NOVEMBER 2018

ORION

CONNECTING NORTHERN ONTARIO'S RESEARCH AND EDUCATION COMMUNITY

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ABOUT ORION

ORION is a not-for-profit organization dedicated to empowering Ontario's researchers, educators and innovators. We facilitate ground-breaking discoveries and cutting-edge education by connecting institutions and regions across the province, providing them with the digital tools and expertise they need, and advocating on their behalf.

ORION is Ontario's only provincial research and education network. ORION's fibre optic network covers 6,000 km, connecting regions all over the province and more than a hundred institutions including universities, colleges, libraries, hospitals and research centres, as well as most of Ontario's school boards.

> "ONE IN 10 ONTARIANS RELIES ON ORION FOR RESEARCH, EDUCATION AND INNOVATION RELATED ACTIVITIES."
>
> Conference Board of Canada

More than two million researchers, educators and innovators rely on ORION's high-speed network to share and communicate with each other and to connect to a global grid of similar research and education networks across Canada and around the world. We are the Ontario partner in Canada's National Research and Education Network, comprising CANARIE and 12 provincial and territorial partners. This ultra-high-speed network connects Canada's researchers, educators and innovators to each other and to global data, technology and colleagues.

As a not-for-profit organization, ORION is guided by an interest in providing powerful digital infrastructure for the people of Ontario to connect, thrive and innovate. Our long history of providing advanced network solutions has given us the expertise we need to fulfil the digital requirements of Ontario's innovation community. That commitment extends to ORION's work in the North.

Jessica Taylor

Confederation College

Northern Lights

Meet Jessica Taylor, who completed her Early Childhood Education diploma at Confederation College through Contact North, right in her hometown of Ginoogaming First Nation, Ontario.

"I liked online learning. I can work at my own pace, not in a huge classroom with hundreds of people."

INTRODUCTION

Many rural and remote areas in Northern Ontario lack the high-speed broadband connectivity enjoyed by most of the province. There is an opportunity to support the region's economic development by providing access to the connectivity and resources required to address some of its unique challenges.

ORION's mandate is to serve all parts of the province, including Northern Ontario's remote and rural regions. That means rising to the challenge of creating ultra-high-speed broadband connections in an area with limited infrastructure. As the province's most recent growth plan for Northern Ontario[1] makes clear, economic success depends on a diversified economy, a culture of innovation and entrepreneurship, and educated, creative and skilled people.

CONNECTIVITY IS THE KEY TO UNLOCKING ECONOMIC POTENTIAL IN NORTHERN ONTARIO.

This report is the outcome of ORION's shared interest with Northern Ontario Heritage Fund Corporation (NOHFC) to ensure our province's Northern regions have access to essential connectivity and digital services.

Northern Lights

Rene Pitremont

Treaty Three Police Officer

Meet Rene Pitremont, a Treaty Three Police Officer. He completed his online Police Foundations program at Confederation College through the ORION network and Contact North.

"Protecting my family, protecting my friends, and knowing that the people who live around me are safe, that's what keeps me working for the Treaty Three Police Service."

[1] Ontario Government. 2011. Growth Plan for Northern Ontario. Retrieved from: https://www.placestogrow.ca/images/pdfs/GPNO-final.pdf

THE NORTHERN ONTARIO CONTEXT

The significance of connectivity services in Northern Ontario must be informed by an understanding of the region's unique economic and demographic context.

The North is not monolithic in its needs nor its composition. This intra-regional diversity translates into different connectivity needs for different communities. For example, the needs of Thunder Bay are not comparable to the needs of remote fly-in communities near Wunnumin Lake. However, since it is common to leverage infrastructure in urban centres to connect rural and remote regions, connectivity in remote/rural regions is interrelated with and sometimes dependent on infrastructure in urban centres.

Population and geography

Northern Ontario is 802,000 km,[2], constituting approximately 90 per cent of the province's land mass. Larger than most provinces, it contains just 10 per cent of Ontario's population. Creating and sustaining digital infrastructure solutions for such a thinly spread out population over a vast area is a challenge.

It is home to an estimated 800,000 people, including about half of Ontario's Indigenous population and 150,000 Francophones. Much of the population is concentrated in or near five urban hubs: Thunder Bay, Sudbury, Timmins, North Bay and Sault Ste. Marie, each with key access and distribution routes to and from the North. Most other communities are small and often remote, with populations typically ranging between 500 and 2,000. There are about 144 municipalities, 106 Indigenous communities and 150 unincorporated communities in the region. Small communities may be fly-in only, inaccessible by roads or hydro infrastructure.

