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Municipal digital infrastructure and the COVID-19 pandemic: A case study of Calgary, Canada

ABSTRACT

The COVID-19 pandemic has placed unprecedented demands upon digital infrastructure as large portions of the population work, socialize and attend school online. National regulators worldwide have been struggling to maintain service for all citizens as the essential place of internet access in contemporary life becomes paramount. This article narrows the policy focus from the national to the municipal level. Using the case study of Calgary, Canada, the authors outline a unique and successful private–public partnership where local internet service providers have been able to adapt to the changing demands of the COVID era, supported by forward-thinking municipal policy. The authors draw upon local data sources, municipal reports and interviews with key public and private sector officials to explore how municipalities can best position themselves to provide resilient and sustainable digital service in the face of this global pandemic.

KEYWORDS

telecommunications policy
municipal politics
broadband policy
COVID-19
digital infrastructure
digital divides
internet access

INTRODUCTION

The COVID-19 crisis has demonstrated the profound centrality of internet access to our contemporary lives. Jobs, shopping, education and social interactions have increasingly moved online. It has also further isolated those without adequate broadband, exacerbating digital divides as citizens turn to these online services to cope with social distancing. Across much of the world, getting broadband access to less populated regions remains a consistent challenge (Organization for Economic Cooperation and Development [OECD] 2004; Taylor and Middleton 2020). However, the majority of the world's population (55 per cent – a number much higher in North America and Europe) live in cities, and this number is expected to reach two-thirds of the global population by 2050 (United Nations 2018a). In Canada, where policy-makers continue to focus on much-needed rural broadband infrastructure (ISED 2019a), the challenges of COVID-19 have also brought to the fore questions of the resiliency and accessibility of networks within urban centres, where over 80 per cent of Canadian citizens reside (United Nations 2018b). Despite having higher densities, often thought to go hand in hand with broadband penetration, a digital divide remains and urban residents in lower income brackets face broadband access inequalities (CRTC 2019; Koch 2018). Canada has consistently shown expensive internet rates in comparison to other developed countries (ISED 2019b), and studies in Canada and elsewhere show the economically disadvantaged people face a difficult choice of paying a higher percentage of their income on broadband services or going without (Hudson 2010; Gonzales 2016; CRTC 2019). While the federal and provincial governments have greater financial resources needed to ensure universal access, this research explores policy at the municipal level as the site for real change and public engagement in digital infrastructure. This article analyses the strengths and adaptability of municipal broadband during the unprecedented data demands of the COVID-19 pandemic using the case study of Calgary, Canada.

In assessing digital infrastructure, the local matters. At the federal level in Canada, high-speed broadband has been declared a basic service (CRTC 2016), yet national and provincial efforts have thus far failed to provide high-speed universal access. Calgary provides a useful case study as it is a growing, medium-sized city (population 1.3 million) with a low population density compared to other Canadian urban centres. This sprawling population can present challenges for complete coverage. Some municipal connectivity data remain elusive. The City of Calgary's unsuccessful application to the Canada's Smart Cities Challenge contest in 2018, contained a plan to complete a study of a digital 'access-to-service gap analysis for low-income Calgarians' (City of Calgary 2018). Despite recent economic hardships largely as a result of declining oil revenues, Calgary still has much in its favour including three universities, a strong health-care system and, significantly, an extensive municipally owned fibre network. While national policy develops, Calgary in many ways demonstrates a role for municipal governments in closing the digital divide.

Calgary is essentially served by two major internet service providers (ISPs): Telus and Shaw. While the national regulator, the Canadian Radio-television and Telecommunications Commission (CRTC), lists dozens of ISPs available in Calgary, the overwhelming majority are small providers without their own infrastructure and which hold a market share of just 13 per cent according to a recent study (CMCR 2020: 38). To offer service, they must first purchase wholesale access from Telus' or Shaw's networks. Nationally, Canada's eight major ISPs dominate 82.7 per cent of the market share for home internet service (CMCR 2020: 38). Of those, four (Videotron, Cogeco, Eastlink and SaskTel) do not operate at all in Alberta, while the other two (Bell and Rogers) do not offer residential internet service in Calgary (ISED 2020), leaving Telus and Shaw as the remaining incumbents. If there is sufficient internet service in Calgary during the COVID-19 pandemic, it is not a result of an abundance of competition. When it comes to broadband, this western city is a two-horse town.

