Growing the Digital Economy in Rural and Remote Northern Communities

A report prepared for the Northern Development Ministers' Forum, providing a reflection on the 2013 priority project on "Pan-Northern Minimum Broadband Standard," discussing the digital divide, highlighting rural and northern success stories in the digital economy, and recommendations for the effective development of the digital economy in the North.

Executive Summary

Key Points

- The importance of Information and Communications Technologies (ICT) in Canada has been growing for years, with the 2016 declaration by the Canadian Radio-television and Telecommunications Commission (CRTC) that high-speed internet is a basic telecommunications service (BTS) explicitly underlining our reliance on ICT.
- In 2013, a Northern Development Ministers' Forum (NDMF) priority project produced a report on the state of ICT in the North; the report recommended a pan-northern broadband standard where all northerners had access to broadband of 9 megabits per second (Mbps) download speed, but noted this target may quickly become too low.
- By 2016, the nature of ICT had changed so dramatically that the CRTC had set a universal service objective (USO) of 50 Mbps download and 10 Mbps upload speed with unlimited data transfer for all Canadians by 2031; this target is five times higher than the 2013 speed target after only three years.
- As of December 31, 2016, 84% of Canadians already have access to Universal Service Objective (USO)-level broadband, but only 39% of rural Canadians have broadband that meets the USO; many of these rural Canadians live in the North.
- A recent Auditor General of Canada report noted it was unclear how the USO would be achieved for 3.9 million rural Canadians, and reported others' cost estimates for closing the divide between rural and urban communities as being between $6.5 and $50 billion dollars.
- Thus far, market forces have been insufficient to drive equitable broadband development in rural and northern communities.
- The NDMF asked for an update from the 2013 report on the state of ICT in the North.
- From a jurisdictional scan and a review of literature and available ICT data, this report identifies:
  - Gaps in northern ICT data that inhibit effective policy making and evaluation;
  - The need to move beyond ICT and consider the "digital economy" it enables; and
  - Recommendations on goals for policy makers seeking to address the digital divide in ICT and the digital economy in the North.

Information and communications technologies (ICT) are increasingly becoming a fundamental part of the global "digital economy," a world in which ICT infrastructure drives productivity, innovation, and competitiveness.

A 2013 Northern Development Ministers' Forum report recommended establishing a pan-northern minimum broadband standard to address the digital divide that was observed at the time between northern communities and the rest of the nation.

This report provides a new look at the state of ICT and the idea of a digital divide in the North, reflecting on the 2013 report and evaluating the relationship of ICT infrastructure to the digital economy it now supports. The report notes that data available to assess connectivity in the North are often imprecise, are conflated with rural communities outside of the North, and are varied across jurisdictions. These data challenges make simple comparisons of ICT infrastructure between jurisdictions or over time potentially misleading or unhelpful. However, what usable data there are illustrates a clear digital divide that has either persisted since 2013 or potentially grown.[1] Using rural as a proxy for the North where necessary due to data issues, this report seeks to illustrate the challenges facing northern communities with their ICT infrastructure. Further, given the rapid advancement of ICT infrastructure and the digital economy since 2013, the report illustrates how broadband speed targets are insufficient to drive meaningful ICT development or participation in the digital economy for northern communities. A new approach is needed to bridge the digital divide in the North.

The report seeks to help policy makers move beyond speed targets, and focus on meeting the underlying needs of northern communities seeking to participate in the digital economy. With this focus, policy makers can leverage existing success stories to create purpose-built ICT infrastructure and digital economy programming. Policy makers and communities can thus create the conditions for effective participation in the digital economy, which is the intended goal of ICT infrastructure projects. Aiming for this long-term objective instead of short-term outputs can help identify the most impactful ways policy makers can support the North and reduce the digital divide. To create a manageable scope for the working group, the digital economy is broken down into three components: the primary digital economy, the secondary digital economy, and the digitisation of the government sector.

The report uses current literature on ICT connectivity and a scan of participating Canadian jurisdictions to identify key themes and key examples of northern success in the digital economy. In summary:

- **Growth of the primary digital economy in the North is dependent on suitable ICT infrastructure. When this infrastructure is present, communities and businesses can leverage unique and untapped advantages of the North.**
- **Transitioning traditional sectors into the broader secondary digital economy can help northern communities and businesses be globally competitive. However, effective transitions**

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[1] Auditor General of Canada, *Connectivity in Rural and Remote Areas*, par. 1.10, 1.45-8, http://www.oag-bvg.gc.ca/internet/English/att__e_43221.html

rely on programs based on outcomes not just infrastructure outputs. Appropriate ICT infrastructure and digital literacy remain key challenges.

- **Government sector services can be provided both at higher quality and more efficiently when delivered digitally. When services migrate to a digital platform before communities have access to appropriate ICT infrastructure or digital literacy, however, the digital divide widens.**

The report presents a summary of promising practices identified in success stories brought forward through a jurisdictional scan. These practices illustrate how different jurisdictions and their communities are tackling the digital divide in the North.

- **Overall, provincial and federal programs exist to fund both ICT infrastructure and growth in the primary and secondary digital economy. However, programs tend to be diverse to meet a diverse set of needs in different jurisdictions. Effective programs are coordinated to reduce applicant burdens, and provide outcome measures data so that best practices can be identified and shared.**

From this scan and a review of the relevant literature, the following goals are suggested for policy makers addressing ICT infrastructure and the digital economy in the North:

- **Within or between jurisdictions, establish a repository of promising practices and success stories for advancing the development of the digital economy in the North, moving beyond a discussion of ICT infrastructure speeds as an outcome on its own and focusing on community and jurisdictional outcomes in the digital economy.**
- **Map the northern funding ecosystem in each jurisdiction for ICT infrastructure and digital economy participation; review programs to ensure they reflect local citizen, business and government outcome goals, and are accessible, flexible, comprehensive, and coordinated.**
- **To address data measurement, jurisdictions should:**
  - **Develop, measure and make available a basic, standardised set of ICT measurements and measurement methodology that can be used to accurately reflect the nature of connectivity in the North;**
  - **Identify gaps in capacity to conduct accurate ICT measurement, note these gaps in available data, and develop a plan to address these gaps; and**
  - **Encourage policy makers and other program delivering entities to consider, measure, and report meaningful desired outcomes (such as service delivery or eCommerce growth) in their digital economy initiatives instead of focusing on ICT infrastructure speed targets; ICT infrastructure should be purpose-built to ensure it is cost-effective and economically impactful.**

Glossary

Backbone: An internet network connection that interconnects one or more Points-of-Presence to an internet gateway, providing a path for the exchange of information between different subnetworks, and usually having greater capacity than all the networks feeding into it.

Bandwidth: The maximum throughput of a computer network, both in and out of a network. Although not technically accurate, colloquially bandwidth is used to describe the amount of data transferred over a network during a period of time as well (correctly termed **Bit Rate)**. Whether bandwidth referred to as throughput or total data transferred over time is therefore contextual.

Bit and Byte: Units of measure for digital information, where one bit represents a 1 or a 0, and one byte represents eight bits. Bits are represented by a lowercase "b" and bytes are represented by an uppercase "B." The prefixes "kilo" "mega" and "giga" approximately correspond to a thousand, a million, and a billion respectively of the unit it precedes. For example, a Gigabit (Gb) is 1 billion bits, and about 0.125 Gigabytes (GB).

Bit Rate: See **Bandwidth**.

BTS: Basic telecommunications service, within the meaning of subsection 46.5(1) of the federal Telecommunications Act, seen as a necessary service for all Canadians (see also **Universal Service Objective**).

Digital Economy: Digitalisation, the growth and transformation of the economy and society as induced by the use of information and communication technologies (OECD, 2016). For this report, we focus on the following aspects of the Digital Economy:

> **Primary digital economy:** New economic activity created by ICT. Examples are software-as-a-service firms, social media, web design, and programming.
>
> **Secondary digital economy:** Traditional sectors changed by ICT. Examples are drone-assisted forestry, online marketing for manufactured goods, and remote-controlled machinery in the oil and gas industry.
>
> **Digital Citizens:** Citizens using ICT infrastructure to access government services traditionally delivered through other means or that didn't exist before the internet. Examples are eHealth, eLearning, ICT-based resident retention and attraction initiatives, and municipal broadband.