NORTHERN ONTARIO IS HOME TO AN ESTIMATED 800,000 PEOPLE, INCLUDING ABOUT HALF OF ONTARIO'S INDIGENOUS POPULATION AND 150,000 FRANCOPHONES.

Economy

Northern Ontario is dependent on a few key industries. Although some economic diversity is emerging in the region's five major cities, smaller communities remain largely dependent on a single industry or employer. The public sector accounts for three of the region's major employment avenues (academic and educational institutions, health care and public administration).[2] The balance of jobs is distributed among business services, construction, manufacturing, trade, hospitality, forestry, lumber and mining.

In general, Northern Ontario's economy has not performed as well as the rest of Ontario, generally due to outward migration, volatility in resource markets, resource depletion and shifts in production and demand.

[2] McIntrye, J. 2018. Places to Grow: Best Practices for Community-based Regional Economic Development in Ontario's North. *Northern Policy Institute.*

Northern communities are at a disadvantage in the global economy and have struggled with attracting private sector development because of the region's remoteness and limited infrastructure[3].

Many Northern communities face significant challenges in retaining local talent. Some face declining populations as young people and skilled workers move away, and attracting new residents is difficult. Many professions require high levels of connectivity to be successful and compete in their industry.

> "THE PRESENCE OF BROADBAND INTERNET ACCESS IS THE KEY TO IMPROVEMENT EDUCATIONALLY, ECONOMICALLY AND SOCIALLY FOR BOTH INDIVIDUALS AND COMMUNITIES IN NORTHERN ONTARIO."
>
> Innovation, Science and Economic Development Canada

FedNor, the Government of Canada's economic development organization for Northern Ontario, held consultations across Northern Ontario on what was needed for economic growth. "Access to broadband was brought up repeatedly as a missing link to business opportunities, personal and corporate communications and professional advancement… Overall, we were told that the ability to use a safe, secure, affordable and quality internet connection is a prerequisite to significant economic development."[4] It will also improve the participation and economic sustainability of Indigenous communities.[5]

[3] ROMA. 2011. A Voice for Rural and Northern Ontario. *Rural Ontario Municipal Association.*

[4] Canada. 2017. Prosperity and Growth Strategy for Northern Ontario: What we heard. Retrieved from: http://fednor.gc.ca/eic/site/fednor-fednor.nsf/vwapj/PGSNO-What-We-Heard.pdf/$file/PGSNO-What-We-Heard.pdf

[5] Ontario. 2017. Expanding Broadband Infrastructure in Remote Northern Ontario. Newsroom Bulletin. Retrieved from: https://news.ontario.ca/mndmf/en/2017/10/expanding-broadband-infrastructure-in-remote-northern-ontario.html

BROADBAND SERVICES IN NORTHERN ONTARIO

Coverage

Connectivity networks in Northern Ontario were originally built along the major highways such as 69, 11, 144 and 17. Some networks were buried along the CN and CP Rail lines. These national transport fibre routes have limited breakout points, meaning that many communities do not have access to them. The Broadband and Associated Infrastructure Mapping Analysis Project (BAIMAP) has illustrated the gaps and bandwidths available in the Northeast and Northwest.[6] Their analyses confirm that connectivity and bandwidth dramatically decrease the farther away a community is from one of the five urban hubs in the North.

The issue of coverage has far-reaching implications for the 106 Indigenous communities in Northern Ontario. While the Canadian Radio-television and Telecommunications Commission (CRTC) has declared the internet a basic service, many Indigenous communities are being left behind, affecting access to health care, social services, employment and education opportunities. "It's time for Canada to recognize internet connectivity in Indigenous communities as a critical tool for reconciliation. Working with First Nations, Inuit, and Métis communities to ensure access to high-quality, sustainable and affordable internet will not only reinforce our national commitment to the Truth and Reconciliation Commission's calls to action, it will also save lives – literally."[7]

> "WORKING WITH FIRST NATIONS, INUIT, AND MÉTIS COMMUNITIES TO ENSURE ACCESS TO HIGH-QUALITY, SUSTAINABLE AND AFFORDABLE INTERNET WILL NOT ONLY REINFORCE OUR NATIONAL COMMITMENT TO THE TRC'S CALLS TO ACTION, IT WILL ALSO SAVE LIVES—LITERALLY."
>
> Mark Buell, Internet Society

The BAIMAP demonstrates that the challenge of connecting customers in a community (last-mile) is at the heart of ensuring widespread connectivity in Northern Ontario. Local fibre networks are typically limited to larger population centres where the investment in infrastructure is justified by the large customer base. However, fibre to the home has recently come to a small subset of communities, such as the Town of Cochrane via Cochrane Tel or Vianet.

