

# The Rebuild

*Going Digital and the Role of  
Canadian Telecom in a Post-  
COVID Future*



November, 2020

Research by



The Information and Communications  
Technology Council

# Preface

The Information and Communications Technology Council (ICTC) is a not-for-profit, national centre of expertise for strengthening Canada’s digital advantage in a global economy. Through trusted research, practical policy advice, and creative capacity-building programs, ICTC fosters globally competitive Canadian industries enabled by innovative and diverse digital talent. In partnership with an expansive network of industry leaders, academic partners, and policy makers from across Canada, ICTC has empowered a robust and inclusive digital economy for over 25 years.



## To cite this paper:

Cutean, A., McLaughlin, R., “The Rebuild: Going Digital and the Role of Canadian Telecom in a Post-COVID Future” (November 2020), Information and Communications Technology Council.

Researched and written by Alexandra Cutean (Senior Director, Research & Policy) and Ryan McLaughlin (Senior Economist & Research Analyst) with generous support from the ICTC Digital Think Tank team.

# TABLE OF CONTENTS

<b>Introduction</b>	<b>04</b>
<b>Section I: Telecommunications and Connectivity in Canada</b>	<b>06</b>
Data Consumption	06
Internet Penetration Across Canada	08
Internet Use During COVID-19	09
<b>Section II: Connectivity Needs in a Post-COVID Future</b>	<b>11</b>
Internet-Enabled Sensors and Internet of Things	12
Low-Power Wide-Area Networks	13
5G: The Backbone of a Hyper-Connected and Smart Future	14
<b>Section III: The Future of Work</b>	<b>19</b>
Remote Work and the Emergence of "Zoom towns"	19
Bridging the Digital Divide in Canada	21
Connectivity Outside of City Centres	22
Satellite Technology and Expanding Connectivity for all Canadians	24
<b>Conclusion</b>	<b>26</b>
<b>Endnotes</b>	<b>27</b>



# INTRODUCTION

As the COVID-19 pandemic and economic crisis continues to unfold across Canada, Canadians and Canadian businesses alike are transitioning toward the digital economy faster than ever before. The overall economy suffered a significant GDP and employment contraction since March, and despite an employment rebound as lockdowns and stay-at-home measures began to lift, one million jobs remain lost due to the pandemic.[1] Yet, amid this harsh reality, the digital economy has proven resilient. It has been impressively insulated from the COVID-19 crisis and ICTC research finds that employment in the digital economy is well above pre-pandemic levels.[2]

As Canadians increasingly move toward consuming more services online, working remotely, and adopting emerging technologies highly dependent on data, it is important that Canada's telecommunications infrastructure is affordable, accessible, and up to date. Gaps persist in access across provinces, most starkly between rural and urban communities. Policies that strive to close these gaps are critical, as are next-generation technologies that will drive economic and labour market growth. In today's increasingly digital world, strong telecommunications infrastructure is key. Section I of this paper examines the current state of telecom services in Canada, including data consumption trends compared to OECD peer nations, internet penetration across Canada and between provinces, and the extent to which internet use has changed during the COVID-19 crisis.

Section II outlines the potential technological needs and opportunities in post-COVID Canada, with telecommunications infrastructure at the core. Internet-connected sensors and Internet of Things (IoT) can form the bedrock of numerous smart applications, and Low-Power Wide-Area Networks can act as low-cost connectivity solutions to service some of these developments. At the same time, a variety of other innovations will rely on the inherent strengths and unique attributes of 5G mobile. This section concludes with the value proposition of coupling 5G with emerging

technologies such as augmented and virtual reality (ARVR), as they shape the next generation of digital services. Digital health solutions, autonomous vehicles and drones, and lights-out manufacturing are just a few examples of 5G's value proposition in a fully connected future.

Finally, Section III dives into the future of work for Canadians. COVID-19 has accentuated and accelerated the adoption of many existing opportunities, namely the shift toward large-scale remote work. Technology firms around the world have announced a permanent transition toward partial or universal remote work. These include the American FAANGs (Facebook, Apple, Amazon, Netflix, and Google) as well as Canadian giants like Shopify. Many others are expected to follow in their footsteps. In May 2020, Transport Canada also became the first federal department to make its COVID-inspired remote work policy a permanent fixture.<sup>[3]</sup> For these organizations and many others, telework is no longer the exception but the norm. Taking this digital-first reality into account, renewed efforts to close the digital divide in Canada are underway, with access, equity, and affordability comprising core priorities.

# SECTION I: TELECOMMUNICATIONS AND CONNECTIVITY IN CANADA

## DATA CONSUMPTION

The number of mobile subscriptions by country serves as an indicator of overall mobile service proliferation. In Canada, despite a growing digital economy, fewer total mobile subscriptions are noted per capita compared to other countries in the OECD.

Simultaneously, Canadians are also found to use less data per mobile subscription than other OECD countries. While the average data usage across the OECD is 2.8GB per mobile subscription, in Canada, this is just 1.5GB. The average Canadian consumes roughly half the data of the average person in the OECD, per subscription.

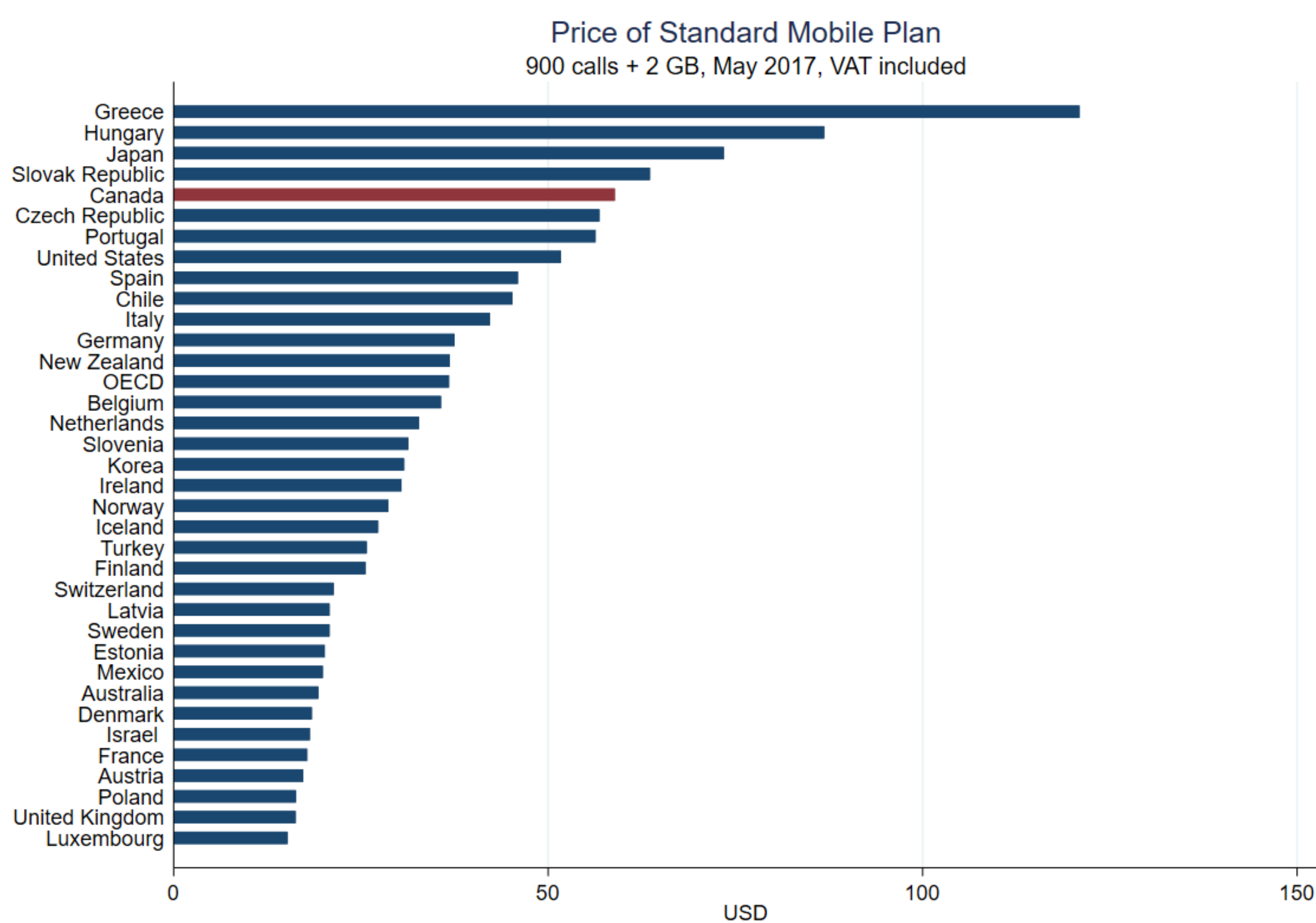


Figure 1. Cost per mobile plan, OECD (2017)

The cost of telecommunications services play a role in data consumption and use. Other geographically large countries like Australia (which also has lower average



population density than Canada) are able to offer robust data plans to subscribers at a lower cost. According to the most recent data available of this nature,[4] the cost of mobile services[5] in Canada are the fourth highest in the OECD.

Mobile broadband subscriptions per 100 inhabitants is another indicator tracked by the OECD, as a time-series variable across its 36 member countries. This indicator is an important proxy for mobile data penetration—it picks up individual data plans used on smartphones as well as mobile subscriptions used by Internet of Things (IoT) devices (this is why the value often exceeds 100). By 2018, the average number of mobile broadband subscriptions was estimated to be 110 per 100 inhabitants across all OECD countries.[6] Although it is likely that this average has changed in the subsequent two years, at the time, Japan ranked highest, with 172 mobile broadband subscriptions per 100 inhabitants, while Canada placed 30th with only 76 mobile broadband subscriptions per 100 inhabitants. In contrast, the United States placed 4th, with 144. Figure 2 provides a comparison across different OECD member states over the past 10 years, showing growth in mobile broadband subscriptions.

