold expert symposia on such diverse risk issues as genetically modified foods, particulate matter, asbestos, and the disposition of a colony of primates.

The lead researchers have chosen mid-range video conferencing (e.g., Polycom) that will allow experts working in various areas to communicate with immediacy in collaborative decision-making. These exchanges, if made available to risk issue managers and the general public, will represent an effective improvement to the management of risk controversies in society. In this way, CA*net3 could become an extremely valuable resource for this policy process and others like it in the future. In the long term, an efficient and cost-effective decision-making and communication process for high-risk issues will benefit all Canadians.

Innovation Systems Research Network

This research project examines the innovation process through a number of case studies of industrial clusters across the country. Technical innovation in modern societies results from co-operation between industries, governments, and research institutions. The Innovation Systems Research Network (ISRN) was recently granted $2.5 million from the SSHRC Major Collaborative Research Initiative Program. This research project will compile data from industrial clusters and construct a relational database on selected examples of the innovation process. The second stage of the project will create simulation and forecasts of innovation pathways and provide tools for strategic analysis to firms and governments. As a condition of the SSHRC grant, the network was encouraged to use communications technology to link each of the research nodes, and this project will help to fulfill this requirement.

Broadband video conferencing is necessary for this project at two levels. Phase 1 will see the development of the research project and demonstration of techniques (via video conferencing) to the main Western Canadian sites of ISRN: the University of British Columbia, Simon Fraser University, and University of Calgary. It will require bimonthly video-conferencing sessions among researchers for management, program co-ordination, and data transfer. Phase 2 will connect ISRN researchers located in Toronto, Ottawa, and Quebec to those located in Western Canada to compare research findings.
Using Access Grid to Foster National and International R & D Partnerships

This research-and-development consortium arose from a Department of Foreign Affairs and International Trade (DFAIT) R & D Partnership mission to Singapore in the spring of 2000. Some of the members of this group suggested that broadband technology could provide a less expensive alternative to travelling vast distances in order to develop R & D and trade-related partnerships. Beyond Singapore, other potential sites for this partner project include the University of Amsterdam and the University of Stuttgart.

This project proposes to set up a series of Access Grid nodes at three Canadian research sites (Ryerson, Calgary, and Sheridan). Access Grid, or AG technology, is a suite of IP-based broadband applications that allows group-to-group collaboration at a distance (see URL: http://www-fp.mcs.anl.gov/fl/accessgrid/). The Access Grid was created to facilitate communication between supercomputing groups in the United States. Numerous universities there are already connected to the Access Grid, and a number of international institutions have adopted the technology as well. Joining the AG opens up a vast network of expertise to researchers at the respective institutions.

This project will evaluate human factors and test the technical capabilities of the AG platform, first through communication with other North American sites and subsequently with international nodes. The team will investigate human factors such as production elements, camera positioning, and design of the Access Grid space to improve the overall experience of large-group video conferencing. The team will also undertake some technical design work with regard to creating a shared whiteboard space, indicating the active screen, and ensuring compatibility with H.323 video-conferencing systems. If these systems can be integrated, this will provide a cost-effective alternative to installing a full Access Grid.

Sustainable Forestry Management Network, National Centre for Excellence

The Sustainable Forest Management (SFM) Network is a national multisector network (NCE) with close to 50 partners and 90 researchers. The network currently uses an audio-graphic delivery program for communication events such as seminars.

A reliable video-conferencing application might provide a valuable tool for this research network given the widely dispersed management team and the collaboration required to run the SFM Network. To this end, the team will test group-to-group video conferencing to facilitate its manager meetings between the host site at the University of Alberta and the University of Montreal, the University of Quebec at Montreal, the University of British Columbia, and Dalhousie University. If these demonstration experiments are successful, the four sites involved in the Management Team meetings will also participate in a pilot demonstration (at the end of the project) to link the multisector national Partner Committee and Board of Directors via video conferencing for their bimonthly meetings.
Dissemination of results and future challenges
The hopeful outcome of this project is to demonstrate the tremendous potential that video conferencing, and broadband applications in general, hold for the research community.7

The National Centres for Excellence and granting councils encourage collaborative research by providing strategic grants that link academic researchers to the public and private sectors—yet there has been no movement to enhance these strategic and collaborative relationships through high-speed networking. One way we hope to ensure the legacy of InSite is to secure the support of the major research granting institutions for high-speed networking. Our preliminary discussions with SSHRC, which took place in January of this year, were extremely positive. We organized exploratory meetings between SSHRC and CANARIE to ensure that SSHRC was aware of CANARIE’s mandate. Although we obtained funding from the SSHRC Research Development Initiative for research evaluation and dissemination, our original budget was cut back, severely affecting our dissemination plans. We hope that in the long term, collaborative researchers will not find it so difficult to obtain funding to use video conferencing to enhance their research process.

Another legacy from this project will be a critical mass of researchers and technicians across the country who will have had varying levels of exposure to this technology. Primary investigators and technicians in the project will have an intimate working knowledge of the tools and their potential. Others will have “access” in the sense of having been participants in forums, meetings, workshops, or lectures utilizing the technology. Yet others will have experienced the technology in a relatively passive way, through “broadcast”-oriented sessions (e.g., Webcast or video-streamed), but they will have gained, at the very least, an awareness of its potential.

Conclusion
The InSite project aims to demonstrate how broadband video-conferencing technology can assist collaborative research goals. We propose a rigorous and thorough evaluation strategy based on a knowledge-management theoretical framework to deepen our understanding of broadband applications in a research setting. The sheer size and scope of the project will require the collective skills of a great number of technicians, researchers, and graduate students from various disciplines and institutions across Canada. In this sense the project is in itself a model for collaborative research using high-speed networking technologies. In addition to testing new broadband applications, the project will also determine improvements to maximize their potential and make recommendations toward solving the “final mile” connectivity problem.

In the long term, we hope that the project will benefit research in Canada in general by providing an integrated communications resource, accessible to any number of geographically dispersed collaborative research teams in Canada. At the same time, the value of video-conferencing applications suddenly no longer
needs elaborate justifications given the security issues posed by travelling in this uncertain international climate.

Notes
1. CANARIE stands for the Canadian Advanced Network for Research, Industry and Education. ANAST stands for the Advanced Network Applications Services and Technology Program. The InSite project is supported by a contract with CANARIE that covers 50% of the research costs. The other 50% is provided by the institutions and researchers that are involved in the project.
2. These are: Simon Fraser University, Athabasca University, Ryerson Polytechnic University, Sheridan College, l’Université de Montréal, and the Universities of British Columbia, Alberta, Calgary, Saskatchewan, Guelph, Toronto, Ottawa, Laval, and Dalhousie.
3. Lead Researchers: William Leiss (President, Royal Society of Canada) and Michael Mehta (University of Saskatchewan); Lead Technical Support: Gary Berg, University of Saskatchewan.
4. Lead Researchers: Adam Holbrook (Simon Fraser University), Cooper Langford (University of Calgary); Lead Technical Support: David Jager (Calgary), Rob Scholander (SFU).
5. Lead Researcher: Andrew Pauskauskas (Sheridan College); Lead Technical Support: Ron Rankine (Ryerson Polytechnic University).
6. Lead Researcher: Dianne Korber (University of Alberta); Lead Technical Support: Kevin Watts (University of Alberta).
7. Some of the major organizations supporting Canadian research are NSERC, SSHRC, and CIHR. The newly formed CIHR has in fact mandated interdisciplinary collaboration in its new granting scheme.

Reference