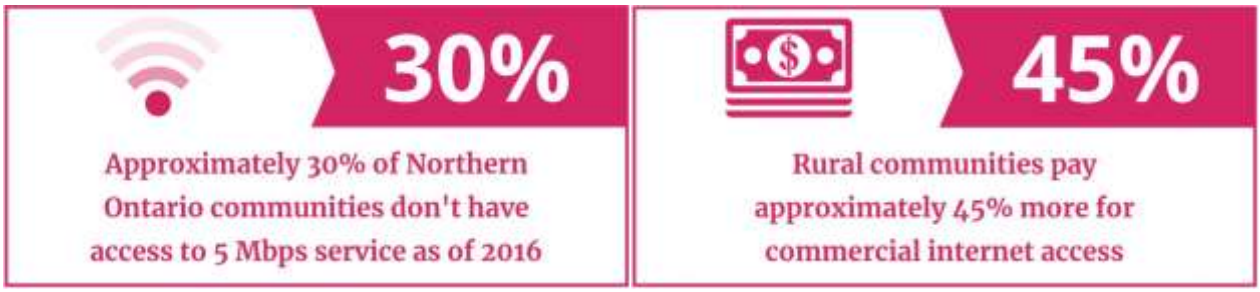
[6] Broadband & Associated Infrastructure Mapping Analysis Project. Retrieved from: http://www.connectednorth.ca/learn

[7] Buell, M. 2017. Internet as an act of reconciliation. Retrieved from: http://firstmile.ca/internet-as-an-act-of-reconciliation-article-by-mark-buell/

Cost

Where there is service in rural areas, the cost of connectivity is disproportionately higher than in urban Ontario. For example, in rural communities with some service, residents paid an average of 35–45 per cent more for a quarter of the service levels available in fully serviced communities. In 2016, a basic internet plan providing 5 Mbps[8] cost between $30 to $93 per month in rural Ontario,[9] compared to between $25 and $58 per month in urban Ontario. In addition to more expensive monthly fees, the data caps in rural communities are usually lower than in urban/suburban communities. Consequently, a rural resident could be charged $35 to $75 for every gigabyte over the limit.

This trend in higher costs and slower speeds in rural areas is consistent across Canada.[10] When average family incomes are considered, this translates into those with lower incomes being charged more for connectivity while receiving reduced speed and reliability. This inequitable situation is more evident when considering connectivity in Indigenous communities. For example, the lowest median incomes for Indigenous peoples were found in Manitoulin ($17, 249) and Kenora ($17,404), both districts with significant rural populations. Thus, the conversation about access to internet services in Northern Ontario must consider price, as many individuals, especially Indigenous residents in rural and remote areas, are required to pay more even though they earn less.[11]



Challenges in Northern connectivity

The need for connectivity in the North is apparent and there appears to be political will both provincially and federally to connect the North. So why does the challenge of reliable and affordable connectivity persist? Growing and sustaining broadband access in the North, especially in rural and remote regions, entails challenges of cost, geography, existing infrastructure and local resources. These challenges intersect in complex ways and addressing them effectively requires cross-sector partnerships involving government, local communities, and both public and private telecommunications providers/organizations.

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[8] Mass, M.J. 2016. The Digital Divide: Internet Access in Northern Ontario. Retrieved from: http://www.northernpolicy.ca/article/the-digital-divide-internet-access-in-northern-ontario-26289.asp

[9] Middleton, C. 2017. Rural Ontario Foresight Papers. Broadband Infrastructure for the Future. *Rural Ontario Institute*.

[10] CYBERA. 2016. Canada's Internet Performance: What the Numbers Show. Retrieved from: http://www.cybera.ca/news-and-events/tech-radar/canadas-internet-performance-what-the-numbers-show/

[11] Leary, K. 2015. Show Me The Money: Some Positive Income Trends in Northern Ontario. *Northern Policy Institute*.