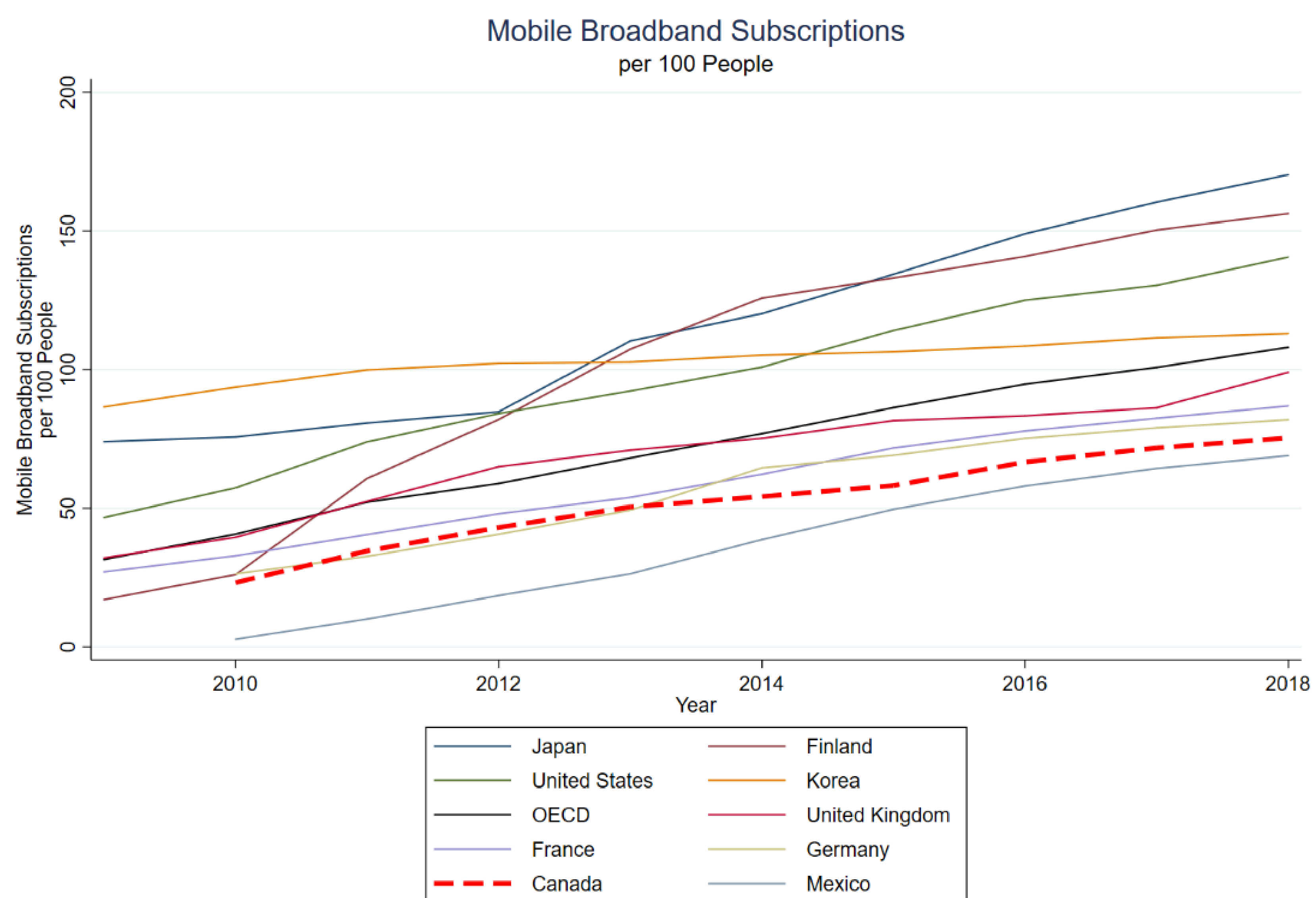


Figure 2. Mobile Broadband Subscriptions per 100 Inhabitants, time series (OECD, 2017)



## INTERNET PENETRATION ACROSS CANADA

Compared to peer nations, Canada has a high proportion of the population connected to the internet. This inherent feature bodes well for Canada in a future where many services, jobs, and educational opportunities require internet access. According to the World Bank, in 2017 (the most recent complete data available),<sup>[7]</sup> over 91% of Canadians were considered active internet users. This figure is among the highest in the world, surpassing the US (76%), Australia (87%), and New Zealand (88%).<sup>[8]</sup> Only certain Northern European countries and Korea surpass Canada in this measure.

### Share of the population using the Internet, 2017

All individuals who have used the Internet in the last 3 months are counted as Internet users. The Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV etc.

Our World  
in Data

World

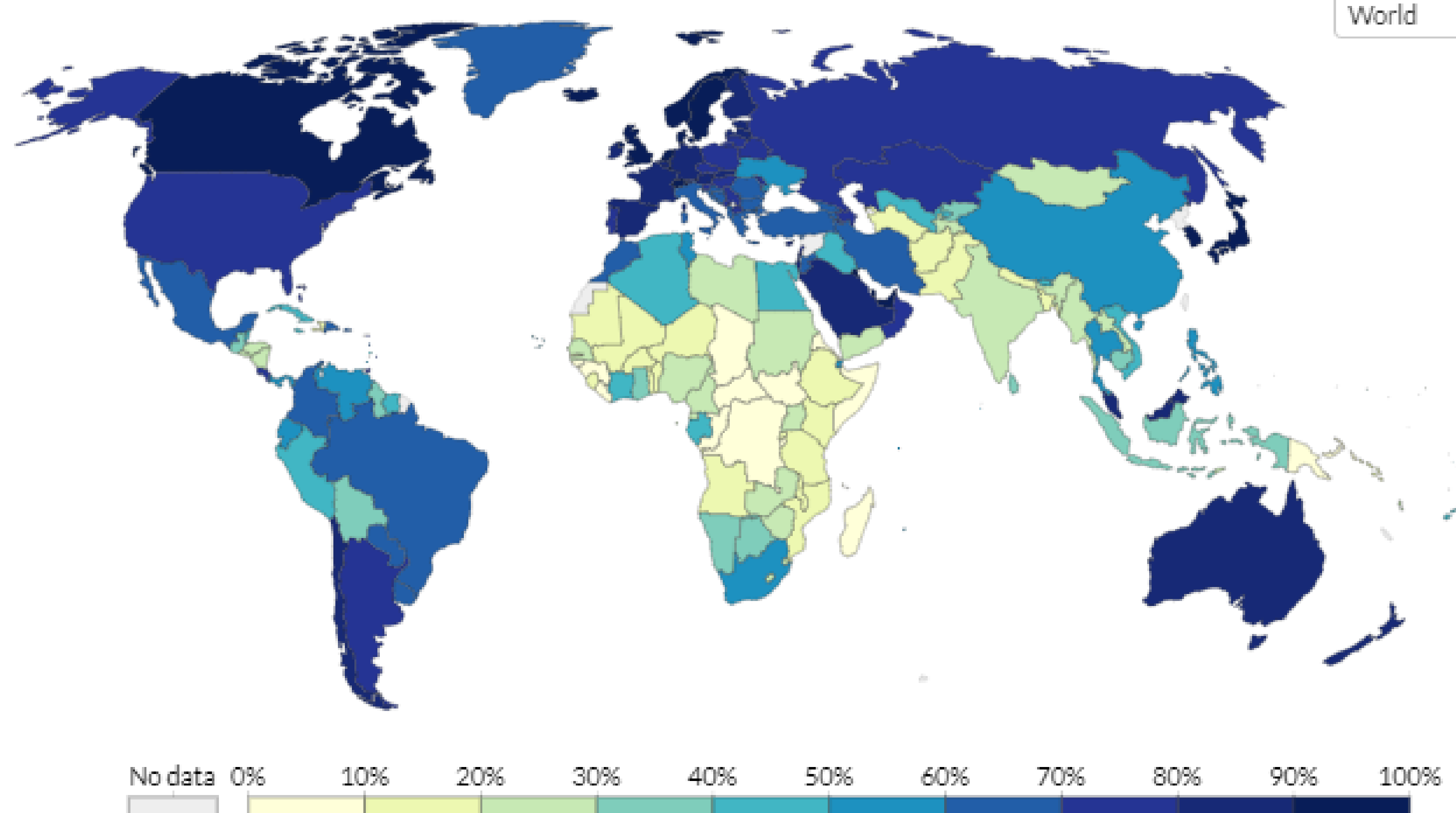


Figure 3. Share of Population Using Internet (World Bank, 2020)

Historically, internet usage varies within Canada by province and by demographic. Although COVID-19 has ramped up usage across Canada, according to the Canadian Internet Use Survey by Statistics Canada completed in 2018, Alberta and British Columbia were home to Canada's most active internet users. Among the small portion of Canadians without home internet access at the time, the most commonly stated reasons were the cost of internet service (28%), the cost of equipment (19%), and the unavailability of (reliable) internet service (8%).

