Keewaytinook Okimakanak Broadband Network

SUMMARY OF APPLICATIONS, USERS, TRAFFIC AND PRELIMINARY NETWORK DESIGN

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General Overview

In the previously completed section of this report, the consultants compiled community profiles, completed community consultations and reviewed the telecommunications infrastructure for the communities of the Keewaytinook Okimakanak Tribal Council. All this information will be carried forward as a baseline for decisions as we move to design and implementation. In the following two sections we will examine the applications that are possible on the network, which of these can be implemented, possible partners and what capacity the traffic will require. All these components will determine the technical design of the network.

The development of a broadband network to connect the communities of Keewaytinook Okimakanak is only feasible if there is traffic to utilize the connections between the communities. These applications will be driven by the internal and external organizations that will deliver service to the communities. To accomplish this, the network has to be shared among the users to make access affordable. In this component of the study the utilization profile will be developed to use as a base for the technical design of the network. The applications will determine the traffic of the network, which will in turn, drive the design considerations of the network.

The first section will review the applications that are being used and developed for use over broadband networks. These applications fall into defined sectors. The following list of services and applications are guidelines for community development:

Health Based Applications
Educational Services
Videoconferencing Services
Policing and Justice
Government Services
Internet Access
Economic Development Initiatives

After examination of the trends and initiatives in these sectors, we will look at possible partnerships that can be fostered to develop users on the broadband network. In the final section, we will determine the traffic in each community, which will govern the technical design of the network

Health Based Applications

The cost of delivering health care services in Canada is climbing in all areas and geographic locations. The cost in communities where there are no physicians and where procedural patients have to be flown out is more than considerable. The direct costs for the patient care are a small portion of the costs to the system. In addition to the cost, the level of service is the other critical factor in health care delivery.

The costs of adopting alternative health care solutions can also be substantial. For example, the Sioux Lookout Zone Hospital recently completed a telehealth pilot project connecting the communities of Big Trout Lake and Webequie to the Zone Hospital. While it was successful in terms of medical consults, the cost of the dedicated satellite link made it unaffordable. One of the other issues the provincial government has to solve is how to reimburse physicians for their consults.

The ability of technology to transform the delivery of health care is well recognized by providers and policy makers. The difficulty is that the changes that need to be made to the system to utilize these technologies are costly and time consuming. These require significant investments not only in equipment, but also in human resources. These systems are also dependent on acceptance by the organizations and staff in order to make them successful.

Educational Services

Distance education is considered one of the applications that is driving the installation of broadband capabilities throughout North America. Trends in education such as life-long learning, multiple career paths, learn where you earn, and the increasing technical complexity of work, have made traditional education providers more flexible and creative. Private training networks for large organizations such as international corporations and the military have been established for some time. With the advent of the Internet and Videoconferencing, distance education has risen exponentially.

Within this context of rapid technological change and shifting market conditions, an education system is challenged with providing increased educational opportunities without increased budgets. Many educational institutions are answering this challenge by developing multi-media distance education programs. These programs can be delivered by CD-ROM or over a network to provide an enriched learning experience where and when the student requires it.

Videoconferencing Services

Videoconferencing is simply audio and video telephony. Videoconferencing systems show moving pictures of people and objects and allow you to hear them and see them in real-time. The traditional view of videoconferencing included audio and video only, but in recent years it has become common to include data collaboration or file sharing under the videoconferencing umbrella. The videoconferencing equipment industry has gone through several transition stages over the past five years. The original equipment was dedicated room systems (also known as group systems), often costing $75,000-$100,000.

Group videoconferencing systems are designed to handle groups of people at each end. Group systems typically are installed in conference rooms or studio settings and use higher quality audio and video components, including motorized pan-tilt-zoom cameras that can be controlled from the remote location. In many group systems, the camera includes audio or video circuitry to automatically find or track the speaker during a conference. Group systems often use NTSC, PAL, or SECAM video outputs to drive large TV monitors, and often, but not always, use digital connections at 384 kbps (or 336 kbps) and higher.

In the early 1990s, several vendors or room systems introduced "roll about" systems – smaller group videoconferencing systems selling at first under $50,000 and later at under $30,000 prices. These systems had an air of "portability" about them. The group systems market witnessed an important evolution in the later 1990s when at first PictureTel, then Polycom, and eventually Sony, Tandberg and a slew of other competitors introduced videoconferencing appliances configured as set-top boxes.

These products caused an explosion in group conferencing systems for two major reasons. With prices under $20,000 (and now $10,000) these compact systems provided users with 80-90% of the functionality of higher end group systems for as little as 25% of the cost. Large companies can afford to deploy them in departmental settings, and small companies can afford equipment that was far too expensive to cost justify in the past. The new systems are far easier to set up and operate than earlier generation group systems. The user interface if often a small, hand-held remote. Diagnostic systems are vastly improved. Users find that this generation of videoconferencing product can be deployed in large numbers across a corporation without burdening the central support staff.

In the mid-1990s, several vendors introduced videoconferencing kits that, when added to a personal computer, turned the PC into a full-fledged videoconferencing workstation. Thus began the desktop videoconferencing industry.