The unique variable in this limited marketplace is provided by the municipality of Calgary. Since 2001, the City of Calgary has built a fibre network across Calgary in City-owned rights of way and now has over 550 km of fibre. Calgary leases access to this fibre to third-parties but it is explicitly not an ISP since it does not provide internet service nor network equipment (City of Calgary 2020a). Still, the presence of this formidable municipal-owned fibre network has been a key element in Calgary's response to the data demands of COVID-19. Also key to Calgary's ability to maintain capability despite increased data traffic is a general culture of support between the public administration and privately run ISPs who provide the overwhelming majority of home internet service to Calgarians. While other jurisdictions have seen stark divisions between incumbents and municipalities, that does not appear to be the case in Calgary thus far.

Drawing upon work in Canadian telecommunications policy research and complemented by recent work in infrastructure studies, this article addresses two of the issues identified for this Special Issue: digital media policies, especially policy on COVID-19 in different national and regional contexts (in this case local), and implications for future public policy. Our objective is to explore and evaluate the current state of digital infrastructure within Calgary and ask if its current configuration has adapted to the challenges posed by the COVID-19 pandemic.

The research questions were:

1. What can municipal governments do to safeguard resiliency for digital networks during a crisis in a way that ensures inclusivity for all urban citizens?
2. Who are the actors beyond major ISPs that have a role in ensuring local universal broadband access?
3. How can network capability be maintained and strengthened for future crises?
4. Has there been an effort to ensure connectivity for underserved populations during COVID-19?
5. Has current municipal broadband strategy changed in the wake of the COVID-19 crisis?

To identify specific broadband access challenges, the research incorporates primary documents such as the accessible Calgary municipal data, federal studies and recent industry data and reports. The research team also conducted interviews with key private sector representatives from the two incumbent ISPs, as

well as a public official involved in Calgary's digital planning and fibre network, and a second public official involved in Calgary's libraries' strategy to connect citizens during the pandemic. As this article is written, the COVID-19 pandemic is far from over and unforeseen developments may, and likely will, still occur. Our study explores the early period of the pandemic from March to August 2020.

We believe this research is of international relevance as municipalities worldwide struggle to accommodate populations increasingly working, studying and maintaining social connections online. The study will conclude with specific recommendations for policy-makers to assist in the digital resiliency of municipalities.

CONTEMPORARY RESEARCH

Much of the current scholarship on municipal broadband highlights the social and economic goods afforded to communities with internet access that is fast, reliable and affordable. Universal access to the internet is near-globally viewed as critical civic infrastructure, and an increasing number of municipalities are showing that it is both possible and profitable to deploy telecommunications infrastructure as a utility (Institute for Local Self-Reliance 2020). In order to ensure universal access, some communities have not been content to wait for existing privatized ISPs to come to the rescue of this critical infrastructure and have looked to public models. In 2019, reports surfaced that the Canada Infrastructure Bank had acknowledged the idea of creating broadband access as a public utility in Canada (Schwartz 2019). While that proposal did not gain much traction with the federal government, municipalities in Canada and elsewhere have seen some success in setting up and operating broadband networks. These have shown a positive impact on the economy, as well improvements in education, health-care delivery and local community building (Crawford and Mohr 2013; OpenMedia Engagement Network 2020).

Municipal broadband scholarship focusing on societal impacts of telecommunications infrastructure tends to address how a lack of universal access to the internet disproportionately affects marginalized and vulnerable communities (McMahon et al. 2011; Ali 2019). While people living within rural areas are more likely to be on the wrong side of the 'digital divide', there remain many people within urban centres who lack access to basic online services for health care, education and banking, and are unable to participate meaningfully in the economy both online and off (Blanton 2013; Haight et al. 2014).