In addition to working remotely (30% of employed Canadians reported using the internet for at the time of this survey), [9] the Canadian Internet Registration Authority (CIRA) finds that Canadians use the internet for a wide variety of reasons. The top online activities are checking email (90%), online banking (71%), social media (60%), checking the news (58%), and online shopping (50%).[10]

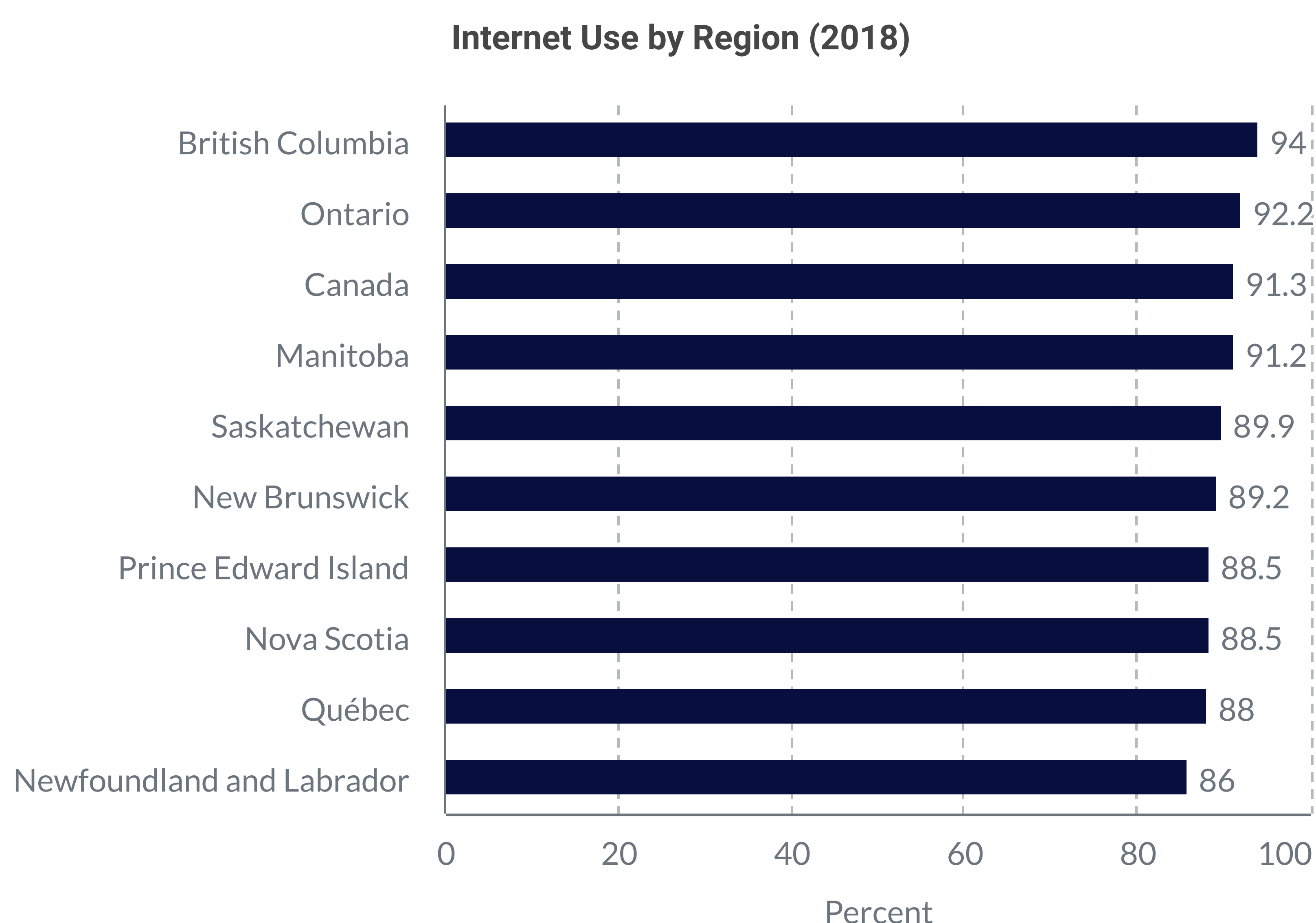


Figure 4. Internet Use by Region. Statistics Canada Data, ICTC Analysis, 2020.

## INTERNET USE DURING COVID-19

During the COVID-19 pandemic, internet use ticked up quickly. Global experts estimate that around the world, total internet traffic grew by 40% to 60% during the Spring 2020 lockdown period, with access to newspaper sites, video chat applications, gaming, and home-based work and learn programs driving this increase. [11] The surge in demand seen during daytime weekdays also caused many telecommunications providers to make infrastructure upgrades to address growing

network congestion. In response, many telecommunications companies engaged in “traffic shaping.” This is a form of bandwidth management that involves modifying the speeds of different kinds of data and applications to reduce network congestion. For example, this can involve slowing large downloads for video games and operating system updates in favour of bandwidth for video conferencing applications. During the global lockdown of Spring 2020, Netflix and Amazon Prime both reduced the quality of their streamed video content in some countries to accommodate the surge of remote workers requiring bandwidth.[12]

In Canada, during a House of Commons committee meeting in May, Rogers Communications reported that client internet usage had increased by more than 50%, voice call usage on wireless networks was up by 40% and 1-800 toll-free calls grew by more than 300% compared to pre-pandemic levels.[13] During the same time period, Telus Communications also noted consistently experiencing four times the network traffic of its busiest day pre-COVID,[14] and Cogeco Communications, a telecommunications firm based on Montreal, noted a 60% growth of internet service during the day, along with a 40% boost in traffic for video on demand, and 20-40% growth in video streaming services.[15]

With the spread of COVID-19, internet usage began growing rapidly in rural regions as well. Xplornet Communications Inc., the largest rural-focused internet provider in Canada, said that by May 2020, it saw a 30-40% increase in daytime use among rural Canadian homes.[16] However, internet quality is far from equal for Canadians living in urban versus rural areas. Although the CRTC recommends that every household in Canada have access to download speeds of at least 50 Mbps, research by CIRA in August 2020 found the median download speed in rural Canada to be 5.96 Mbps.[17]



## SECTION II: CONNECTIVITY NEEDS IN A POST-COVID FUTURE

While many businesses recognized the value of digitization prior to COVID-19, the growing importance of digital capability quickly took the spotlight. COVID-19 brought significant growth in employment within the Canadian digital economy. After a long but gradual upward trend in the representation of digital workers in the overall economy, the pandemic and subsequent lockdowns spurred the digital economy's portion of all economic activity to rise from 10% to 11%.

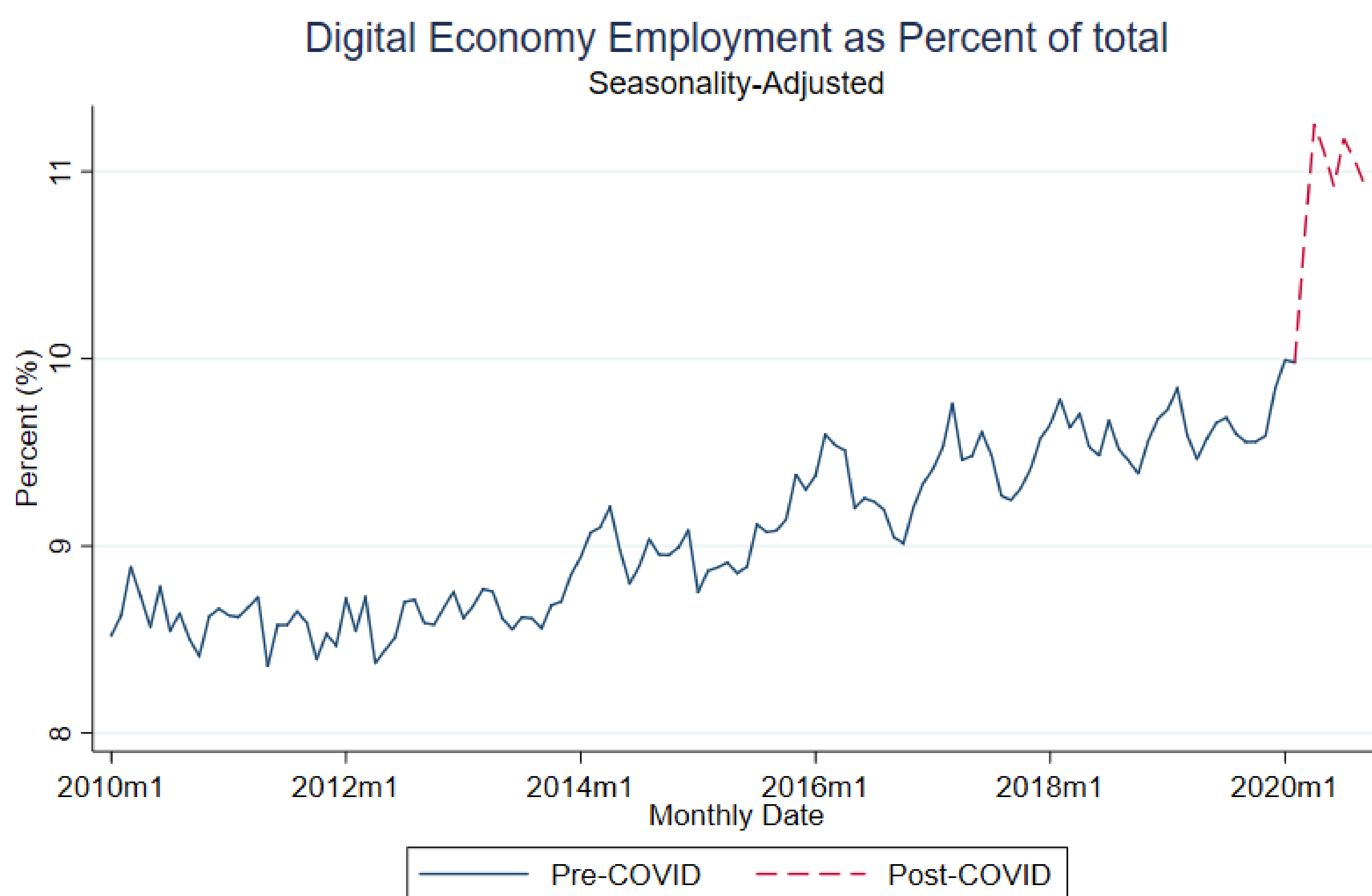


Figure 5. Digital Economy Employment as a Percentage of Total. Statistics Canada LFS Data, ICTC Analysis, 2020.