Prices for kits began at $10,000 but are now well under $3,000 and in several cases, under $2,000. Desktop videoconferencing systems are personal systems used for personal conferencing, in contrast to group systems typically deployed in meeting rooms. Data collaboration is often a primary concern. Personal conferencing systems use a computer monitor (sometimes an NTSC monitor is used in addition to or instead of) for the display and typically operate at 128 kbps data rates, although some desktop systems do support 384 kbps over a wide area connection. Since most corporate desktops also are attached to a LAN of some kind, the desktop videoconferencing industry also introduced the concept of LAN-based conferencing. Since LANs are based on packet-switching technology (as opposed to the circuit switching technology used in the telephone system), the videoconferencing industry soon coalesced around the most common packet-switched protocol know as Internet protocol or simply IP.

The once-distinct line between group systems and desktop systems now is blurry. Many desktop systems are deployed as small group systems, and some small group systems are being used as personal systems in executive offices.

It is no longer possible to differentiate group systems from personal systems based on the electronics engine driving the machine. Even higher-end group systems today are likely to have an Intel Pentium processor at the core. While LAN connections, and the ability to conference over an Ethernet network were once the province of only desktop systems, these capabilities are being added to today's group systems as well.

Policing and Justice

The delivery of police services is a significant challenge in any jurisdiction: it is that much more difficult in a geographic area of 250,00 square miles with little or limited road access. This challenge makes it critical that Nishnawbe-Aski Policing has the tools and support they need to mitigate these challenges. Technological advances have given police forces additional tools to more efficiently deliver their services. One of these tools has been videoconferencing which, when deployed properly, can save valuable resources in travel costs, manpower, and time.

The Nishnawbe-Aski Treaty Area is the largest in Ontario, encompassing approximately 250,000 square miles. As of June 1, 1998, the Nishnawbe-Aski Police Service has thirty detachments and two divisional headquarters. NAPS now polices approximately thirty five First Nation communities with 25,000 residents. At the present time, NAPS has 100 uniformed officers and 20 civilian staff positions. This makes NAPS the largest First Nation Police Service in Canada. Over time, NAPS will have their own criminal and identification units as well as other specialized services.

An application that can improve public safety in the Keewaytinook Okimakanak communities and save time and allow a geographically dispersed organization to communicate effectively is the use of both desktop and group videoconferencing for meetings, presentations, headquarters to region coordination, regional coordination or ministerial briefing. The benefits to these applications can include:

Access and participation of key individuals not available by other means
Better consensus and team cohesion
Reduced down time
Travel eliminated or reduced
Professional development

One of the most time consuming and highest travel expenses for Nishnawbe-Aski Policing is the cost of prisoner escorts and court appearances. Bail hearings and remands not only cost the organization in direct expenses such as travel and wages but also affect the operational efficiency in terms of lost presence, and the inability to perform duties in the community.

The First Nations communities in Nishnawbe-Aski Policing have court on a rotating basis in the communities. This can be scheduled monthly or bi-monthly based on demand in the community. When a person is charged with an offense in the community, depending upon the type offence, that person can be released on a promise to appear, or would be transferred to the nearest court for a bail hearing.

At a bail hearing a judge may release the accused on conditions or remand the accused into custody. If the accused is kept in custody then he or she will be retained in one of the provincial detention centres. These jails are often hundreds of miles from the community. The travel expenditures of the force are extremely prohibitive.

The accused then will have to be escorted for trial to the community in which the incident occurred. In many cases the matter will be remanded at the initial appearance and sometimes adjourned many more times. Each time this individual is escorted from the secure facility to the community for court, often for a five minute remand appearance.

In conversation with officials of the force, this is one of the most costly and time-consuming responsibilities of the police service when resources are so limited. Other court officials commented on the injustice when bail hearings are conducted outside of the community. The accused has a bail hearing without the benefit of evidence and or witnesses from his or her community. It is difficult to have community members speak on the accused behalf, which is an important part of the Native Justice System.

Government Services

Computerization has created the ability to maintain large databases of information by government ministries and businesses in a central location. In the past, these were controlled by the ministries and accessed only by private networks.

Recent changes in the delivery of government services to a decentralized model has necessitated remote access to these databases. Client server technology and Internet based protocols have enabled this access to be developed. This remote connection has to be secure and cost effective.

The communities can easily develop and/or deploy application programs and services over the Ethernet wide area network structure and have quality access from each community. This will allow each community to share information with other communities no matter where the information is located on the network and share administrative programming and data collection. Reporting requirements for government can be simplified and connection to centralized databases can be accomplished through one gateway.

The communities of Keewaytinook Okimakanak can develop their own databases in various sectors for planning and development purposes. As has been the case through Knet, many programs can be incorporated into the network to improve the quality of life in the communities, with solutions and programs developed by the communities themselves.