Digital Literacy: As defined by the OECD, "the set of knowledge, skills, and behaviours that enable people to understand and use digital systems, tools and applications, and to process digital information." Digital literacy is linked to the capacity for being innovative, productive and creative, and to the ability to participate in democracy and the digital economy. The OECD notes that "even where

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broadband Internet services are available, individuals may not be able to use the service to its fullest potential based on their level of digital literacy."[2]

Download (Upload) Speed: A partial measure of bandwidth indicating the available throughput on a network to receive (or with upload, to send) data. Generally measured by amount of data transferred per second in Kilobits, Megabits or Gigabits.

> **Kb(ps):** A Kilobit, or 1000 bits of data (transferred per second). For scale, 256 Kbps is the recommended download speed to stream Apple Music to one phone.

> **Mb(ps):** A Megabit, or 1000 kilobits of data (transferred per second). For scale, 1.0 Mbps is the recommended download speed for four people to stream Apple Music to their phones or for one person to stream low-definition Netflix to a laptop.

> **Gb(ps):** A Gigabit or 1000 Megabits of data (transferred per second). For scale, 1 Gbps download speed would allow roughly 4000 people to stream Apple Music to their phones, and 1000 people to stream Netflix in low-definition to their laptops.

eCommerce/eBusiness: Traditional commerce or business processes or transactions carried out with the aid of ICT infrastructure. For example, ordering products online instead of going to a physical store is an application of eCommerce.

eLearning: Traditional learning and teaching processes carried out with the aid of ICT infrastructure. For example, an online classroom for a university course is an application of eLearning.

eHealth: Traditional health and medicine processes carried out with the aid of ICT infrastructure. For example, video conferencing between a doctor and a patient in a remote community is an application of eHealth.

High-speed: A relative measurement of the transmission speed available over a broadband internet connection. Over time, what is considered high-speed has changed as technology has improved. See **Broadband**.

ICT: Information and Communications Technology(ies) that capture, transmit and display data and information electronically. When referring to connectivity to internet connectivity, ICT infrastructure includes several different types of technology:

> **Broadband:** Fixed (stationary) or mobile (can be moved) internet connectivity with a minimum speed of at least 1.5 Mbps. (related, **High-speed**).

> **Fibre optic:** A technology for transmitting large amounts of data over optical cables using light. The technology is used to deliver fixed broadband or as part of a network backbone.

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[2] Bridging The Rural Digital Divide, OECD, 2018, p. 46

Microwave: A technology capable of transmitting internet over microwaves, either to bridge gaps between fixed broadband networks or to deliver mobile broadband in a limited coverage area.

Satellite: Technology linking individual fixed or mobile broadband connections or linking networks through orbital communication stations. Typically, access to Internet services via satellite is only used in communities where there is no suitable terrestrially-based transmission service.

WiFi: A technology providing fixed or mobile broadband access to devices within range of a wireless access point or wireless router.

Last-mile: A term used to describe the last stretch of distance in connecting homes, businesses, or other clients to a network connection.

Northern Communities/the north: The CRTC defines "The North" as the three territories. For the purposes of this report, the North includes Yukon, Northwest Territories, Nunavut, and the self-defined northern part of other participating jurisdictions. Where specific data is not available for the North, data for rural Canada is used as a proxy. Given the rural nature of most northern parts of participating jurisdictions, this appears to be a reasonable substitution.

Rural community: A community with less than 30,000 people, as defined by Statistics Canada and used by the CRTC.

Universal Service Objective: The target level of service set by the CRTC for broadband internet access across the country. Currently this is set at speeds of 50 Mbps download and 10 Mbps upload as well as the availability of an option for unlimited monthly data transfer.

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1. Introduction

Transformational technologies can quickly become inseparable from the daily functions of an economy. Highways are an example of this kind of integration.[3] While many Canadians take roads for granted, this "technology" was once a new and innovative way to move people and goods. Over the 20th century, Canada has built and come to rely on over 38,000 km of highways. The millions of cargo and passenger vehicles that make almost every sector of our economy function are inseparable from the technology of the highway.[4]

In the 21st century, information and communications technologies (ICT)[5] and broadband internet are becoming the new road system for the emerging "digital economy," a world in which ICT infrastructure drives productivity, innovation, and competitiveness.[6] Initially a novel, separate sector, ICT has now permeated almost every facet of the Canadian economy. The 2016 declaration by the Canadian Radio-television and Telecommunications Commission (CRTC) that high-speed internet is a basic telecommunications service (BTS) demonstrates the reliance of our society on ICT. Recognizing the importance of ICT, the Northern Development Ministers' Forum (NDMF) drafted a report on ICT in the North as part of the 2013 priority project to develop a pan-northern minimum broadband standard. With the 2013 report as context, this report examines current efforts in the North to develop ICT infrastructure. It also discusses how the ICT needs of northern communities are changing as ICT becomes the new highway for Canada's digital economy.

1.1 Context of Previous Report

In 2013, the NDMF put forward a report as part of a priority project recommending the establishment of a pan-northern broadband standard. The report recognized that globally, citizens, businesses and governments had a growing need for access to reliable and affordable ICT infrastructure. While many Canadian communities had access to broadband and cellular networks, communities across the North struggled to keep pace with the ICT infrastructure developments happening in southern Canada. The report recognized a widening gap between ICT infrastructure in the North and the rest of Canada, largely due to profit incentives for private investors being smaller in the North than in southern, urban communities[7]. Researchers at the time found that this north-south "digital divide" had compounded the inequalities experienced by those in Canada's North, and even more so by marginalized or equity-seeking groups.[8] This finding is echoed in global observations made by the Organisation for Economic Cooperation and Development (OECD) in 2011, which noted that to achieve social inclusion, nations need to prioritise digital inclusion and the elimination of disparities in ICT infrastructure[9]. The 2013

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[3] Ways of the World: A History of the World's Roads and of the Vehicles That Used Them, M. G. Lay, 1999

[4] Transport Canada, https://www.tc.gc.ca/eng/policy/anre-menu-3042.htm

[5] Bridging The Rural Digital Divide, OECD, 2018, p. 11

[6] Skills In The Digital Economy: Where Canada Stands And The Way Forward, The Information and Communications Technology Council, 2016.

[7] Pan-Northern Minimum Broadband Standard, NDMF, 2013, p. 1

[8] Revisiting the digital divide in Canada: the impact of demographic factors on access to the internet, level of online activity, and social networking site usage, Haight et al., 2016, http://dx.doi.org/10.1080/1369118X.2014.891633

[9] Digital Divide: From Computer Access to Online Activities : A Micro Data Analysis, OECD, 2011, p. 5

report also noted that the lack of ICT infrastructure in the North meant northern businesses were struggling to compete in a national and global business environment that was moving toward the increased use of internet and email technology. Additionally, the report noted that in some instances government services were harder to access in the north, as many of these services were beginning to move to online platforms.

The report identified three key areas of concern regarding northern ICT infrastructure:

1. Affordability was low, with high subscription cost and overage fees compared to the rest of Canada.
2. Current ICT infrastructure did not have the bandwidth to meet demand, and service quality was low or intermittent.
3. Redundancy in northern ICT networks was low, leading to outages and service failures.

The report noted that the CRTC's 2011 broadband standard of 1.5 Mbps download speeds was insufficient for 2013 technology. Other northern jurisdictions, such as Finland, had set standards of up to 100 Mbps download speed as a basic level of service. The report recognized the challenges of connecting the North, and recommended the initial pan-northern minimum broadband standard goal of 9 Mbps download speeds with redundant capacity in every major community. The report anticipated that this level of ICT infrastructure would open the door to technology sector participation in northern communities. The 9 Mbps speed was arrived at by comparing the speeds required by various personal, business, and government applications in 2013, and extrapolating a reasonable general broadband speed for most technologies to function. The intent was to develop a universal standard speed that would allow for current technology to function, and also hopefully provide some room for growing bandwidth needs as new technology emerged. However, the report also stated that to achieve the goals of equity and long-term development in the North, the standard should be updated regularly and the ultimate broadband goal should be parity with southern Canada.