The magnitude of recent shifts toward the digital economy may be partly temporary in nature. If COVID-19 restrictions completely end in 2021, it is possible that traditional industries such as food and accommodation may yet recover to pre-pandemic levels. However, it is also possible that many other shifts in consumption behaviour brought on by COVID-19 may be permanent. In May 2020, e-commerce sales in Canada totalled

\$3.9 billion—a 99.3% increase since February (\$2 billion).[18] During this period, Statistics Canada reported a 35% increase in the time spent playing video games among Canadians aged 15-49.[19] More broadly, internet use saw a surge of 75% among this age group.[20]

In the Spring of 2020, day-to-day online activity in Canada was so high that daily internet traffic resembled peaks previously witnessed only on Sunday nights and weekday evenings.[21] According to the Canadian Network Operators Consortium (CNOc), peaks that were previously seen only after 7:00pm were evident from lunchtime until 9:30pm.[22] OpenVault found that daily broadband usage in the US on August 1st, 2020 (15.196 gigabytes) was lower than its peak on March 28th, 2020 (17.417 gigabytes), but still significantly higher than pre-pandemic levels (peaking at 13.564 gigabytes on February 17th, 2020).[23] More recent data on Canadian household internet usage is not available.

The COVID-19 crisis has highlighted the resiliency of the digital economy and simultaneously the urgent need for Canadian businesses to digitize operations and prioritize online goods and services. The strong performance of heavily tech-weighted stock indices like the S&P 500 are a testament to this reality. Due to the relative resiliency of large tech-focused firms, several stock indices remain high, despite considerable drops in GDP and a surge in small-firm bankruptcies (which are not represented in these indices). The surge in prices for FAANG stocks (Facebook, Apple, Amazon, Netflix, and Google), for example, may suggest the notion of a permanent shift to online economic activity. With this shift comes the continued proliferation of digital businesses, remote work, and the acceleration of remote education and digital learning opportunities. The success of all of these elements—which will have to operate simultaneously—depends in large part on strong, reliable, and accessible telecommunications infrastructure.

## **INTERNET-ENABLED SENSORS AND INTERNET OF THINGS**

Sensors and the Internet of Things (IoT) are foundational inputs that can support a wide range of downstream next generation technologies. The Internet of Things refers to the proliferation of internet-connected objects that are often embedded with



sensors and designed to measure a specific outcome. IoT can be applied to numerous sectors and industry verticals, and it can be an effective and inexpensive method of collect different types of data. When deployed on a large scale, internet-connected sensors and IoT are key contributors to an increasingly connected and smart future.

Smart parking stalls represent a current-day and relatively widespread example of IoT in action. An IoT device that is embedded into or adhered onto the pavement can send information to a centralized app, reporting whether a parking stall is occupied or vacant. Drivers that use such an app will be able to move directly to the vacant stall, rather than driving around searching for a spot (a process that increases emissions, traffic congestion, and wastes time). This is an instance where IoT can easily be used to make parking more effective and efficient.

Elaborating on the example of smart parking, in San Francisco, where 19,250 parking spaces were monitored earlier this year,[24] a demand-management technique similar to Uber's "surge pricing" is applied to incentivize users to move toward less in-demand stalls. A subsequent study by the city found that the use of connected sensors to facilitate this behaviour led to an increase in parking revenues for the city, totalling \$1.9 million per year and a 43% decrease in the time spent by drivers looking for parking spaces.[25]

While smart parking stalls represent a relatively simplistic application of sensors and IoT at work, such developments will become increasingly important when autonomous vehicles become widespread. In this environment, the vehicle will need to be able to communicate with the built environment to determine both routing and parking, without human involvement.

## **LOW-POWER WIDE-AREA NETWORKS**

Low-Power Wide-Area Networks (LPWANs), including LoRaWAN and Sigfox, are important telecommunications technologies for IoT devices. LPWANs are particularly effective in instances where relatively small packets of data are being transmitted (LPWAN supports data packets 10-1,000 bytes).[26] Battery life is also a key



consideration for internet-connected sensors, and because LPWAN technology is most effective in small data transfer, it can operate efficiently for up to 10 years on a single charge.[27]

Again, in the case of the smart parking stall, very small trickles of data suffice (sometimes as little as a single bit per minute, indicating the binary presence of a vehicle or not). At the same time, signals must be transmittable through steel and concrete, if used in an underground parkade. In these instances, high-quality telecom infrastructure like 5G is unnecessary—as the data transmitted requires neither low latency, high bandwidth, or high reliability—and LPWANs are perfectly suitable. LPWANs also consume very little power, reducing the need for costly battery changes. Because these networks are inexpensive to build and maintain, and have long signal ranges,[28] they are easy to install and maintain, and are relatively inexpensive.

## **5G: THE BACKBONE OF A HYPER-CONNECTED AND SMART FUTURE**

While LPWANs are appropriate for many basic IoT applications, 5G remains a critical infrastructure for enabling an advanced hyper-connected world. Parking stall sensors may thrive with LPWAN, but the kind of IoT used in a smart manufacturing facility, for example, will rely on 5G.[1] In the case of (autonomous) robots, these devices are moving in real time and require ultra-high reliability, coupled with low latency for the sake of safety and efficacy. Devices on the factory floor using machine vision to stream video content will also require more bandwidth, and factory workers using augmented reality glasses will need mobility, bandwidth, and near-zero latency provided exclusively by 5G.

The next generation of connectivity technology, 5G is an order of magnitude increase in both speed and latency reduction. The technology also improves connectivity quality, which is important for a variety of digital applications that increasingly require “ultra-reliability.” In a highly connected world, 5G will be necessary to drive and scale the development of many advanced applications.

## ***VIRTUAL HEALTH***

Telemedicine is rapidly rising in importance as a method of facilitating healthcare provision, particularly during a pandemic where in-person interaction must be limited. The ability to use Zoom for a doctor's appointment is, however, only the beginning of how 5G can enable access to healthcare.

With its ability to effectively and quickly transfer large packets of data, 5G can create efficiencies in healthcare logistics, and improve patient outcomes. For example, with 5G, patients who have undergone MRIs or CT-Scans to detect potentially life-threatening anomalies can have their image files (which are very large) quickly sent to a specialist for review[30]—this is a process that on low-bandwidth networks can take several days to complete. AT&T and the Austin Cancer Centre are currently leveraging 5G to test this option. Although still in early phases, according to Jason Lindgren, CIO of the Austin Cancer Centre, the 5G network is already showing impressive results for speed in file transmission. “[Due to their size], we used to have to send these files after-hours. Now as soon as the patient leaves the scanner, the [file] is already on its way.”[31]

Another promising application of 5G is with Augmented and Virtual Reality (AR/VR). Since AR/VR requires high bandwidth, ultra-low latency, and high mobility, 5G may be a necessary foundational technology for mass deployment of such applications. AR/VR, in turn, can be increasingly important for the provision of next generation healthcare, promising to unlock new methods of disease detection and medical training.[32] Although some forms of VR have been in use for medical training for more than a decade,[33] tailoring existing VR hardware to new surgical simulations can make the technology's application more broadly adopted. For example, VR headsets coupled with low-latency and high bandwidth 5G connectivity can help physicians fully “immerse” themselves into the anatomy of a patient and efficiently diagnose problems from a holistic perspective (by having access to a 360-degree visualization of the patient's anatomy).

## ***INTELLIGENT RETAIL***

On the consumer front, COVID-19 has resulted in a surge of digital services, including



the purchasing of goods and services online.[34] 5G can be an important facilitator in the further transformation of e-commerce. At its most basic level, it can allow consumers to access the internet quicker and more reliably, a critical factor for all online retailers, experienced or new entrants. A recent study by Google, “The Need for Mobile Speed,” found that more than half of all website visitors abandoned a webpage that took more than three seconds to load.[35] Faster connections and low latency will go hand-in-hand with improving omnichannel strategies of retailers,[36] ushering in the generation of e-commerce that prioritizes a unique and memorable customer experience (including the large-scale use of AR and eventually VR applications).

### ***AUTONOMOUS SYSTEMS***

An increasingly connected future may bring forward developments like autonomous vehicles or drones that can deliver people, commercial goods, or medical products. 5G will be an important enabler of these services on a wide scale. In so doing, the concept of network slicing becomes important.

Network slicing allows a 5G provider to subdivide its network into numerous tranches or “slices,” each responsible for a specific function. In the case of autonomous vehicles, a slice may be provided that is dedicated specifically to the transmission of data from the vehicle to its surroundings (vehicle-to-everything). Although network slicing is a function that extends beyond autonomous vehicles, it plays a central role in the ability to safely operate. Having a dedicated network for autonomous driving ensures that data transmitted to/from vehicles will not be interrupted by or mixed up with other data that is being transmitted at the same time—for example, data being sent to/from infotainment services that may run simultaneously.[37]

Considering much of current-day singular drone or unmanned aerial vehicle (UAV) deployment, 5G connectivity may not necessarily be considered mission critical. Yet, in the case of multiple UAV deployment at higher altitude, collision avoidance becomes a primary concern. Recent research finds that LTE is sufficient to support the deployment of low-altitude drones, but 5G will be better capable of dealing with issues of interference and mobility at higher altitudes.[38] Bandwidth is another key consideration for drones that operate at higher altitudes, and it is particularly relevant



in cases involving real-time monitoring. The higher the quality of the video captured by the drone, the more bandwidth is required; the more “real-time” the data capture, the more latency plays a role.

### **LIGHTS OUT MANUFACTURING**

As COVID-19 saw national borders close, and governments around the world scrambled to procure scarce personal protective equipment and other medical equipment, a renewed interest in onshoring and calls for domestic production of various goods was brought to the forefront. Yet, for countries like Canada, onshoring goods production that was recently left to global supply chains to fill, must be coupled with automation and the use of “advanced” or “smart” manufacturing techniques in order to be economically feasible. 5G is an important and a necessary element for this next generation of manufacturing.