Cost

- There is inadequate return on investment for private companies despite development subsidies. Ongoing network operations is costly, even if infrastructure is heavily funded. Many funding programs require a 50-50 split with the applicant, making such projects cost prohibitive. For example, in 2017 the Federation of Northern Ontario Municipalities (FONOM) identified 40 broadband investment projects promising speeds up to 25 Mbps across communities in Northern Ontario. However, broadband providers say they may not be able to sustain these operations, arguing the small numbers of customers don't support adequate returns.
- Installing transport and IP networks is expensive when considering that the services needed are low speed. Connecting a remote connection back to the core is expensive and time-consuming.
- Even when high-speed services are available, costs are high for users without subsidies.

> "THE SIZE OF OUR COUNTRY IS A CHALLENGE AND SO IS ITS CLIMATE, SINCE THE MOST AFFORDABLE WINDOW FOR BUILDING INFRASTRUCTURE IS JUST A FEW MONTHS EACH YEAR – PARTICULARLY IN THE FAR NORTH."
>
> Canadian Internet Registration Authority

Geography

- Remoteness and harsh geography increase the complexity and cost of deploying broadband infrastructure.[12]

Local resources

- Broadband projects require specific expertise and that can be an issue in some Northern areas. Importing technical expertise is expensive and depending on external investment is not sustainable for local development.

Regional governance

- The region's mix[13] of local governments, unincorporated areas, and First Nation communities with their own governance create a challenge for the type of regional coordination needed for broadband projects.

Existing infrastructure

- Broadband infrastructure does not sit in a vacuum; its development must be part of an integrated strategy for regional infrastructure to maximize economic development.

[12] CIRA. 2018. The gap between us: perspectives on building a better online Canada. Retrieved from: https://cira.ca/gaps

[13] Noga, A. 2018. Northern Ontario think tank wonders — do we need more noodles? *Northern Policy Institute.* Retrieved from: http://www.northernpolicy.ca/upload/documents/news/18.07.05-northern-ontario-think-tank-won.pdf

KEY ROLE OF CONNECTIVITY FOR RESEARCH AND EDUCATION INSTITUTIONS

Access to research and education opportunities is essential to economic development, and Northern Ontario is home to a full range of such institutions. The presence of post-secondary institutions has a positive impact on regional and local development with social and economic benefits.[14]

There are many examples of significant regional educational and research collaborations:

- The Keewaytinook Internet High School began as a pilot in 1990, led by the Northern Chiefs Tribal Council. The innovative high school leverages technology to allow learners to pursue a high school education without leaving their home community.
- The Northern Ontario School of Medicine (NOSM) is a joint initiative between Lakehead University and Laurentian University that meets local needs by providing medical education that is community-based and specifically addresses the health care needs of urban, rural and remote areas in the North.
- The Sudbury Neutrino Observatory Lab (SNOLAB) is a world-class research centre and facility exploring sub-atomic physics, including neutrinos and dark matter.

The post-secondary sector is well represented with five Indigenous institutes, six colleges and five universities, including Francophone institutions. To better serve rural and remote communities, many of these institutions have satellite campuses in smaller communities and offer distance learning opportunities through Contact North. There are multiple school boards in the K-12 sector. Libraries also play a critical role in education and research, especially in the North where many of the 172 libraries act as the de facto community hub, providing access to internet, resources and specialized programming. The North also has many First Nation Public Libraries, which act as "vital centres for access to cultural activities and language revitalization in ways that are distinct from non-Indigenous public libraries."[15]

Dr. Allison Crawford

CAMH

Northern Lights

In 2015, Dr. Allison Crawford from the Centre for Addiction and Mental Health led the Centre's Northern Psychiatric Outreach Program. This program uses televideo and online resources to increase the capacity to provide health care access to under-served populations in remote, rural communities across Northeast and Northwest Ontario as well as Nunavut.

Her model generates more collaborative partnerships, and brings continuing professional development to colleagues working in remote areas.

[14] Smart Specialisation Platform. 2011. Connecting Universities to Regional Growth: A Practical guide. *European Union Regional Policy*.

[15] NVision Insight Group. 2017. Ontario's First Nation Public Libraries: A Needs Assessment Report.