1.2 Current Situation –The Digital Divide and ICT Data

The previous report was accurate in its estimation that a 9 Mbps broadband standard would soon be outdated. Today's technology has evolved farther and more quickly than what was anticipated in 2013. By 2016, the nature of ICT infrastructure had changed so dramatically that the CRTC set a Universal Service Objective (USO) of 50 Mbps download and 10 Mbps upload speeds with unlimited monthly data transfer by 2031.[10] This speed target is over 5 times higher than the previous recommended pan-northern standard set just three years earlier, and is a clear illustration of how ICT speed targets rapidly become outdated.

As of December 31, 2016, 84% of Canadians currently have access to broadband at the USO level. In contrast, only 39% of rural Canadians meet this USO. A recent Auditor General of Canada (AGC) report

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[10] CRTC, https://www.canada.ca/en/radio-television-telecommunications/news/2018/03/christianne-laizner-to-the-conference-and-annual-general-meeting-of-the-canadian-association-of-wireless-internet-providers-canwisp.html

noted that it was unclear how the USO would be met for 3.9 million rural Canadians, and also shared reported costs estimates for closing the digital divide ranging between $6.5 and $50 billion dollars.[11] Several reasons have been suggested as contributing factors to this kind of digital divide in Canada and other OECD nations, including geography and digital literacy of under-served citizens.[12] However, these characteristics are not universally limiting and appear to have been overcome in some jurisdictions. Instead, in 2018 the OECD noted that private investment has been the overwhelming source of finance for building ICT infrastructure, and scarcely populated areas are less profitable for companies making these investments.[13] The Canadian Internet Registration Authority (CIRA) also reported that market forces have failed to drive broadband development nationally in Canada, and particularly in rural and northern communities.[14]

While jurisdictions across Canada reported good efforts to improve northern ICT infrastructure, the north-south digital divide has persisted or increased since the 2013 report. To evaluate the effectiveness of these efforts and the extent of the divide, precise data on the state of ICT infrastructure in the North are required. Data on exact conditions of ICT in northern communities, especially historical data, are not readily available for study. The AGC noted that ISED and the CRTC have accurate connectivity data, but this data is not publicly available.[15] Further, what is available often lacks granularity to inform policy. For instance, the CRTC does not break down their connectivity data into northern or southern communities in its latest report on connectivity.[16] As a result of this lack of data, a direct update on any progress made in the North on ICT infrastructure since 2013 is not possible. This is unfortunate and important to highlight for all northern jurisdictions. Until this kind of data are collected and made available, a direct comparison of the north-south divide and progress addressing it is not viable. This means jurisdictions cannot reliably know which ICT building initiatives have been especially effective, and if northern communities are actually being included in the digital economy. The AGC has also called for ISED, in collaboration with the CRTC, to make this data public to guide future ICT infrastructure development.[17]

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[11] Auditor General of Canada, Connectivity in Rural and Remote Areas, par. 1.38, http://www.oag-bvg.gc.ca/internet/English/att__e_43221.html
[12] Bridging The Rural Digital Divide, OECD, 2018, p.12
[13] Bridging The Rural Digital Divide, OECD, 2018, pp. 10, 12

[14] The Gap Between Us: Perspectives on Building a Better Online Canada, CIRA, 2018
[15] Auditor General of Canada, Connectivity in Rural and Remote Areas, http://www.oag-bvg.gc.ca/internet/English/att__e_43221.html
[16] Communications Monitoring Report 2017, CRTC
[17] Auditor General of Canada, Connectivity in Rural and Remote Areas, par. 1.47-8, http://www.oag-bvg.gc.ca/internet/English/att__e_43221.html

Based on the scan conducted for this report, the primary data used by most jurisdictions is provided publically by the CRTC. These data have several characteristics that make it hard to use to evaluate the reality of northern ICT Infrastructure (Figure 1). The CRTC has also noted some limiting characteristics of the data they provide, and has made efforts to continue to improve it over time.[18] Figure 1 summarises some of the characteristics in their data that make an evaluation of the past or current state of northern ICT infrastructure. While these data characteristics present a challenge, there are still enough data to suggest that the digital divide has persisted or grown. Given the lack of data, this report uses the urban-rural digital divide as a proxy for the north-south digital divide in Canada. The northern communities of most jurisdictions are usually rural, and it is common practice to use the urban-rural divide when assessing the digital divide in the North.[19, 20, 21] Appendix 1 contains several examples of key data that illustrate the presence of the digital divide in the North. Despite data limitations, this report's findings are consistent with the findings in the 2018 AGC report. The working group for this report also found northern Canadians were significantly disadvantaged when it came to ICT infrastructure than their southern counterparts, and this divide has remained or widened since the previous 2013 NDMF report.

1.3 The Digital Economy

While the presence of a digital divide between northern and southern communities is established, the impact of the divide is that Canadians living in the North are often cut off from the digital economy. A Bank of Canada Review has pointed to the transformative impact of ICT on almost every facet of the national economy.[22] This is a standard view

Figure 1. CRTC Data Characteristics

Open data rarely provided to assess coverage or preform targeted analysis.

Data not available for analysis of northern communities in all jurisdictions; data only split into rural vs urban.

Measurements of ICT infrastructure at a community level can obscure real individual household or business access.

Speeds reported are ideal advertised maximum speeds and coverage; significant differences between reported speeds and coverage in communities and actual speed test data reported by other organizations.

Types of ICT technology are reported inconsistently; cannot evaluate technology deployment over time and across or within jurisdictions to track technology evolution.

Prior to 2016, measurement methodology assumed matching proportional coverage in 25km^2 geographical of ICT Infrastructure and households. This has been shown to often provide a poor measurement of true ICT coverage.

After 2016, measurement based on "pseudohouseholds," statistical artifacts created from a number of undisclosed factors that estimate where households may be within coverage maps provided by ISPs. This estimate limits both opportunities for measurement replication, and for mapping jurisdictional programs onto CRTC data to evaluate program impact.

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[18] Communications Monitoring Report, CRTC, 2017, p. 278

[19] Broadband Connectivity In Rural Canada: Overcoming The Digital Divide - Report of the Standing Committee on Industry, Science and Technology, House of Commons, 2018, 42nd Parliament, 1st Session

[20] Broadband Connectivity In Rural Canada: Submission to the House of Commons Standing Committee on Industry, Science and Technology, Canadian Rural Revitalization Foundation et al., 2017

[21] The Gap Between Us: Perspectives on Building a Better Online Canada, CIRA, 2018

[22]The Digital Economy, Bank of Canada Review, 2017

across multiple expert sources, with the recognition that the digital economy is rapidly replacing the old non-connected economy.[23][24] ICT infrastructure can still be seen as a separate technology sector of the economy, a "primary" digital economy. However, it has been conclusively established that ICT infrastructure is now fundamental infrastructure for every sector, a digital highway moving goods, businesses and people in the global or "secondary" digital economy[25].

Further, all jurisdictions that participated in this report continue to digitise government services, meaning Canadians are increasingly also digital citizens. The shift to online delivery of government services was noted in the 2013 report. Data from the jurisdictional scan supports the assertion that this shift continues, and lack of ICT infrastructure in northern communities continues to create barriers for citizens accessing services from the "government sector" of the broader digital economy. Government information, civic participation, education, and health care are just a few of the critical services observed moving to online platforms. Thus, where northern communities are underserved in broadband, they may also be unable to fully access both global markets and many government services.

1.4 2018 Report

The CRTC designation of broadband as a BTS means that it is time to view broadband and ICT infrastructure in the North the same way we view other critical infrastructure like roads, electricity and clean water. The BTS designation means that there should be an effort to achieve parity in ICT infrastructure in the south and the north. However, any efforts to address the digital divide purely in terms of minimum bandwidth and internet speeds will always be a game of catch-up, with the now-outdated standard recommended in the 2013 report being a perfect example. Instead, this report looks to highlight where communities and government programs are supporting successful engagement in the digital economy throughout the North. The intention of this report is to use the jurisdictional scan and key highlighted successes to support recommendations around northern ICT infrastructure that focus on the positive economic and community outcomes. These positive outcomes are enabled through effective, appropriate ICT and digital economy programming. They illustrate an opportunity to move away from a focus on speed targets, to instead deliver purpose-built ICT infrastructure and digital economy programs which target and deliver on desired outcomes.