With up to one million connections per square kilometre (1,000 with 4G), a factory with 1,000 sensors is capable of generating large amounts of real-time data. Data volume is essential to accelerating the automation of various processes currently conducted by humans. Autonomous production plants without many (or any) humans on the factory floor can greatly improve efficiency, and because 5G-based equipment does not need to be wired, machines can roam and move about the factory freely and without risk of collision.[39] While companies like Amazon have stated that fully automated warehouses are about a decade away,[40],[41] others such as Japan’s Fanuc are already experimenting with completely human-free (lights-out) factories under specific circumstances (in Fanuc’s plant, robots manufacture other robots without human intervention).[42]

In manufacturing, 5G connectivity allows for wide-scale creation of “digital twins” (digital copies) of factories and other industrial processes. Equipment connected to the internet through 5G continually uploads data and allows an exact digital recording of processes, bottlenecks, breakdowns, and unexpected events. This can greatly reduce cost and improve efficiency while potentially removing the human from unnecessary or dangerous processes. According to Giampaolo Tardioli, VP of Network Access and Internet Infrastructure at Keysight Technologies, humans will still

play some role in the manufacturing process, just not necessarily on the shop floor. “5G will play a role in enabling new ways of human-machine interfacing (HMI)... new remote-control use cases and the use of mobile control panels.”[43]

# SECTION II: THE FUTURE OF WORK

## REMOTE WORK AND THE EMERGENCE OF "ZOOM TOWNS"

Futurists have long predicted the “death of distance” as an outcome of the ICT revolution and its capacity to reshape work patterns and the structure of cities and communities. What was needed was sufficiently mature technology. An editor of The Economist magazine wrote in 2001:

*“A number of companies offer telephone calls over the Internet and, while the sound quality is often no better than could be had from tying two cans together with a piece of string, the prices are low enough to drag down long-distance charges. In addition, the Internet provides a way to try out new kinds of service, such as the videophone (long predicted, finally affordable, thanks to the Webcam).”*

-Frances Cairncross  
The Death of Distance, 2001

Nearly 20 years later, just prior to COVID-19, the initial exuberance over wide-scale telecommuting seemed to be losing steam while the biggest and priciest global cities continued to experience rapid population growth, despite the availability of well-developed information technology.

COVID-19 changed everything. Suddenly, trends rapidly began to reverse. Many large employers opted to implement long-term remote work options. Twitter and Square, both led by Jack Dorsey, announced that staff would be permanently allowed to work remotely.[44] Other tech firms, including Dropbox, Elastic NV, Facebook, Apple, Amazon, Netflix, and Google, announced that returning to the office will be a long process,[45] and both Dropbox and Facebook have told employees that they may work from home until the end of the year if they choose. Microsoft recently upped the ante, stating that remote work will become a permanent fixture for the company.[46]



In 2020, video conferencing applications like Zoom and Skype have become much superior to “the cans tied together with string” described by Cairncross in the early 2000s. Moreover, project management apps like Wrike and Microsoft Project, coupled with CRM software like Salesforce, and data sharing apps like Power BI and Dropbox, have become powerful and widespread. It may be that the technology had always been mature enough for a remote-work revolution, but inertia kept workers commuting to the office. COVID-19 provided the impetus to break the inertia. By forcing the world to work remotely, COVID-19 proved that telework is entirely feasible, and in some cases, preferable.

There is already some evidence of shifts in living patterns, particularly in relation to departures from city centres toward “Zoom towns” (places that have begun to see growth—including an influx of new residents—as remote work becomes more prevalent.)<sup>[47]</sup> According to Zumper, a San Francisco-based apartment rental website, rents between the most-expensive US cities and least expensive cities have been closing since the pandemic started. In September, the year-over-year median price for a one-bedroom rental in the top 10 most expensive markets fell by 7.2%, while the median price in the 10 least expensive cities rose 4.8%. The median price of a one-bedroom rental in San Francisco in August was \$3,040, a 14.1% decrease from a year ago. In New York, the median one-bedroom price was \$2,700, down 10.9% from a year ago. Simultaneously, prices in smaller cities were on the rise. For example, the median rent for a one-bedroom rental in Norfolk, Virginia, rose 5.4% from August to September 2020.<sup>[48]</sup>

In Canada, a similar trend may be occurring. According to PadMapper, an apartment-hunting app, rents in Toronto have fallen by 10% year-over-year, while prices in Vancouver fell 9.1%, and 6.7% in Montreal. In contrast, smaller cities like Victoria (up 15%), Ottawa (up 14.5%), and Kingston (up 14.4%) are rising in cost.<sup>[49]</sup> While it is too early to tell how this will evolve over the longer-term, initial findings suggest that some portion of urban workers who are now working remotely have moved away from Canada’s biggest cities toward smaller (and often less expensive) centres.

## BRIDGING THE DIGITAL DIVIDE IN CANADA

In a world of rising remote work opportunities, stable, affordable, accessible, and advanced telecommunications infrastructure will be more important than ever. 5G will be needed for various applications in a digital-led future, although currently this infrastructure is optimized to work best in urban environments. If more high-speed-internet-consuming workers opt to live across a more geographically dispersed area, fiberoptic cables and small cell infrastructure may need to be expanded into rural or remote areas—and quickly.

In bridging the “digital divide,” service affordability is a critical variable, as is infrastructure investment and deployment. Research by Statistics Canada finds that in 2012 (most recent data available), 98% of households of top quartile of income earners had access to internet at home, compared to just 58% in the lowest quartile. These ratios are likely to shift in the coming years (including for low-wage income earners), as internet access evolves into a necessity (prompting the UN to declare it a human right).[50] Nonetheless, there is a strong correlation between digital penetration and income. Ensuring that internet access is affordable is a critical consideration in effectively narrowing the digital divide among Canadians, including those living in rural or remote communities, as well as those who face socioeconomic challenges.

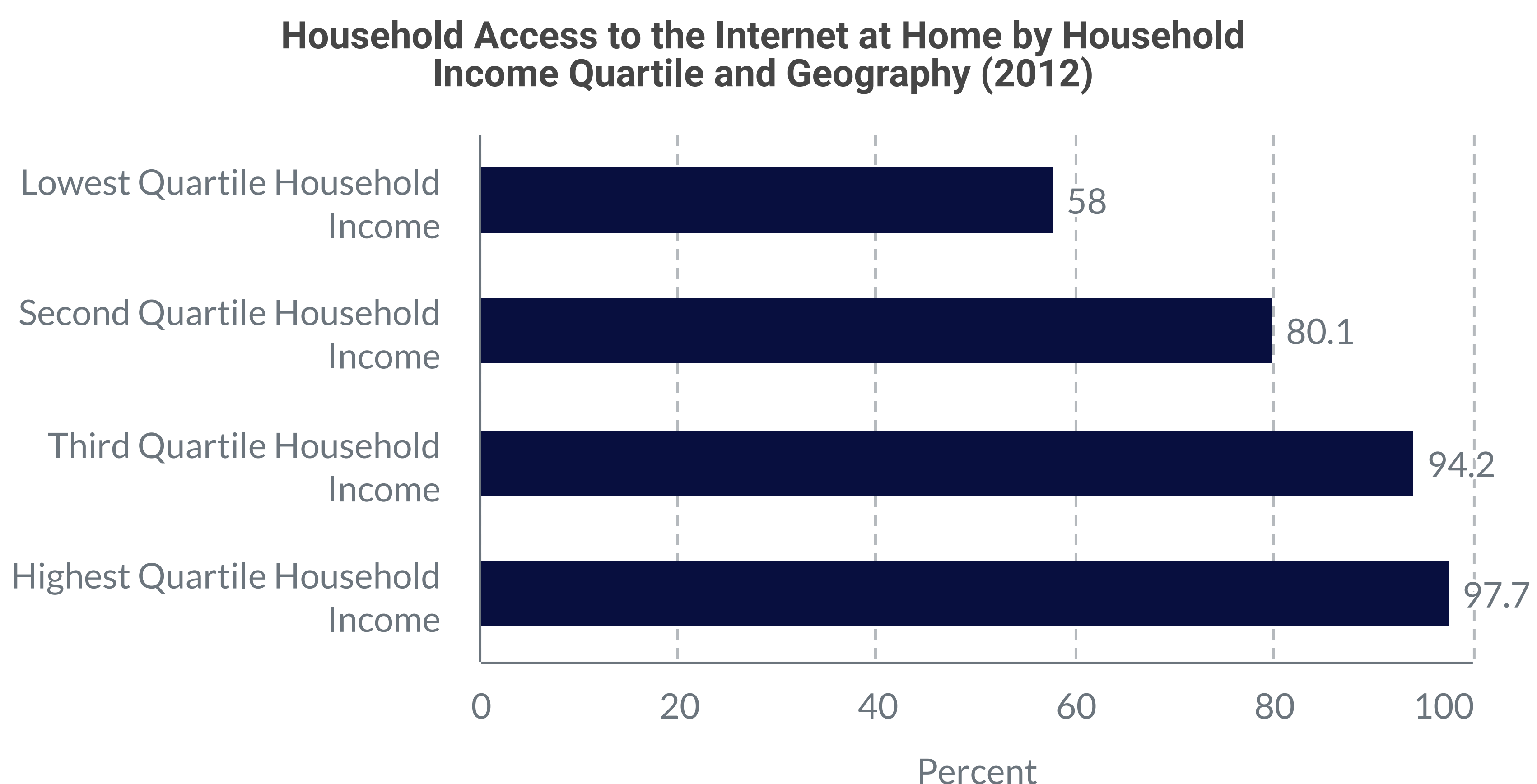


Figure 6. Internet Service by Income Quartile (Statistics Canada data, ICTC analysis, 2020)



## CONNECTIVITY OUTSIDE OF CITY CENTRES: THE NEEDS OF RURAL AND REMOTE REGIONS IN CANADA

It is no secret that Canada has among the most challenging geographies globally for deploying and maintaining telecommunications infrastructure. A thinly dispersed population across large landmass can make it difficult to effectively support everyone with reliable telecommunications services. According to the World Bank, Canada's urbanization rate is roughly 81%, a level that is high relative to the world average of 56% but lower than some peer nations like Australia, which sits at 86%, or New Zealand, at 87%.[51] The overall urbanization rate is a key indicator of what proportion of the population lacks access to high quality internet. As seen in Figure 7 (a geographic representation of LTE connectivity in Western Canada), areas outside of the major metropolitan areas often lack high quality internet.