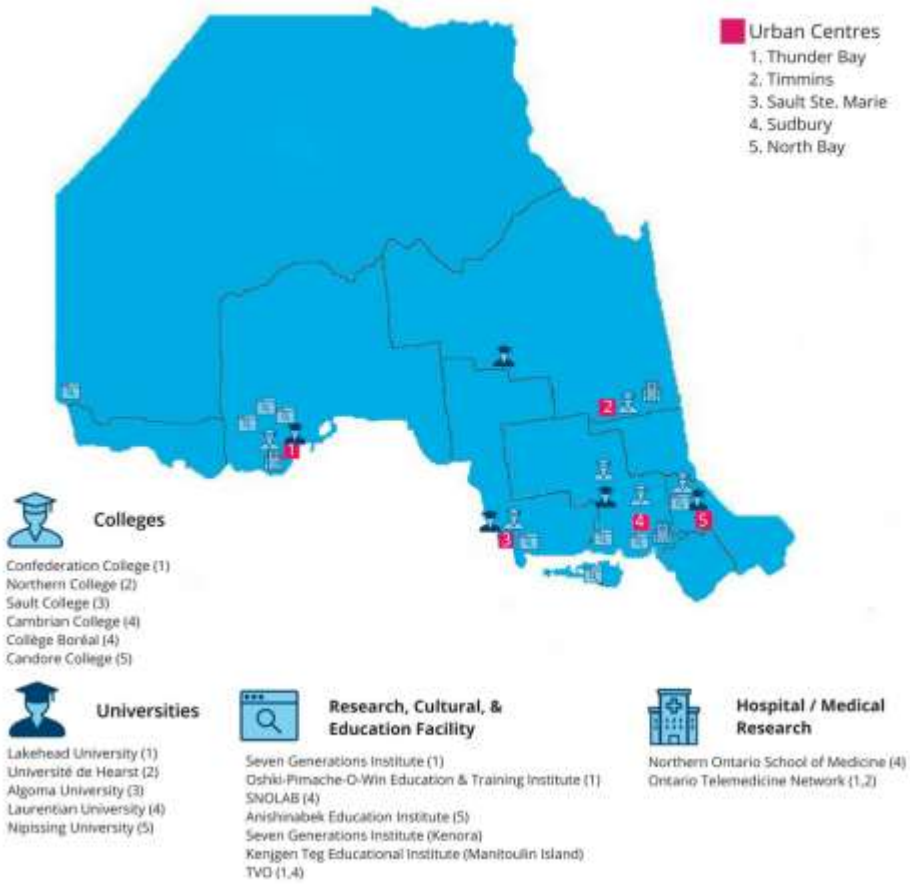

Figure 1: Education and Research Institutes in Northern Ontario.
Note that K-12 schools and libraries are distributed throughout the region.

The presence of the institutions represented in the figure above does not translate to educational access for all communities. These institutions, especially post-secondary institutions, cluster around the urban areas of the North. Even with satellite campuses, some communities face significant travel times and, for remote fly-in communities, the options for accessing educational institutions are cost prohibitive. While the Ontario school system is widely regarded as high performing, the graduation rates in the North are well below the provincial average and Indigenous student graduation rates are even lower.[16]

[16] Commito, M. 2015. Making the Grade? Education Trends in Northern Ontario. *Northern Policy Institute.*

ORION has a strong foundation in the North with five points of presence – North Bay, Sault Ste. Marie, Sudbury, Thunder Bay and Timmins. However, ORION estimates these Northern Ontario links will experience a 30 Gbps rise in traffic over the next three to five years. This estimate is based on usage increasing at a rate of over 30 per cent a year, which we're seeing across our network. It points to the growing use of online services and the growing demand for high-speed connectivity associated with that.

For example, we're seeing continuous growth of online, blended and flexible learning. Education and research institutions will see the increased use of artificial-intelligence (AI)-enabled systems both for predictive analytics and to enhance student-facing services (AI tutoring systems, AI advising systems, AI-enhanced books and course material). In addition, the growth of robotics, coding and 3D printing in schools, colleges and universities will create a heavy demand for connectivity and cloud storage, as well as high-speed and high-capacity IT systems.

Enhancing capacity and increasing the service area is necessary so that more communities can reap the benefits of having institutions connected to high-speed networks. This infrastructure is critical to fulfil the provincial mandates of organizations such as Compute Ontario, which focuses on growing the skills and abilities of researchers who leverage advanced research computing (ARC) tools and techniques. It also supports the work of eCampusOntario, which strengthens online and technology-enabled learning in higher education, as well as Contact North, which provides access to online learning in small, remote, rural, Indigenous and Francophone communities across Ontario.