Qualitative research on successes in the digital economy was gathered from Alberta, British Columbia (B.C.), Newfoundland and Labrador, Northwest Territories (NWT), Ontario, Quebec, Yukon, and the federal government. From these diverse submissions, key themes and trends in the development of the digital economy in Canada's North were identified. Three broad categories of the digital economy were highlighted:

1. The primary digital economy, involving activities generally associated with the technology sector such as software development.

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[23] OECD Digital Economy Outlook, p. 22
[24] Broadband Connectivity In Rural Canada: Overcoming The Digital Divide - Report of the Standing Committee on Industry, Science and Technology, House of Commons, 2018, 42nd Parliament, 1st Session
[25] OECD Digital Economy Outlook, pp. 22-24

2. The secondary or broader digital economy, including examples of how traditional sectors are integrating and being transformed by ICT.
3. The digitisation of the government sector of the digital economy; digital citizens' services and initiatives, involving government programs and services focused on or delivered through ICT.

Based on an overview of submitted data and information, the report uses themes and current literature on ICT infrastructure to make three recommendations to support the successful development of an inclusive, functional and vibrant digital economy in the north.

2. Overview of Successes from Northern Communities

2.1 Primary Digital Economy

Across OECD countries, rural and remote communities are actively seeking new opportunities to drive economic growth. The OECD found that without adequate ICT infrastructure, however, communities experience constraints in accessing these opportunities.[26] The jurisdictional scan in this report likewise found that ICT infrastructure was critical in Canada's North.

Overall, the scan showed that rural growth in the primary digital economy largely depended on ICT infrastructure targeted to the technology and innovation sector (see Appendix 2 for selected examples). Funding to build effective ICT infrastructure is key for several reasons. Some jurisdictions have seen growth in the primary digital economy driven by the building of ICT infrastructure itself. These builds are not generally economically attractive to companies currently building ICT infrastructure in the south, so when funding is provided to build the infrastructure, new jobs and opportunities in the North are created. Other jurisdictions have seen new growth in the digital economy emerge once funded ICT infrastructure is in place, as it allows companies to leverage northern advantages such as low-cost electricity or positive environmental conditions. Additionally, growth in the primary digital economy tends to be enabled not only by broadband speed, but also by technology choice. In several jurisdictions where different types of reliable ICT infrastructure were available in a community, an ecosystem of primary digital economy companies would emerge that leveraged the different ICT in unique ways. Funding for only one type of ICT infrastructure would have prevented this growth (see the example of Prince George in Appendix 2 for an example of a northern tech ecosystem). Overall, these digital economy jobs tend to be well-paying, although some resistance in communities moving away from traditional sectors was occasionally noted.

2.2 Secondary Digital Economy

The secondary or broader digital economy is often less visible than the primary digital economy. While data centres and global software companies stand out as clearly digital, the permeation of ICT infrastructure into the business processes in other sectors is often harder to notice. This is especially true in northern communities, where the focus tends to be on the traditional sector and not the

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[26] Bridging The Rural Digital Divide, OECD, 2018, p. 9

technological advances enabling it. However, ICT infrastructure not only allows for traditional sectors to drive new growth in the North, it is becoming necessary in order for these sectors to compete in the national and global marketplace.

In 2016, the CIRA reiterated the 2014 OECD finding that "no businesses today run without the help of ICTs."[27] A 2017 Bank of Canada Review identified ICT infrastructure (including broadband internet), along with energy, transport, and analog communications networks, as essential components for the development of Canada's entire economy. Across Canada's North, examples are emerging of the successful integration of ICT infrastructure into traditional sectors, leading to growth in the secondary digital economy (see Appendix 3 for selected examples).

The most prevalent adoption of ICT infrastructure into traditional sectors across jurisdictions appears to be in the area of electronically-facilitated business (eBusiness or eCommerce). Through the use of ICT, traditional retail and service businesses add a digital component to their operations, or transition into digital delivery entirely. Both Indigenous and non-Indigenous businesses are leveraging eCommerce tools to transform traditional retail operations into globally connected ventures. Traditional sectors like forestry, oil and gas, mining, agriculture and tourism are all also leveraging ICT to improve business processes, find new revenue, and market their products competitively to the world.

The scan only scratched the surface of how ICT infrastructure is transforming traditional sectors across northern communities. It is clear from the jurisdictional scan that successful programs and initiatives to develop the secondary digital economy stretch across a range of sectors. Many of these efforts seem to focus on identifying desired sector outcomes, and then funding both ICT investment and sector partnerships to leverage efficiencies and create economic growth. ICT investment and programs growing the secondary digital economy stood out when they were targeted to the outcomes that were being sought. For instance, eCommerce may rely on fixed broadband at lower speeds, but also requires training for businesses beyond just providing connectivity so these companies can be effective. Identifying these desired outcomes appears important for establishing the most effective target for ICT investment. All jurisdictions identified success stories; however, the trend across the North was that traditional sectors and communities continue to experience barriers to participation in the secondary digital economy. These barriers are particularly acute in areas where ICT infrastructure requires upgrades or new development, and where digital literacy is low. By targeting funding and programs to the specific sectors or priorities in the secondary digital economy, policy makers can be more effective and efficient in developing the ICT infrastructure and other supports needed for northern success.

2.3 Government Sector and Digital Citizens

The provision of government services digitally has also sparked growth in ICT infrastructure use. This digital migration of services in the government sector has been driven by factors similar to those that led to the digital transformation of other traditional sectors. Governments can use ICT infrastructure to offer services that are more innovative, efficient, and sometimes more effective than services delivered

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[27] From Broadband Access To Smart Economies: Technology, Skills and Canada's Future, CIRA, 2016, p. 1

through non-digital means. The growth in government services leveraging ICT infrastructure means that citizens are increasingly becoming digital citizens in that they use ICT to interact with their government and access services (see Appendix 4 for selected examples).

The most fundamental example of government service through ICT is the direct provision of internet access through municipal broadband internet. Municipal broadband lays the foundation over the "last-mile" connecting the broader internet and homes or businesses. This infrastructure then enables community members to access the entire digital economy, including government services that are delivered through broadband. Municipal broadband is present in many forms across jurisdictions, with different business cases and different levels of private-sector involvement underpinning them. Larger ICT infrastructure projects are also being deployed in several jurisdictions to address the "backbone" ICT infrastructure that connects last-mile infrastructure to the world. Without these backbone projects, communities are either limited in how they can access government services, or cut off entirely. Both of these types of programs target specific outcomes (e.g. connecting communities to government services, or creating backbone access) that can include speed targets. However, these speed targets are merely a characteristic of the ultimate program objective, and are based on either the ultimate outcomes that communities or governments are seeking in the digital economy.

Once ICT infrastructure is in place, major government services can be provided effectively and efficiently to connected communities in the North. These services include a multitude of offerings, with eHealth and eLearning being prominent across jurisdictions. Given that healthcare and education tend to be costly programs to deliver, using ICT to deliver these programs more efficiently makes good economic sense. A range of other government programs have also migrated online across jurisdictions, including help for job seekers, new Canadians, and those looking for government reports or information.

Given the increasing digitisation of the government sector, ICT infrastructure has become critical for those who seek to access those online services. In northern communities without reliable ICT infrastructure, the digitisation of services jeopardizes the ability to receive services comparable to those available in the south. Where ICT infrastructure exists in the North, many government services can be provided more effectively and efficiently digitally than through traditional means. This improvement in service delivery creates the potential for northern communities to engage citizens in ways that have not been possible in the past, as long as they have appropriate ICT infrastructure. Building infrastructure that targets effective service access as an outcome can help policy makers determine the most appropriate ICT infrastructure and digital literacy programs to support that outcome.