### BROADBAND INTERNET SERVICE COVERAGE IN WESTERN CANADA

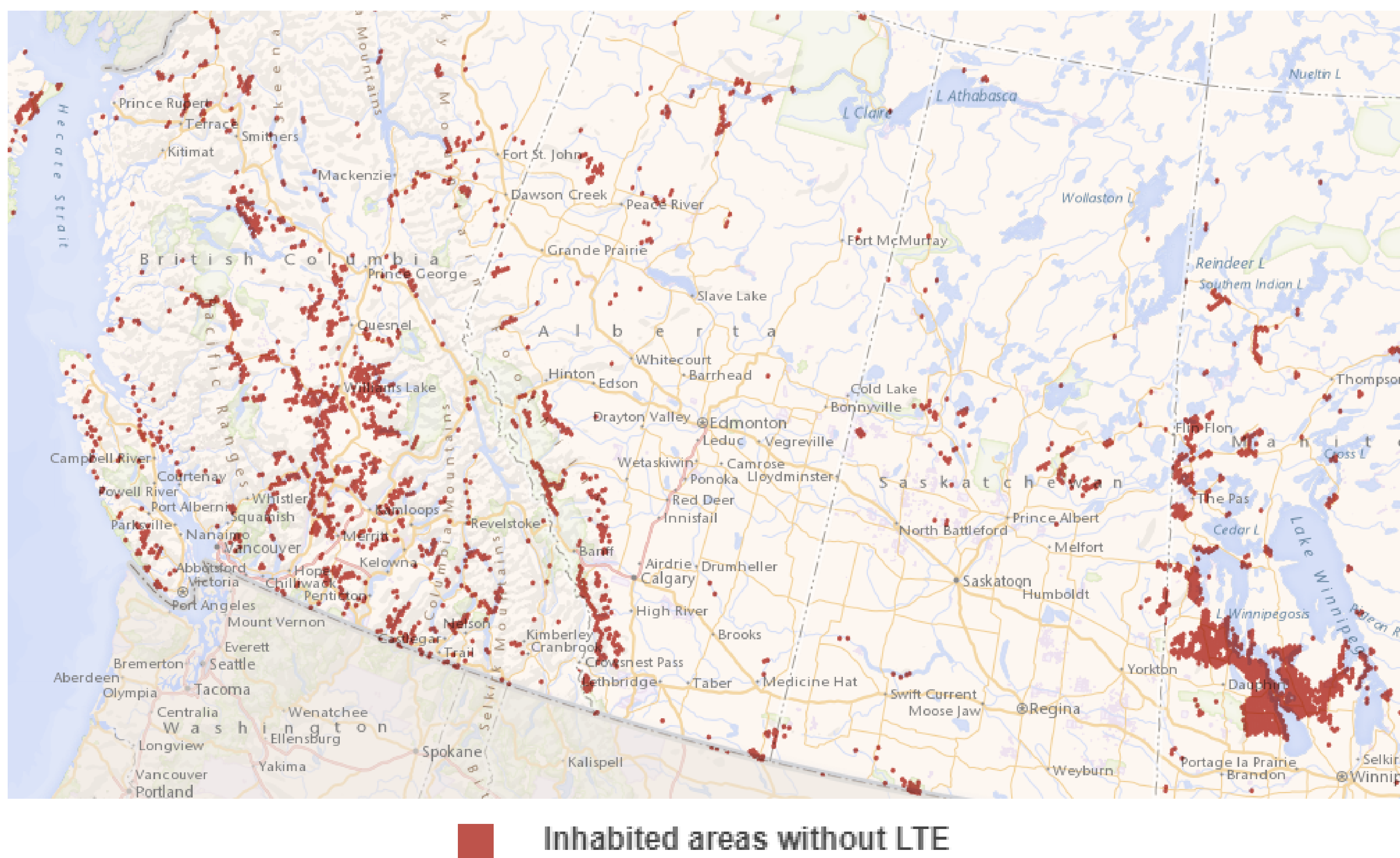


Figure 7. Broadband Internet Service Coverage in Western Canada, 2017 (CRTC, 20120).[52]

The urban-rural divide when it comes to connectivity is not something that is unique to Canada. A similar divide can be seen in many other peer countries, particularly



those with a large land mass and a geographically dispersed population. A comparison of a peer nation with a similar geography is offered in Figure 8, highlighting incidences of mobile blackspots outside of capital city Sydney, Australia. As connectivity quality decreases (as one moves further from the city centre), incidences of blackspots increase.

The need to improve internet accessibility and quality across Canada has spurred recent investments to improve broadband and cellular service in rural and remote Canadian communities. For instance, a new program in Ontario called *Improving Connectivity in Ontario* (ICON) will receive a total of \$450 million (public and private funding) to bring higher quality internet to the 12% of Ontarians who are underserved or unserved.[54] According to the CRTC, while 86% of all Canadians have internet download and upload speeds of 50 Mbps and 10 Mbps respectively, only 41% of rural Canadians have this level of internet.[55] In Indigenous communities, only 24% of households have access to 50/10 Mbps.

#### **MOBILE BLACK SPOTS OUTSIDE OF SYDNEY AUSTRALIA**

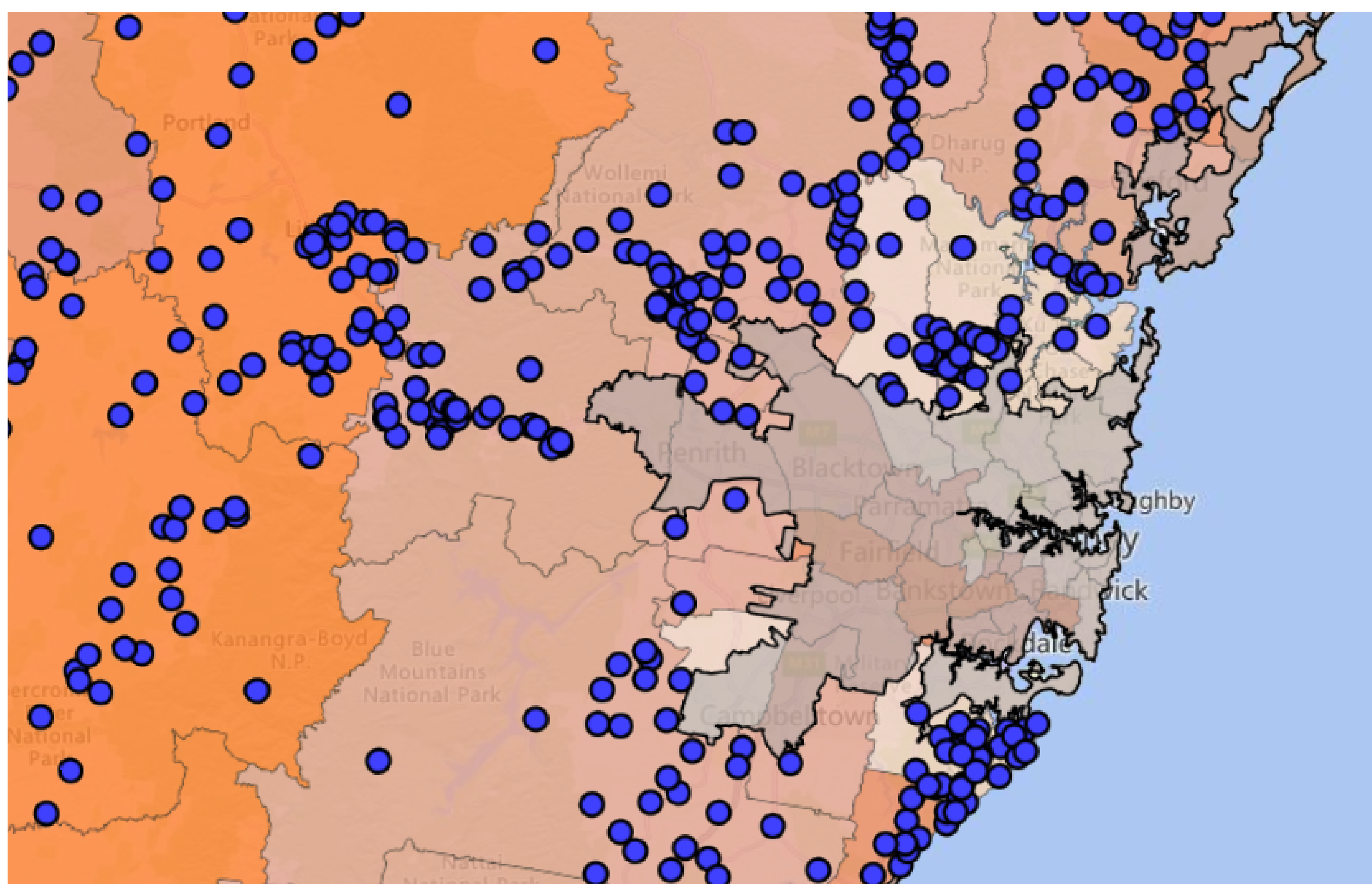


Figure 8. Mobile Black Spots Outside of Sydney Australia (Australian Government, 2020).[53]