Much of the current academic literature focuses on case studies of municipalities that have built their own broadband or wi-fi networks (Middleton and Crow 2008; Sadowski et al. 2009; Hudson 2010; Crawford and Mohr 2013; Morisson and Bevilacqua 2018). In Canada, several communities have started their own broadband or wi-fi networks, including Olds, Alberta and Coquitlam, British Columbia (OpenMedia Engagement Network 2020). In the United States, more than 560 communities have some form of a municipal network (Institute for Local Self-Reliance 2020). Municipal networks can pose a direct challenge to the existing for-profit model, which is largely dominated by a handful of incumbent telecommunications providers in most areas, which is certainly true in the two ISP market of Calgary. Studies have shown that municipalities that own their own electricity distributors are well suited to the provision of broadband, with their existing experience, universal provision and built infrastructures (Stokes and Baller 2005). This is one of the reasons the City of Calgary example is illuminating: it falls somewhat outside the group of

municipalities that are offering internet as a utility, yet it is clearly not subjecting its citizens to the whims of the marketplace. In the early months of the COVID-19 pandemic, the Calgary example appears to be working.

There are many models for a municipal network to follow, including owning and operating the infrastructure, as well as providing service to homes, businesses and government buildings. A publicly owned network may operate the infrastructure, provide service and sell access wholesale to open up competition at the retail level. A third model, as employed by Calgary, is to operate the infrastructure while providing wholesale access only, leaving the service provision to incumbents or smaller retail companies to directly connect homes and businesses. The latter option, a structurally separated, or open-access model, has been proposed as a solution to the lack of competition in the telecommunication sector nationally (Middleton 2011). An open-access model works to vertically integrate a process in which one distributor controls various levels of the media infrastructure system – the municipal broadband system under a public open-access mission. A benefit of vertical integration is that it allows municipalities to more quickly recoup the costs of the capital investment by using revenues made from leasing their infrastructure (Sadowski et al. 2009).

Arguments against municipal-owned and operated infrastructure include concerns that entry into the market will unfairly advantage municipalities at the expense of private players, which will limit competition and therefore drive up prices and degrade the quality of the network. It is argued this would occur over the long term as less competition removes incentives to invest in the network (Bar and Park 2006; Landgraf 2020). This is not the case in Calgary as the City fibre network does not compete with ISPs since the City fibre does not provide internet service. It is because of this significant difference that Calgary has avoided what has happened in the United States, where some states, under pressure from major ISPs, have ratified laws aimed at curbing municipal broadband networks (Crawford and Mohr 2013). Even in Chattanooga, Tennessee, often held up as a model for municipal networks to follow (Morisson and Bevilacqua 2018), the city's public utility faced four lawsuits from incumbent telecommunications firms, as well as 'an intense public relations campaign funded by incumbent telecommunications companies with the intent of discrediting municipal broadband' (Koch 2018: 1). Instead of being at loggerheads over internet service, our study of Calgary in the COVID-19 era, often demonstrates a city government and private sector working in tandem.

MUNICIPAL BROADBAND IN CALGARY

In 2016, Calgary joined the ranks of a select 100 cities around the world as a part of the Resilient Cities (100RC) network, a programme funded through the Rockefeller Foundation (Anon. 2017). The programme was designed to aid growing cities with shocks from social, economic and environmental challenges (100 Resilient Cities n.d.). The 100RC programme states that '[r]esilience is what helps cities adapt and transform in the face of these challenges, helping them to prepare for both the expected and the unexpected' (100 Resilient Cities n.d.: n.pag.). Suffice to say, the COVID-19 pandemic qualifies as unexpected.