3. Promising Programs

In addition to the successes mentioned above, some other promising programs for the development of the digital economy in the North emerged from the jurisdictional scan. Although the scope of the programs identified across jurisdictions were diverse, they tended to fall into two broad categories: programs promoting the primary and secondary digital economies in the North, and programs that helped build ICT infrastructure. Some of these programs were specifically targeted to communities in the North, and some were jurisdiction-wide programs that also support northern development.

3.1 Programs for the Primary and Secondary Digital Economy

Programs to grow primary and secondary digital economies, either in the North or inclusive of the North, were quite varied across jurisdictions. These programs were based on community, regional, or jurisdictional needs, available infrastructure, and other economic considerations (see Appendix 5 for selected examples).

Whatever the approach taken by programs seeking to develop the primary or secondary digital economy, a common theme of these programs across jurisdictions was the importance of seeking and sharing information, including successes and failures. The variety and number of different program approaches within and among communities and jurisdictions is large. Given this, jurisdictions seem to recognize the utility and value of shared information on initiatives and programs that are underway or in development. Policy makers and resource-constrained northern communities can both benefit from the examples of others, as digital economy programs are created or updated.

3.2 Infrastructure

ICT infrastructure programs are also quite varied across all jurisdictions. Sometimes ICT infrastructure programs focus on developing infrastructure, and sometimes infrastructure development is part of a larger economic initiative. Some programs are targeted at specific northern communities or regions, and others are jurisdiction-wide initiatives (see Appendix 6 for selected examples).

Overall, jurisdictions use a wide variety of programs to fund and promote ICT infrastructure in northern communities. Provincial and territorial programs are often designed to leverage federal programs, and regularly require projects to receive a portion of matching funding from multiple funding streams. Access to a range of funding programs supports the diverse needs that individual communities have when it comes to participating in the digital economy. However, it was noted that when matching funding is required, mismatched program intakes and multiple program applications with different requirements for the same ICT project can create undue burden on under-resourced northern communities. Further, there are disparities amongst jurisdictions on how ICT infrastructure is assessed, how projects are classified, and how project success is measured. The inconsistency in information and measurement makes it hard to compare the ICT infrastructure and relative success of associated programs between and within jurisdictions. Further, opportunities exist for greater coordination between programs at all levels of government to support common objectives.

4. Future Outlooks & Recommendations

The need to move goods has always been fundamental to economic success. As the digital economy grows, supplanting and transforming economic activities from the early 21st century, ICT is becoming the new highway on which Canada's digital goods and services move. No longer a separate sector, ICT infrastructure is a necessity for Canadians. Canada's north-south digital divide highlights how necessary ICT is to work and live in society. Learning from the limitations of the 2013 report, and taking into account the jurisdictional scan for this report, the following goals are proposed to support successful development of ICT infrastructure and the digital economy in the North.

4.1 Share

By sharing promising practices from community and government programs, jurisdictions across Canada can provide invaluable support for the entire North. In surveying attempts to bridge the digital divide, the OECD found that there was no single best way to expand ICT infrastructure to rural communities.[28] Instead, discussion and sharing of experiences was seen as key to helping jurisdictions compare ICT infrastructure and digital economy programs to avoid duplicating experiments or unsuccessful programs that others have already trialed. Likewise in Canada's North, when communities and jurisdictions learn from one another instead of re-inventing initiatives, more effort can be spent on implementation and on achieving success. **Within or between jurisdictions, establish a repository of promising practices and success stories for advancing the development of the digital economy in the North, moving beyond a discussion of ICT infrastructure speeds as an outcome on its own and focusing on community and jurisdictional outcomes in the digital economy.**

4.2 Fund

Funding programs like the CRTC's new broadband development fund are fundamental for ensuring ICT infrastructure delivers BTS across the nation and in the North. However, as the digital economy grows and evolves, the ability to access a wide variety of funding programs is important for northern success. In 2017, it was estimated that completely bringing the North's ICT infrastructure to parity would cost $2 billion dollars or more nationally.[29] The estimate is now between $6.5 and $50 billion, and the AGC has noted that current federal funding for last-mile connectivity is insufficient on its own to meet existing needs to connect the most rural 10% of Canadians.[30] To address such a large gap, especially in the North, spending must be targeted for maximum impact. Communities, not-for-profits, businesses, governments, and other groups all have different ICT needs. Dedicated infrastructure funding programs must be paired with complementary funding programs for addressing key components of the digital economy, especially since some of these components are often viewed as outside the core mandate of entities like the CRTC.[31] This kind of funding can support digital literacy programs, primary and secondary digital economy development, and ensuring government services are delivered effectively and equitably online to all Canadians wherever they live. Whenever possible, this funding should be provided in a flexible manner with low administrative burden to ensure those applying can focus less on the approval process and more on delivering program success. Therefore, the availability of the appropriate type of funding to support the digital economy in the North is just as important as having the appropriate amount of funding. **The report recommends the goal of creating a map of the northern funding ecosystem in each jurisdiction for ICT infrastructure and digital economy programming. This exercise should include a review of programs to ensure the funding available reflects local citizen,**

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[28] Bridging The Rural Digital Divide, OECD, 2018, p. 6

[29] Standing Committee on Industry, Science and Technology, 42ns Parliament, 1st Session, meeting No. 85, https://www.ourcommons.ca/DocumentViewer/en/42-1/INDU/meeting-85/evidence

[30] Auditor General of Canada, Connectivity in Rural and Remote Areas, par. 1.38, par. 1.50, http://www.oag-bvg.gc.ca/internet/English/att__e_43221.html

[31] CRTC, 2016, https://crtc.gc.ca/eng/publications/reports/rp161221/rp161221.htm

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business and government outcome goals, and are accessible, flexible, comprehensive, and coordinated.

4.3 Measure

There is a common saying that what gets measured gets done. Consistent measuring allows for better comparison of ICT infrastructure across jurisdictions and over time, and thus better assessments of the success of connectivity programs. Internationally, the OECD has called for better tools for monitoring the availability of ICT infrastructure to allow for the evaluation of how plans affect citizens, to determine resource allocations based on need or impact, to improve development planning, and to provide evidence for future strategic directions.[32] The state of ICT infrastructure data in Canada currently inhibits effective policy and spending decisions, since impact cannot be clearly measured. For real impact, all stakeholders must have an accurate understanding of what communities are actually experiencing. Without this, there is a real risk that money and effort spent to bridge the digital divide in the North will not deliver the outcomes that are hoped for.

At a minimum the following measures seem necessary to establish a baseline for measuring ICT infrastructure development in the North:

- The number of households and businesses in a jurisdiction.
- The appropriate data to assess the size and geographic location of communities that a jurisdiction's households and businesses are located in.
- The kinds of ICT infrastructure those households and businesses have access to (e.g. fixed or mobile broadband).
- The specific technology making up the ICT Infrastructure. Examples include:
  - Cable/DSL
  - Fibre optic
  - Microwave
  - Satellite
  - WiFi network
  - HSPA+ and/or LTE cellular
  - Other emerging ICT
- The real (not the advertised) speeds, both upload and download, on this technology in Mbps or Gbps.
- The price per Gigabyte (GB) of data transferred.

While the availability of this data is necessary to determine the effectiveness of ICT infrastructure plans, it is recognized that some jurisdictions may not currently have capacity to collect some or all of these data. For this reason, the report recommends each jurisdiction also identify ICT infrastructure measurement gaps and develop plans to close these in the future. This can include partnering with local

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[32] Bridging The Rural Digital Divide, OECD, 2018, p. 6

and First Nations governments, not-for-profits, and even directly with citizens to crowdsource data and assess need.

Beyond measuring basic ICT characteristics, setting and measuring meaningful outcomes for digital economy initiatives and programs are important components for success. Meaningful outcomes help policy makers ensure the work they are doing is delivering on digital economy growth for northern communities. As stated before, the 2013 report set the northern broadband standard based on a survey of the bandwidth needs of 2013 technology. This appeared to be a reasonable approach at the time, and other OECD countries have used it in the past as well.[33] However, both globally and in Canada's North, experience has made it clear that setting program output targets based on today's technology will likely lead to underestimating future needs. The same is likely true of the CRTC's 50/10 Mbps USO target for 2031. If the rate of increase for a basic standard of internet increases at the same rate over the next 12 years as it did between 2013 and today, 250/50 Mbps is likely to be a more accurate USO target. However, this is pure conjecture based on a rough extrapolation. Some urban households already have access to 1.5 Gbps (1500 Mbps) download speeds[34], and experience thus far suggests these speeds may become the norm in the future.