## SATELLITE TECHNOLOGY AND EXPANDING CONNECTIVITY FOR ALL CANADIANS

Satellite technology promises to be a key element in closing the digital divide for the most remote communities in Canada. Currently, firms like Xplornet can provide internet to remote communities with speeds of up to 25 Mbps via satellite,[56] but many other players are looking to enter this space. US rocket firm SpaceX applied to the CRTC for a Basic International Telecommunications Services (BITS) licence in June 2020. This licence would authorize the company to carry telecommunications traffic between Canada and the US, which is a foundational step for expansion of its services in Canada. The company's eventual plan is to launch satellites that would orbit just 550 kilometres above the Earth, vastly speeding the interaction with residential computers on the ground compared to regular satellites that orbit 20,000 km above the Earth. SpaceX has launched several "Starlink missions," which are intended to bring internet to remote communities around the world, eventually including in Canada.[57]

### NATIONAL INTERNET COVERAGE

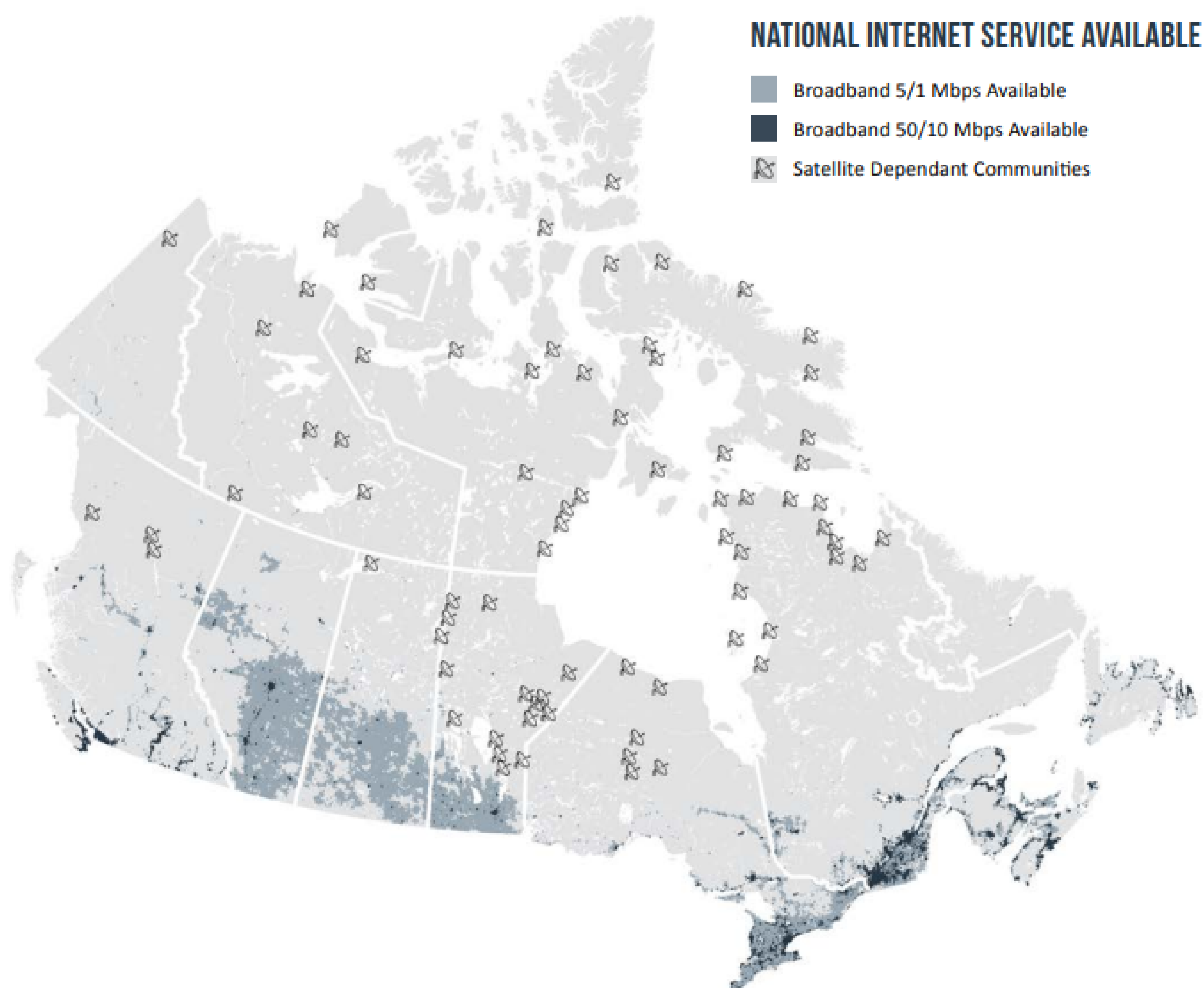


Figure 9. National Internet Coverage (ISED, 2019)[58]

On October 15th, the CRTC approved SpaceX's application for a Basic International Telecommunications Services (BITS) licence. Although this approval is currently limited to the flow of traffic between Canada and the US, SpaceX's application to the CRTC received substantial support during the public comment phase, mostly from rural Canadians. The company currently has 835 low-Earth orbit satellites but plans to eventually have 12,000. Although it is not known how soon full services will be available in Canada, the firm has stated the desire to launch beta tests with volunteer households in Canada starting in the fall of 2020.[59]



# CONCLUSION

Universal and high-quality telecommunications services are crucial for the next generation of technologies that will drive the future of work while supporting a competitive and resilient Canadian economy.

Canadians currently consume less data than most other countries in the OECD, although the COVID-19 crisis has created a new reality where data transmission and reliable connectivity reigns supreme. As the pandemic lingers, it affirms that there is no going back to “the way things were” and that a fundamental shift in consumer behaviour, methods of working, and ways of living is occurring. Canadians need telecommunications services that can support critical information technologies, enhanced service provision, and the proliferation of new economic growth opportunities. IoT and internet-enabled sensors, LoRaWAN, and 5G are all connectivity services that will support the varied needs of our post-COVID connected future.

In light of these changes, many of which may be permanent, closing the digital divide within Canada is a renewed priority. While governments in Canada have made progress over the past 10 years in achieving previous objectives, new targets have been set, including universal 50/10 Mbps broadband access by 2030. Achieving this goal will involve considerations related to cost, competition, the mix of technologies noted above, as well as other interventions such as the use of low orbit satellites. Many rural, Indigenous, and low-income Canadians still lack anywhere near the quality of internet access that will allow them to fully participate in and reap the benefits of an economy and labour market that is increasingly digital.

Canada’s future will be one in which digital technology is ubiquitous and constitutes a critical component of every-day life. Innovation in technology development, accessibility, and affordability will ensure that all Canadians will have the opportunity to participate in and benefit from Canada’s digital future.

## ENDNOTES

- [1] Jessy Bains, "Canada added 245,800 jobs in August," Yahoo Finance, September 4, 2020, <https://ca.finance.yahoo.com/news/canada-added-245800-jobs-in-august-124557433.html>
- [2] Maryna Ivus, Akshay Kotak, Ryan McLaughlin, "The Digital-Led New Normal: Revised Labour Market Outlook for 2022," ICTC, Aug 2020, <https://medium.com/digitalthinktankictc/the-digital-led-new-normal-bd014c5624af>
- [3] Christopher Nardi, "After Twitter and Shopify, Transport Canada? Federal department becoming work-from-home office by default," National Post, May 30, 2020, <https://nationalpost.com/news/politics/after-twitter-and-shopify-transport-canada-federal-department-becoming-work-from-home-office-by-default>
- [4] Data that compares the cost of a standard mobile plan across the OECD.
- [5] Including cost of data.
- [6] Mobile broadband subscriptions are mobile subscriptions that advertise data speeds of 256 kbit/s or greater. The subscription must allow access to the Internet via HTTP and must have been used to make a data connection via Internet Protocol (IP) in the previous three months. Standard SMS and MMS messaging do not count as an active Internet data connection even if they are delivered via IP. This indicator is measured in number of subscriptions per 100 inhabitants. Accessed here: <https://data.oecd.org/broadband/mobile-broadband-subscriptions.htm>
- [7] 2019 statistics are only available for roughly 27% of countries (i.e., ~73% with "no data").
- [8] "Individuals using the internet (% of population)," The World Bank Data, [https://data.worldbank.org/indicator/IT.NET.USER.ZS?most\\_recent\\_year\\_desc=false](https://data.worldbank.org/indicator/IT.NET.USER.ZS?most_recent_year_desc=false)
- [9] "Canadian Internet Use Survey," Statistics Canada, Nov 8, 2019, <https://www150.statcan.gc.ca/n1/daily-quotidien/191029/dq191029a-eng.htm>
- [10] "2019 Canada's Internet Factbook," CIRA, <https://www.cira.ca/resources/corporate/factbook/canadas-internet-factbook-2019>
- [11] Ella Koeze and Nathaniel Popper, "The Virus Changed the Way We Internet," New York Times, April 7, 2020, <https://www.nytimes.com/interactive/2020/04/07/technology/coronavirus-internet-use.html>
- [12] James McLeod, Emily Jackson, "Internet networks feel the strain as COVID-19 sparks surge in Canadians working from home," Financial Post, Mar 24, 2020, <https://financialpost.com/telecom/networks-feel-strain-as-covid-19-sparks-surge-in-working-from-home>
- [13] Ross Marowits, "Internet usage has risen sharply amid coronavirus pandemic, providers say," Global Ness, May 14, 2020, <https://globalnews.ca/news/6946816/canadians-internet-coronavirus-providers/>
- [14] Ross Marowits, "Canadian telecoms say COVID-19 causing surge in demand for services," BNN Bloomberg, May 15, 2020, <https://www.bnnbloomberg.ca/canadian-telecoms-say-covid-19-causing-surge-in-demand-for-services-1.1436844>
- [15] Ross Marowits, "Internet usage has risen sharply amid coronavirus pandemic, providers say," Global News, May 15, 2020, <https://globalnews.ca/news/6946816/canadians-internet-coronavirus-providers/>
- [16] Ibid.
- [17] Briar Stewart, "How COVID-10 worsens Canada's digital divide," CBC News, September 23, 2020, <https://www.cbc.ca/news/canada/british-columbia/covid-19-highlights-urban-rural-digital-divide-1.5734167>
- [18] "Retail Trade, May 2020," Statistics Canada, July 21, 2020, <https://www150.statcan.gc.ca/n1/daily-quotidien/200721/dq200721a-eng.htm>
- [19] "Table 2: Change in weekly habits as a result of COVID-19, March and April 2020," Statistics Canada, April 8, 2020, <https://www150.statcan.gc.ca/n1/daily-quotidien/200408/t002c-eng.htm>
- [20] Ibid.
- [21] James McLeod, "Internet networks feel the strain as COVID-19 sparks surge in Canadians working from home," Financial Post, March 24, 2020, <https://financialpost.com/telecom/networks-feel-strain-as-covid-19-sparks-surge-in-working-from-home>
- [22] Ibid.
- [23] Lillian Rizzo, Sawyer Click, "How COVID-19 Changed Americans' Internet Habits," The Wall Street Journal, August 15, 2020, <https://www.wsj.com/articles/coronavirus-lockdown-tested-internets-backbone-11597503600>
- [24] "LPWA Networks and Smart Parking Management," Aeris, <https://www.aeris.com/news/post/lpwa-networks-and-smart-parking-management/>
- [25] "Demand-Responsive Parking Pricing," San Francisco Municipal Transportation Agency (SFMTA), Oct 20, 2020, <https://www.sfmta.com/demand-responsive-parking-pricing>
- [26] "What is Low Power Wide Area Network (LPWAN) Technology?" Thales, <https://www.thalesgroup.com/en/markets/digital-identity-and-security/iot/resources/innovation-technology/low-power-wide-area-technology>