For development to be sustainable, it must meet the needs of the present, as well that of future generations. With symmetrical upload and download

speeds, fibre cables have long been described as a 'future-proof' technology based on their ability to meet seemingly unlimited data needs (Middleton 2016). A single fibre-optic cable can hit up to gigabyte data transfers and allow for perfect real-time communication through the internet (Crawford 2018). Zhang and Li note that sustainable development is time-consuming, however, '[t]aking advantage of [urban resilience] to reinforce the urban system dynamics that promote [urban sustainability] is a key to achieving desired future [sustainable] states' (2018: 145). In essence, resiliency strategies are needed to coincide with sustainability initiatives to ensure a holistic infrastructure policy framework. Zhang and Li (2018) also identify that rational urban development may only be achieved when it is both resilient and sustainable, anything short is irrational for a municipality to fund and pursue. For Calgary, digital fibre infrastructure is a city-wide project that municipal officials have wagered and is both resilient and sustainable.

In our study, we discuss telecommunications infrastructure, which has in recent scholarly works been umbrella termed as 'infrastructure studies'. It should be noted, however, that telecommunications research has had a history of understanding infrastructural developments and their impact on geographic regions (Babe 1990; Winseck 1998). Infrastructure development often suffers from relatively meagre levels of civic participation (Starosielski 2015) and does not always spike great interest in academic research circles (Parks and Starosielski 2015). Infrastructure studies, an area of scholarship, which looks to identify the underlying architectures upon which societies are further built, is crucial to understand the power dynamics built into these systems and technologies (Star 1999). In Langdon Winner's far-reaching *Do Artifacts Have Politics?*, he lays bare how because infrastructures are made by people with political leanings, agendas and motives, an infrastructure and/or technology should not be perceived as a neutral entity (Winner 1980). In more recent years, scholars like Shannon Mattern have identified the importance of a political economy and historic understanding of how media infrastructures shape cities (Mattern 2015). Nicole Starosielski (2015) has argued through her research on undersea cables that when academic scholarship in communications infrastructure is lacking, this affects the general public through the policy-making process not having up-to-date and rigorous research to aid in decisions related to funding of specific infrastructure projects. In addition, Christian Sandvig posits that infrastructure studies is crucial because, '[t]he first such attribute of infrastructure states that it is normally invisible, becoming apparent only when it breaks' (Sandvig 2015: 96). Digital infrastructure in Calgary is certainly strained by the demands of COVID-19 but does not appear to be breaking.

The City of Calgary's fibre-optic network connects a majority of municipal buildings, as well as City partners, non-profits and businesses deploying a host of network applications, including managing light rail transit operations and a grid to ensure clean drinking water. The network connects over 670 facilities and assets (e.g. traffic controllers) across Calgary (City of Calgary 2020c).

By operating their own network, the City's information technology units are able to respond quickly during extreme events, including 'the 2013 flood where a catastrophic loss in network resources was mitigated due to the control, agility and capacity afforded through City fibre. This could not have been achieved without full control of the fibre asset' (City of Calgary 2020c: 4). Other cities may have municipally operated fibre systems, but they are often

overseen by various departments within a municipal administration; Calgary has a committed department for network infrastructure that works across departments.

In the process of deploying their fibre transport network for municipal services, the City has capitalized on the opportunity to install excess capacity, which is relatively inexpensive to do. This 'dark fibre' – active fibre is 'lit' as data is transmitted over fibre-optic cables through light waves, unused fibre remains dark – is then available to be leased out. Organizations including the Calgary Public Library, the University of Calgary and Cybera, Alberta's research and education network, as well as school boards, health-care providers, commercial business tenants and even existing ISPs utilize the City's facilities. The city's 550-km network is open access: there is no discrimination based on who uses the network or for what purposes (City of Calgary 2020a). Calgary's forward-thinking fibre policy was viewed as a strong model in the 2017 study *Understanding Community Broadband: The Alberta Broadband Toolkit*:

> Since 2001, the City of Calgary has been deploying fibre not with the aim of providing internet to residents and businesses, but for connectivity to support municipal services, a mentality that is applicable to communities both large and small elsewhere in the province. Often, councils will disprove of a municipal broadband infrastructure case when broadband is perceived as a retail service. Calgary's strategy was not about broadband, but about developing sustainable communications infrastructure for the delivery of next generation municipal services.
>
> (McNally et al. 2017: 29)