These moving speed goalposts mean that any targets and program outcomes should avoid using speed targets exclusively. Instead, outcomes should meaningfully connect to the ultimate program goal, to avoid a divergence between program outputs and rapidly evolving ICT infrastructure demands.[35] These desired outcomes for the North need to centre on economic and social success, defined with input from the communities, governments, and other stakeholder seeking to leverage the ICT infrastructure being built. B.C.'s Northwest Transmission Line was purpose-built in 2014 to achieve the outcome of opening up mineral deposits and support the development of new mining projects.[36] Likewise, ICT infrastructure and digital economy programs should target and measure specific desired outcomes. The key performance indicators of programs and initiatives should measure whether those outcomes are achieved, and adjust secondary targets like broadband speed or ICT technology accordingly. By ensuring programs and initiatives are purpose-built and measured based on the ultimate outcomes as opposed to speed targets, jurisdictions will help ensure the digital highways they build are responsive to tangible needs. By reporting the data on these programs, best practices can be established for which approaches lead to a successful digital economy in the North.

Regarding measurement, this report recommends the following goals to jurisdictions:

a. **Develop, measure and make available a basic, standardised set of ICT measurements and measurement methodology that accurately reflect the nature of connectivity in the North;**

[33, 21] Bridging The Rural Digital Divide, OECD, 2018, p. 7

[34] https://mobilesyrup.com/2018/08/20/bells-new-gigabit-fibe-1-5-internet-plan-promises-1-5gbps-download-speeds/

[35] Bridging The Rural Digital Divide, OECD, 2018, p. 6-8

[36] https://www.bchydro.com/news/press_centre/news_releases/2014/new-transmission-line-ready-to-power-northwest-bc.html

b. **Identify gaps in capacity to conduct accurate ICT measurement, note these gaps in available data, and develop a plan to address these gaps; and**

c. **Encourage policy makers and other program delivering entities to consider, measure, and report meaningful desired outcomes in their digital economy initiatives instead of focusing on ICT infrastructure speed or other secondary program output targets; ICT infrastructure should be purpose-built to ensure it addresses community or government needs.**
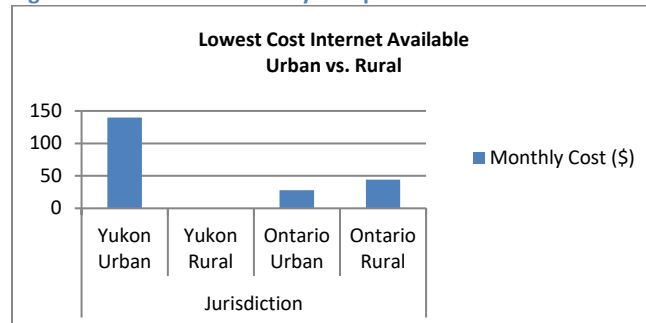
Conclusion

ICT infrastructure is a transformational technology which is now inseparable from the daily functions of Canada's economy. Given the reliance on ICT infrastructure, a northern community without high-quality, reliable, and affordable ICT is like a community without a highway. Cut off from the digital economy, these communities cannot engage effectively in a world that is constantly connected and conducts business online. However, if we build the digital highways the North needs, we can unleash the incredible economic potential that northern communities have. The report's success stories show what is possible, and the recommendations provide direction on laying the foundation for effective, measureable policies and programs to end the digital divide. Decisive action to build ICT infrastructure in the North will pave the way for communities to become full participants in the digital economy.

Appendix 1: Data Demonstrating the Digital Divide Between Canada's North and South

The CRTC has confirmed that, in general, urban households have access to lower broadband prices, more ISP choice, and a larger diversity of service types and speeds than rural households.[37] This is also true between urban households in the south and urban households in Yukon, Northwest Territories, and Nunavut. While indirect, this suggests that the north-south digital divide in ICT infrastructure and internet access observed in 2013 still exists today.

Figure 2. Price and Availability Comparison

Lowest Cost Internet Available Urban vs. Rural

■ Monthly Cost ($)

Communications Monitoring Report, CRTC, 2017, p. 267. Represents 25 Mbps download speeds. Yukon Rural has no 25 Mbps service.

The kind of internet Canadians are using is changing too, necessitating a review of what is considered "high-speed" and adding further evidence of a digital divide. In 2012, 5-9 Mbps was the most common advertised internet speed Canadians subscribed to, at over 40% of broadband subscribers.[38] In 2016, advertised speeds of 100 Mbps and higher are the fastest growing type of internet subscription, with all other speed tiers seeing negligible growth or decline. The 5-9 Mbps tier now accounts for less than 20% of subscribers, and it seems unreasonable to call it "high-speed" when speeds ten times greater are rapidly becoming the norm.

This reflects a migration by mostly urban consumers away from old, outdated technology to better services that are available to them. Between 2012 and 2016, the availability of 100 Mbps broadband for urban Canadian households grew from 40% to 98%.[39,40] However, in rural households, availability of the same speed grew from roughly 10% to 37%.[41,42] The migration from old, slower broadband to new speeds available in mostly urban, southern communities is further evidence of a digital divide. In fact, given the rapid buildout of faster Gbps speed connections in urban markets,[43] it is reasonable to state that in terms of ICT infrastructure, Canadians may face a bigger digital divide today than they did in 2013.

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[37] Communications Monitoring Report, CRTC, 2017, pp. 262-3, 266, 278
[38] Communications Monitoring Report, CRTC, 2017, p. 271
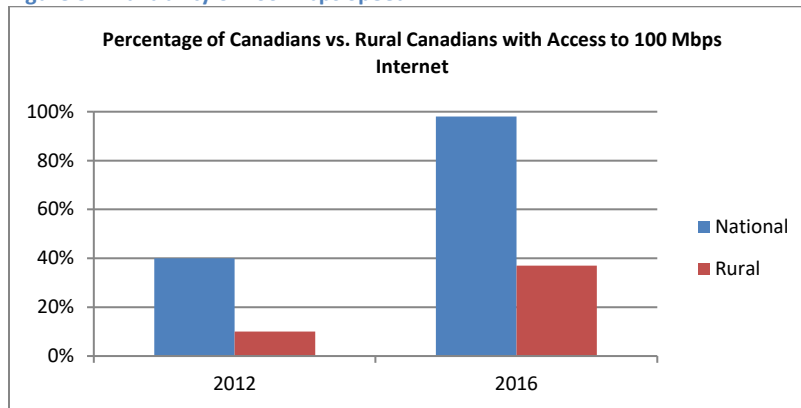[39] Communications Monitoring Report, CRTC, 2013, p. 181
[40] Communications Monitoring Report, CRTC, 2017, p. 285
[41] Communications Monitoring Report, CRTC, 2013, p. 181
[42] Communications Monitoring Report, CRTC, 2017, p. 285
[43] https://mobilesyrup.com/2018/08/02/bell-1-5-gigabit-speeds-august-ontario-canada/

Figure 3. Availability of 100 Mbps Speed

Percentage of Canadians vs. Rural Canadians with Access to 100 Mbps Internet

Communications Monitoring Report, CRTC, 2013 and 2017.

Finally, given that the available speeds reported by the CRTC rely on hypothetical maximums provided by industry, actual broadband experience through crowd-sourced speed tests may provide a more accurate picture of what real speeds are being achieved by Canadian households. In 2016, the CIRA found the average download speed in rural communities was 25% lower than in urban communities.[44] This speed is inflated by "rural" communities with good ICT infrastructure due to close proximity to urban centres. In the three northern territories, large communities dominate the test data even more. For instance, Whitehorse was a dominant test submitter in the Yukon, with an average of 6.68 Mbps download speed. The CIRA estimates that other rural northern communities are likely significantly below the speeds of their comparatively urban counterparts.[45] These speed tests provide perhaps the most striking evidence that the digital divide in the North that was observed in 2013 persists today.