- [27] Ibid.
- [28] "Complete Secure Solutions," eleven-x, Oct 20, 2020, <https://eleven-x.com/technology/>
- [29] Aruna Srinivasan, "Advancing Smart Manufacturing with 5G IoT – The Global Adoption," GSMA, 28 April, 2020, <https://www.gsma.com/iot/news/advancing-smart-manufacturing-with-5g-iot-the-global-adoption/>
- [30] "5 ways 5G will transform healthcare," AT&T Business, <https://www.business.att.com/learn/updates/how-5g-will-transform-the-healthcare-industry.html>
- [31] "Quickly transmit large imaging files," TeckNexus, <https://tecknexus.com/5gusecase/quickly-transmit-large-imaging-files/>
- [32] Annie Turner, "5G slicing and AI can assure healthcare during a pandemic," Inform, June, 2020, <https://inform.tmforum.org/archive/2020/06/5g-slicing-and-ai-can-assure-healthcare-during-a-pandemic/>
- [33] Wee Sum Khor et al "Augmented and virtual reality in surgery—the digital surgical environment: applications, limitations and legal pitfalls," *Annals of Translational Medicine*, December 2016 4(23): 454, <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5220044/>
- [34] Stephanie Crets, "US online sales rise 43% amid pandemic in September," *Digital Commerce 360*, Oct 19, 2020, <https://www.digitalcommerce360.com/article/coronavirus-impact-online-retail/>
- [35] David Kirkpatrick, "Google: 53% of mobile users abandon sites that take over 3 seconds to load," *Marketing Dive*, Sep 12, 2016, <https://www.marketingdive.com/news/google-53-of-mobile-users-abandon-sites-that-take-over-3-seconds-to-load/426070/>
- [36] Chris Martinez, "5G's impact on omnichannel retail and ecommerce: Proceed with caution," *Signifyd*, Jan 13, 2020, <https://www.signifyd.com/blog/2020/01/13/5g-omnichannel-ecommerce/>
- [37] "5G network as foundation for autonomous driving," *Telekom*, <https://www.telekom.com/en/company/details/5g-network-as-foundation-for-autonomous-driving-561986>
- [38] Hanif Ullah et al, "5G Communications: An Overview of Vehicle-to-Everything, Drones, and Healthcare Use-cases," *IEEE Access*, March 2019.
- [39] "Future Factory: How Technology Is Transforming Manufacturing," *CB Insights*, June 27, 2019, <https://www.cbinsights.com/research/future-factory-manufacturing-tech-trends/>
- [40] Nick Statt, "Amazon says fully automated shipping warehouses are at least a decade away," *The Verge*, May 1, 2019, <https://www.theverge.com/2019/5/1/18526092/amazon-warehouse-robotics-automation-ai-10-years-away>
- [41] Claire Caminade, "What is 5G? What are the use cases for the Manufacturing sector?" *Digital Catapult*, October 30, 2018, [https://uk5g.org/media/uploads/resource\\_files/5G\\_Smart\\_Manufacturing\\_-\\_KTN\\_30\\_Oct\\_2018.pdf](https://uk5g.org/media/uploads/resource_files/5G_Smart_Manufacturing_-_KTN_30_Oct_2018.pdf)
- [42] <https://www.automationworld.com/factory/robotics/article/13316849/turning-out-the-lights-on-the-factory-floor>
- [43] "5G in Manufacturing: What's Here and What's to Come," *Tech Briefs*, February 1, 2020, <https://www.techbriefs.com/component/content/article/tb/pub/features/articles/35967>
- [44] Kantrowitz, Alex, "Twitter Will Allow Employees to Work at Home Forever," *Buzzfeed News*, May 12, 2020, <https://www.buzzfeednews.com/article/alexkantrowitz/twitter-will-allow-employees-to-work-at-home-forever>
- [45] Lerman, Rachel et al., "Big Tech was first to send workers home. Now it's in no rush to bring them back," *The Washington Post*, May 18, 2020, <https://www.washingtonpost.com/technology/2020/05/18/facebook-google-work-from-home/>
- [46] "Microsoft makes remote work option permanent," *BBC News*, October 9, 2020, <https://www.bbc.com/news/business-54482245>
- [47] Greg Rosalsky, "Zoom Towns And The New Housing Market For the 2 Americas," *NPR*, September 8, 2020, <https://www.npr.org/sections/money/2020/09/08/909680016/zoom-towns-and-the-new-housing-market-for-the-2-americas>
- [48] Neil Gerstein, "Zumper National Rent Report: September 2020," *Zumper*, Sep 1, 2020, <https://www.zumper.com/blog/rental-price-data/>
- [49] Becky Robertson, "The cost to rent a one bedroom apartment in Toronto has fallen 10% since last year," *BlogTO*, Sep 16, 2020, <https://www.blogto.com/real-estate-toronto/2020/09/cost-one-bedroom-apartment-toronto-last-year/>
- [50] Frank La Rue, "Report of the Special Rapporteur on the promotion and protection of the right to freedom of opinion and expression," *UN General Assembly*, May 2011, [https://www2.ohchr.org/english/bodies/hrcouncil/docs/17session/A.HRC.17.27\\_en.pdf](https://www2.ohchr.org/english/bodies/hrcouncil/docs/17session/A.HRC.17.27_en.pdf)
- [51] "Urban Population (% of Total Population)," *World Bank*, Oct 7, 2020, <https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS?end=2019&start=2019&view=bar>
- [52] "Broadband Internet Service Coverage in Canada in 2014," *Canadian Radio-television and Telecommunications Commission*, Oct 7, 2020, <https://crtc.gc.ca/eng/internet/internetcanada.htm>
- [53] "National Map," *Australian Government*, Oct 7, 2020, <https://nationalmap.gov.au/>



- [54] Bradly Shankar, "Ontario investing \$150 million to improve broadband and cellular service in rural communities," MobileSyrup, Jun 3, 2020, <https://mobilesyrup.com/2020/06/03/ontario-government-150-million-investment-improved-rural-broadband-cellular-service/>
- [55] "Closing the digital divide in Canada," Canadian Radio-television and Telecommunications Commission, Aug 12, 2020, <https://crtc.gc.ca/eng/internet/internet.htm>
- [56] "The Next Generation of Internet is Coming to More Canadians than Ever!" Xplornet, Oct 20, 2020, <https://www.xplornet.com/canada-wide-coverage/new-satellite-program/new-to-xplornet/?postalcode=J0M+0A6#lookup>
- [57] Geoff Zochodne, "Elon Musk's SpaceX applies for telecom licence as it eyes bringing internet to remote Canada," Financial Post, Jun 19, 2020, <https://financialpost.com/technology/elon-musk-spacex-canadian-telecom-licence>
- [58] "High Speed Access for All: Canada's Connectivity Strategy" ISED, 2019, [https://www.ic.gc.ca/eic/site/139.nsf/eng/h\\_00002.html](https://www.ic.gc.ca/eic/site/139.nsf/eng/h_00002.html)
- [59] Connell Smith, "Elon Musk's satellite internet plan gets green light from Canadian regulator," CBC News, Oct 20, 2020, <https://www.cbc.ca/news/canada/new-brunswick/elon-musk-tesla-starlink-low-earth-orbit-high-speed-rural-internet-rockets-satellite-1.5768338>





The Information and Communications Technology Council (ICTC) is a not-for-profit, national centre of expertise for strengthening Canada's digital advantage in a global economy. Through trusted research, practical policy advice, and creative capacity-building programs, ICTC fosters globally competitive Canadian industries enabled by innovative and diverse digital talent. In partnership with an expansive network of industry leaders, academic partners, and policy makers from across Canada, ICTC has empowered a robust and inclusive digital economy for over 25 years.

---

[www.ictc-ctic.ca](http://www.ictc-ctic.ca)