Dr. Greg Ross

NOSM

Northern Lights

Dr. Greg Ross, environmental researcher and professor at the Northern Ontario School of Medicine (NOSM), is utilizing photography and data imaging analysis to better track, validate and report blue-green algae blooms. These informed, expedited reports can significantly reduce health risks for people living near infected areas.

"Without a high-speed network, without a high-capacity network that we have with ORION, we wouldn't be able to do this research."

CONCLUSION

High-speed broadband is essential for growth in Northern Ontario research and education institutions. Despite the CRTC's access and speed targets as well as associated federal funding in 2016, only 70 per cent of Northern Ontario had access to 5 Mbps service. Clearly there is work to be done in connecting the North, especially in rural/remote areas.

There is a tendency to view geographical isolation, small populations, high transportation costs and limited infrastructure as barriers to innovation. However, digital infrastructure and the knowledge economy can be leveraged to overcome such barriers.

"ACCESS TO BROADBAND WAS BROUGHT UP REPEATEDLY AS A MISSING LINK TO BUSINESS OPPORTUNITIES, PERSONAL AND CORPORATE COMMUNICATIONS AND PROFESSIONAL ADVANCEMENT… OVERALL, WE WERE TOLD THAT THE ABILITY TO USE A SAFE, SECURE, AFFORDABLE AND QUALITY INTERNET CONNECTION IS A PREREQUISITE TO SIGNIFICANT ECONOMIC DEVELOPMENT."

Prosperity and Growth Strategy for Northern Ontario: What we heard

The region's natural resource ecosystem needs broadband infrastructure to expand the national and provincial economy in terms of trade, employment, economic development and taxation revenue. Beyond that, connectivity also has potential for positive impact on the social health of the region.

This report finds that the North's connectivity needs are essential to the economy, retaining local talent, spurring local industry, ensuring education facilities can provide basic services, and connecting isolated communities to urban hubs and each other.

- Connectivity allows students in remote locations who otherwise can't afford higher education, as well as those who have other responsibilities or wish to remain at home, to access online learning in their own communities. A possible result of connectivity would be an increased pool of skilled workers in remote areas.
- Connectivity also allows research teams working in northern environments to stream data to shared databases, allowing greater insight into specialized research areas. They can also access advanced research for analyzing data, improving research outcomes and discovery.

RECOMMENDATIONS

Out of this report, ORION has identified four recommendations to move toward the goal of ensuring greater access to connectivity across Northern Ontario.

Collaboration with a range of partners at the local, regional and national level is essential to create a plan to address these four recommendations.

Boost capacity and resilience across the research and education network

Northern innovation institutions should be able to access improved connectivity through an extended research and education network that would future-proof the North's ability to support economic development.

This will not only modernize and extend the existing network, but also allow access to advanced research computing (ARC) services and artificial intelligence (AI) platforms integral to new discoveries in the knowledge economy. All enhancements should factor in improved network redundancy. Harsh conditions across some of the existing routes, along with increasing reliance on networks, makes redundancy essential. A plan for local capacity in IT skills development could ensure that existing users have the in-house capacity to support and leverage enhanced network offerings.

Partner with established service providers

Key to growing services in Northern Ontario are partnerships with local and regional telecommunications and data communications service providers. This strategy offers tremendous efficiencies of scale, scope and opportunity. These are most apparent in communities with smaller populations. To expand services, we must begin engagements with service providers to bring new districts and communities onto the network.

Secure funding with partners

Municipal partners should be key in any approach to connectivity in the North. Such partnerships are increasingly common in rural broadband expansion projects. Such initiatives also create maintenance and service jobs within the information and communications technologies (ICT) sector. Such partnerships could also be the most cost-effective approach to solving last-mile deficits. Other co-applicants for funding could include libraries given their role as community hubs, as well as other community leaders.

Produce a comprehensive plan for shared technology services

Northern Ontario institutions should benefit from shared, hosted Canadian-based cloud and other shared technology services. This will present a unique opportunity to reduce costs and share expertise. Cloud services could provide a scalable platform for growth within each of these institutions.

An assessment of the shared technology service requirements in Northern Ontario would likely reveal overlapping requirements. Many such services require additional network connectivity and a trusted aggregator can combine needs to provide scalable services not otherwise within the reach of small organizations. In 2017, ORION hired the country's first shared chief information security officer and services being developed in this portfolio could provide the first instances of shared critical infrastructure.

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