Internet Access

In the last number of years residential and public access to the Internet in Canada has been encouraged by all levels of government as a key strategy to encourage familiarity to the technologies that will stimulate economic activity in the future. This has resulted in SchoolNet and Community Access Programs in Keewaytinook Okimakanak communities. Residential access ranges from twenty per cent to thirty five per cent in regions across the country. Once again, rural and remote areas are at a distinct disadvantage to more urban areas.

While the communities of the Keewaytinook Okimakanak do not have dial up local access, more urban areas are able to have access to high-speed technologies as cable modems and digital subscriber lines. A recent CRTC decision has mandated that local exchange carriers make this service available to remote communities with local telephone service.

The nature of Internet provision makes the capital investment prohibitive when there is only a small customer base. With network provisions, dial up access can be shared throughout the communities.

Economic Development Initiatives

E-Commerce

Currently there is a lot of discussion and focus on the upsurge in development of E-Commerce and business over the Internet. While it is difficult to categorize what an Internet business is, there are what are a number of categories that are developing. One area is what is considered pure Internet plays such as Amazon.com, eBay and America Online. These are businesses which have been created as a direct result of the invention of the Internet.

Small business has also benefitted by allowing information on their products or services to be showcased over the Internet on their website. In addition, direct ordering from manufacturers and distributors have enabled easier access for small enterprises.

Voice over Internet Protocol

Voice over Internet Protocol (IP) is a new technology that is allowing people to make telephone calls over their Internet connection. This allows the user to avoid long distance costs. It is of interest to organizations that run data networks on TCP/IP and wish to reduce costs by operating their branch-to-branch long distance calls over this network. As an emerging technology, Voice over IP has quality of service and standards issues to deal with. This technology will allow organizations on the network to communicate without toll charges.

Partners

There are a number of potential partners that would be involved in this project from providing network support or bandwidth to developing applications. These roles will be more developed in the business plan portion of the study. These may include but not be limited to:

LUNet
Keewatin Patricia Board of Education
Bell Canada
Nodin Counselling Services
Health Sciences North
Nishnawbe Aski Policing Services
Wahsa Distance Education

Contact North
FedNor/Industry Canada
Northern Ontario Heritage Fund

Traffic

At present, Keewaytinook Okimakanak through their association with Knet and SchoolNet, have wireless networks providing internet service for the elementary school, band office and nursing station in the community. Knet also provides training and support for the communities. Our recommendation is that this community network be expanded as well as make videoconferencing services available on a fixed and portable basis. The bandwidth requirements would be as follows:

Sample Community Bandwidth Profile

Community User	*Bandwidth Required*
Band Office	56 Kbps
Community School	56 Kbps
NAPS Office	128 Kbps
Community Video	384 Kbps
Nursing Station	128 Kbps
Aggregate Bandwidth	**768 Kbps**

The model we are suggesting will have an expanded community integrated network that will tie into the community wide area network. Depending upon the traffic generated from the community, the inter-community connections can be designed up to T1 capacity.

Network Hardware

In determining the best network hardware through a careful review of the long term plans of all of the regional service providers, both current as well as proposed, it was found that all are developing their infrastructure around the new Cisco Multi Protocol Label Switching Systems. This service provides the greatest level of broad-based services over private network infrastructures.

Why Cisco MPLS

MPLS is not an overlay network. Instead, every customer connection is explicitly identified as being part of one or more virtual private networks (VPN). The customer does not need to worry about virtual circuit provisioning in its own equipment, or in the service provider's network. Rather than peering with other edge equipment, each customer router is peered with a regional provider router that is owned by the service provider. All IP data that is not local is sent to its associated provider router. The provider routers and the MPLS network take care of all inter-sites routing for the customer.

MPLS Structure and Security

Each incoming interface on a provider router is associated with a particular VPN. Therefore, a packet can enter a VPN only through an interface on the provider's equipment that is associated with that VPN.

In summary, MPLS has the following advantages, from the customer's perspective:

- MPLS virtual private networks provide privacy and security equal to Layer-2 virtual private networks.

- MPLS virtual private networks provide scalable any-to-any connectivity for extended network infrastructure that encompass multiple application requirements

- MPLS virtual private networks make it simple for a service provider to provide server hosts that can be accessed from multiple virtual private networks.

- MPLS virtual private networks offer easy management of membership and easy provisioning of new virtual private networks for quick deployment.

- MPLS virtual private networks make it unnecessary for customers to manage a virtual backbone.

- MPLS virtual private networks allow customers to use private IP addresses. This is possible because the combination of IP address and VPN membership

always identifies a unique address, even if the IP address is used by other users who are connected to the network on different virtual private networks

- MPLS virtual private networks permit local connectivity between any 2 (or more) ports on the same router, as long as they belong to the same VPN. WAN charges do not apply when only local connectivity is required (inexpensive local connectivity).

Network Layout

Star Topology Over TCP/IP

This topology is the most widely used in wide area network design as it provides the easiest level of management while ensuring maximum security. As well, this topology allows for the maximum bandwidth management. The diagram uses Sioux Lookout as a hub for design purposes: the network-operating centre can be located anywhere on the network. A more detailed design is attached as an appendix.

Star Topology Over TCP/IP