[44, 13] Canada's Internet Performance: National, Provincial And Municipal Analysis April 2016, CRIA, pp. 6, 13

Appendix 2: Success Stories in the Primary Digital Economy

Data Centres – Newfoundland Labrador

In some regions of Labrador where reliable ICT infrastructure exists for high-speed broadband, data processing centres have been able to leverage the low hydro rates and cold temperatures to grow the primary digital economy in northern communities. These companies specialize in hosting high-density computer hardware requiring substantial access to both power and cooling. For example, there are currently three data companies operating in Labrador West and one in Happy Valley – Goose Bay, and there is continued private sector interest in further development. Despite the potential to expand this type of business in Labrador, some communities are expressing concerns about noise pollution, high power consumption, and the large footprint of facilities. Municipal regulations are being reviewed to address concerns. While the jobs created by these data centres are high-paying ($75,000 average annual salary), it is important to note that such development may not always be welcomed by or appropriate for every community. Within communities hosting data centres, some residents have questioned if these entities are the best use of electricity. Concerns have been raised over noise from data centres as well. As with much of the potential growth in the primary digital economy, this example illustrates a theme found across jurisdictions that northern citizens need to be given opportunities to gain information about and be involved early in the approval of projects that have large impacts on their communities.

Internet Service and Information Technology - Alberta

Overall, the scan showed that rural growth in the primary digital economy largely depended on ICT infrastructure targeted to the technology and innovation sector. For instance, Arrow Technology Group GP Limited, an information technology (IT) and internet service provider (ISP), and Buried Glass Inc. are both utilizing federal Connect to Innovate funding to provide high-speed internet services to a combined 28 communities (5 of which are Indigenous), and 145 institutions in northern Alberta. In this example, the growth of digital citizens and the jobs and economic activity created in the primary and secondary digital economy will be directly tied to the provision of the ICT infrastructure in these communities. It is also one of several examples demonstrating that funding for ICT development was critical to growing the digital economy in the north.

Tech Sector Ecosystem – British Columbia

In Prince George, B.C., the availability of a variety of ICT infrastructure has allowed a growing primary digital economy to expand in the city. ICT infrastructure in the city includes city-wide WiFi internet, consistent mobile internet coverage, a fibre optic network, and widely-available high-speed fixed broadband. The variety of ICT has allowed for growth in a number of areas in the primary digital economy, including software-as-a-service companies like Sparkgeo and eSports provider Volcanic Gaming. The different ICT infrastructure needs of the companies within Prince George's primary digital economy demonstrates that the type and kind of ICT infrastructure creates different opportunities for development.

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Appendix 3: Success Stories in the Secondary Digital Economy

eCommerce – Northwest Territories

The Sahtu Region of Northwest Territories has seen growth in eCommerce with SMEs. Businesses in all five of the Sahtu communities have begun to use ICT infrastructure to conduct business on-line. The Sahtu Region found that as southern-based businesses, organizations, distributers and manufacturers become more and more integrated into the digital economy, they needed to leverage ICT infrastructure in order to work with those that supply goods and services from the south. The Sahtu Region is beginning to assist local businesses by providing training courses on computer troubleshooting, social media marketing and on-line business platforms to sell goods. As with Ontario's NEOnet, the Sahtu Region's eCommerce initiatives are focused on economic outcomes and competitive integration into the broader digital economy for local businesses.

eCommerce - Ontario

The most prevalent adoption of ICT infrastructure into traditional sectors across jurisdictions appears to be in the area of electronically-facilitated business (eBusiness or eCommerce). Through the use of ICT, traditional retail and service businesses add a digital component to their operations, or transition into digital delivery entirely. The not-for-profit North Eastern Ontario Communications Network (NEOnet), with support from the Federal Economic Development Initiative for Northern Ontario, has helped over 500 businesses in its service area connect to the global marketplace through the Broadband for eBusiness and Marketing (BEAM) program. Small-and-medium-sized enterprises (SMEs) are provided with support to define business objectives and identify the appropriate eBusiness solutions to meet them. NEOnet then funds up to 75 percent of eligible costs (up to $5,000) to procure and implement the identified ICT solutions. In addition, NEOnet introduced an "aftercare" program of ongoing monitoring and support at six-month intervals to measure business outcomes and build capacity. Other organizations throughout northern Ontario, including Blue Sky Net and the Sault Ste. Marie Innovation Centre, offer BEAM programs.

Forestry – British Columbia

ICT infrastructure has also transformed how business is done in the forestry sector. From surveyor drones operated over mobile broadband to remote supply chain analytics, the Canadian forestry sector is rapidly adopting ICT. In turn, this adoption is driving growth in the secondary digital economy in northern communities as new jobs and companies emerge to meet these needs. For instance, TimberTracks Inc., a SME out of Prince George, B.C., has begun helping forestry companies move their data and analytics onto a digital platform. The TimberTracks software application aggregates the harvesting supply chain operating attributes, productivities, and costs broadly across the B.C. forestry sector. The objective of TimberTracks is to data mine broad operational datasets to identify opportunities to improve efficiency and sustainability of the supply chain. TimberTracks recently developed a mobile application that includes electronic timesheets to improve data entry and productivity metrics, a financial analysis tool, and the ability to leverage GPS data to track cycle times in order to find efficiencies in the supply chain. The Northern Development Initiative Trust (NDIT), a legislated economic development entity supporting B.C.'s northern communities, provided funding and

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business advice to TimberTracks to support mobile application development. Industry knowledge and appropriate support has allowed TimberTracks to leverage ICT infrastructure to provide value to forestry clients while creating jobs in the North.

Tourism – British Columbia

Tourism across Canada's North is also increasingly benefitting from ICT infrastructure. Online marketing, emergency services, and other operational aspects of tourism are leveraging ICT infrastructure to grow or strengthen sector competitiveness. For instance, DestinationBC and the Northern BC Tourism Association have partnered with Google to offer over 1500 km of virtual trails for thirty destinations through Google Maps. In addition to marketing tourism opportunities in northern B.C. across the globe, the technology allows tourists to have a safer and more enjoyable experience as they can more accurately plan their visit. DestinationBC also leverages the virtual trails to promote links to nearby services and accommodations, further promoting northern tourism businesses and increasing economic activity in northern communities.

Appendix 4: Success Stories in Digital Government Services Sector

Backbone Infrastructure – Yukon

Larger ICT infrastructure projects are being deployed in several jurisdictions to address the "backbone" ICT infrastructure that connects last-mile infrastructure to the world. The Government of Yukon is constructing a 777 km long fibre backbone network between Dawson City, Yukon and Inuvik, NWT, where it will connect to the NWT's recently completed Mackenzie Valley Fibre Link. This new fibre link will close a 4,000 km long fibre loop through Yukon, NWT and northern B.C. which will ensure more robust and reliable service to communities in all three jurisdictions, while at the same time enhancing satellite services in Nunavut. The provision of redundancy to these northern communities will result in security of service for the commercial sector, reliable access to government eServices, and other online social and education programs for citizens. These benefits are intended to result in an improved investment environment in Canada's north. The line is a $79 million investment in connectivity in Canada's North and is supported financially through the Government of Canada's Connect to Innovate program, as well as Infrastructure Canada's Small Communities Fund.

eHealth - Alberta

Once ICT infrastructure is in place, major government services can be delivered effectively and efficiently to connected communities in the North. In Alberta, the First Nations Technical Services Advisory Group (TSAG) is working in partnership with Alberta Health and Health Canada to help integrate FN and provincial health services through eHealth. Complete electronic community health and immunizations records and a province wide-immunization registry were implemented for all First Nations in Alberta with band or federal nursing - a first in Canada. In 2017, TSAG also achieved the implementation of real-time integration (RTI) between point of care immunization systems and the provincial immunization repository. This is another first in Canada, on or off reserve, and a major step towards achieving a key objective of Canada's Immunization Strategy. For communities that implement RTI, it will mean complete immunization records for their children will be available to any health service provider in hospitals, doctors' offices or public health clinics on or off reserve, through Alberta's provincial electronic health record, Netcare, regardless of where the immunization was given. This means timely identification and fewer missed opportunities for children due for immunization and higher immunization rates. RTI functionality is now being rolled out across First Nations communities in Alberta. The system vendor is OKAKI, an Alberta-based public health informatics social enterprise.

eLearning - Alberta

eLearning has become a fundamental component of the delivery of education in Alberta's northern communities. Most northern Alberta colleges use broadband to provide some of its core IT services using cloud technology. These institutions host their digital library, email and several other services with third party cloud providers. This is only possible with reliable high-speed connectivity. Students and employees are provided with remote access to login to the educational institution's services. This requires that both parties have reasonable bandwidth to support the activities. The combination of digital connectivity, interactive learning technologies and on-line, integrated learner support systems

used by the colleges in northern Alberta are critical for achieving the economies of scale required to support communities.

Municipal Broadband – British Columbia

The most fundamental example of government service through ICT is the direct provision of internet access through municipal broadband internet. Municipal broadband lays the foundation over the "last-mile" connecting between the broader internet and homes or businesses. This infrastructure then enables community members to access the entire digital economy, including other government services that are delivered through broadband. The Village of Granisle in B.C. has provided a municipal broadband service to citizens since 2007. Since then, the service has grown to include fibre optic infrastructure, mobile broadband, and WiFi. A mining town that was "supposed to disappear" after mining left the area, municipal broadband allows community members to access critical services that were never planned for the community. Electronically-delivered healthcare (eHealth), electronically-delivered education (eLearning), personal and business communications, and civic information are all offered over municipal broadband. Granisle leveraged the Connecting British Columbia program to help fund the creation and growth of their municipal broadband, and it has become a fundamental service provided to citizens. The OECD has found that bottom-up models of developing ICT infrastructure, including through funding municipal infrastructure, has been an effective tool for ensuring connectivity in rural communities . Granisle's municipal ICT infrastructure is a specific example of the success of these bottom-up development models. Municipal broadband is present in many forms across jurisdictions, with different business cases and different levels of private-sector involvement underpinning them.

Appendix 5: Selected Promising Programs in the Primary and Secondary Digital Economy

Innovation Hubs – Yukon

Several jurisdictions are creating "innovation hubs." These hubs tend to be collections of resources designed to help leverage ICT infrastructure and other resources to advance economic development. One of these hubs is the NorthLight Innovation Hub in Whitehorse, Yukon, an initiative in partnership with Yukon, Canada, Yukonstruct, Yukon College, and NVD (a private sector partner) to develop a hub that includes a makerspace, a co-working space, and support from Yukon College to develop the innovation ecosystem in Whitehorse. The hub offers a unique collaborative space where people come to network, learn, and share access to various services, tools and technologies with the hope that this will lead to economic growth and diversification. One of the intended outcomes of the NorthLight Innovation Hub, and similar hubs across the country, is the development of entrepreneurial ventures in the primary and secondary digital economy through knowledge transfer and the provision of resources such as high-speed broadband.

Strategic Planning – British Columbia

Northern communities can promote the growth of their digital economy by setting strategic direction and working towards that as a development outcome. An example of this is the District of Tumbler Ridge in northern B.C. Traditionally a mining and resource community, Tumbler Ridge has had a small remote teleworking community since as far back as the 1980s. Today the community offers highly reliable ICT infrastructure that allows remote workers to participate in the digital economy while enjoying quality of life advantages over more expensive southern urban centres like Vancouver or Victoria. In an effort to diversify the economy, Tumbler Ridge highlighted virtual entrepreneurs as a key component of its 2018 economic development strategic plan. The community identified strategies to attract and support virtual entrepreneurs to grow both primary and secondary digital economies. With this goal in mind, coordinated marketing and entrepreneur support programs will be implemented and funding opportunities will be actioned over the next three years to ensure Tumbler Ridge capitalises on the advantages of its ICT infrastructure.

Appendix 6: Selected Promising Programs for Building ICT Infrastructure

Province-Wide ICT Funding - British Columbia

Connecting British Columbia is a province-wide connectivity program that also serves northern communities. Administered for the province by NDIT, the program helps pay for infrastructure required to deliver high-speed internet connectivity to rural and remote areas of the province. Communities, not-for-profits, and companies building ICT infrastructure can apply for funding towards building connectivity throughout the province. The current intake for the program focuses on helping communities develop ICT infrastructure strategies, on funding last-mile broadband projects, and on developing ICT infrastructure to connect communities to the provincial internet backbone. The first intake of the program resulted in more than 43,000 homes and businesses receiving high-speed internet in rural and remote areas across B.C. The current program objective is to accelerate the delivery of high-speed internet connectivity at minimum target speeds of 50 megabits per second (Mbps) down and 10 Mbps up to homes and businesses in rural communities in B.C. NDIT provides educational resources for communities to understand broadband and how to engage with the program, as well as videos from communities that are having success developing and leveraging ICT infrastructure.

Province-Wide Strategy on ICT - Alberta

The proposed Alberta Broadband Strategy is another example of a jurisdiction-wide initiative. While most Albertans have access to basic broadband services, the provincial government is fully aware that demand, speed, and performance expectations are increasing. In response to the CRTC decision to designate broadband as a BTS, and due to the varying levels of broadband connectivity in Alberta, the Government of Alberta began working on developing policy options for a Provincial Broadband Strategy in late 2017. Recognizing that reliable broadband connections will enable jobs and promote economic development and diversification; enable access to education, agriculture, health, and tourism; and ensure long-term viability for rural and remote communities, the Provincial Broadband Strategy will aim to:

- Identify measurable targets for broadband speeds in Alberta.
- Close the urban-rural divide in access to broadband services.
- Work towards ensuring all Albertans have access to high-quality, reliable, and affordable broadband services.
- Accelerate Alberta's ability to participate in the global knowledge-based economy and take advantage of emerging digital innovation opportunities.

The Government of Alberta engaged with representatives from municipalities, Indigenous communities, the small business community, telecommunications companies and internet service providers, and others, to learn how the future policy can reflect the needs and best interests of people living in Alberta. The first round of engagement on a provincial broadband strategy occurred from January 2018 to April 2018, and a second round of engagement began in October 2018 and wrapped up in November 2018.

Targeted ICT Funding - Quebec

Société du Plan Nord (SPN) is responsible for the integrated and coherent development of the area in northern Quebec covered by the Plan Nord project. A part of the SPN's most recent plan involves

improving telecommunications infrastructure in the North to provide the necessary infrastructure for economic development in the region. Within this mandate, the SPN plays a coordinating role to ensure that northern ICT infrastructure is developed effectively and in response to the needs of local communities. An example of this coordination can be found in the development of ICT infrastructure in the Basse-Côte-Nord region. As part of the regional strategy, the SPN led regional consultations, helped develop a shared regional vision for ICT development, and coordinated project funding. Through the deployment of a regional strategy, SPN secured numerous advantages for communities to ensure that the ICT infrastructure developed was better suited to the needs of the region than had been proposed before the SPN became involved. As the new infrastructure is deployed, communities across the Basse-Côte-Nord region will be able to effectively engage in the digital economy.

Other ICT Funding - Federal

At a federal level, the government of Canada has numerous funding programs targeting ICT infrastructure in the North. The Connect to Innovate program will provide $500 million in funding between 2016-2021 to help remote communities reach a minimum of 5 Mbps download bandwidth. Other funding includes targeting next generation rural broadband ICT through the Strategic Infrastructure Fund, the New Paths of Education program for First Nations school connectivity, and ICT infrastructure funding through the Strategic Investments in Northern Economic Development. In addition to specific ICT funding, general federal funding exists as well that can be used for ICT infrastructure in northern communities. For instance, the Investing in Canada Infrastructure Program contains a Rural and Northern Communities Infrastructure stream of funding. Under this stream, $2 billion in funding for infrastructure development will be made available in the North by 2027. With matching funding at the provincial-territorial level, ICT infrastructure initiatives can receive funding through this program.