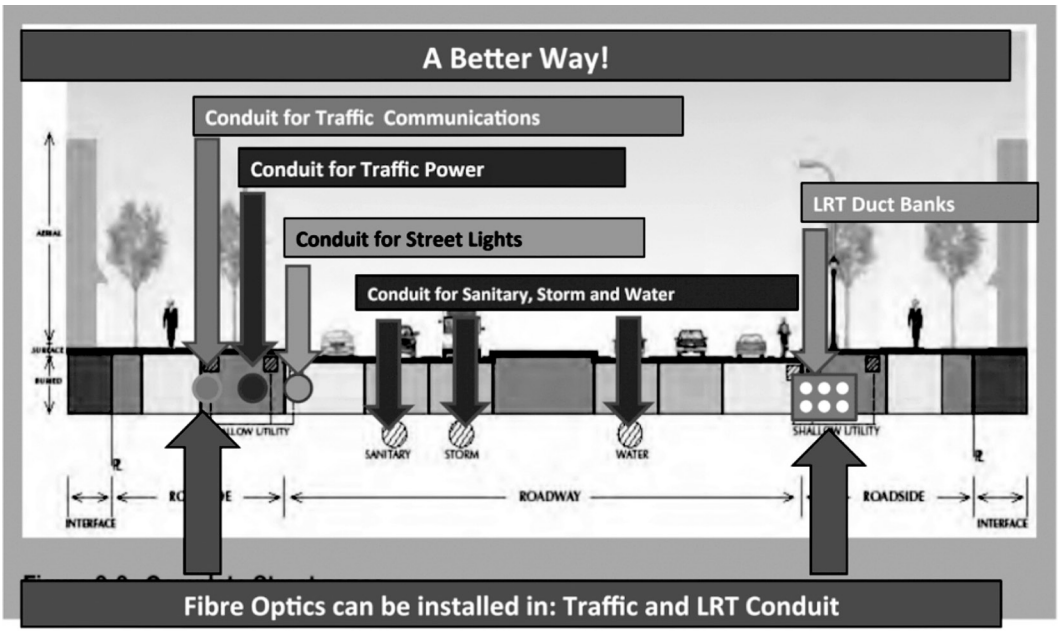

Figure 1: City of Calgary (2016).

Calgary's fibre system makes economic sense. In 2019, Calgary's revenues from leasing fibre surpassed $1 million, an increase of 180 per cent from 2015 and well beyond the $180 thousand originally projected in the strategy (City of Calgary 2020c: 2). As both ledgers and policy submissions assert, 'it is cost effective and efficient for municipalities to construct fibre transport facilities at the same time that municipalities carry out large infrastructure projects, such as road work or the construction of transit facilities' (City of Calgary 2015: 11). As the City of Calgary explained in a telecom regulatory hearing about why it has been investing in broadband: '[i]n the process of installing dark fibre throughout the city to all of our street lights and bus stops and everywhere else – it only makes sense when we are in the process of construction to install excess capacity' (CRTC 2014: para. 7078). Installing fibre-optic cable costs about $200 per metre when roads have to be dug up, while by installing fibre into an existing conduit 'costs drop dramatically to $11 per metre, as the incumbent pays only for the fibre optic cable and the costs of the installation of the fibre optic cable into existing conduit' (City of Calgary 2015: 15).

There are other elements of city digital infrastructure that have added to Calgary's overall resilience from shocks to its digital system. Calgary is home to one of Canada's largest internet exchanges. The Calgary Internet Exchange (YYCIX), a non-profit founded in 2012, provides a free or low-cost option for community organizations and businesses by increasing the quality and quantity of connections. Public internet exchanges provide open, non-proprietary pathways for data to travel from one point to another. By hosting internet exchanges within local communities, it can increase speeds as well as limit traffic flows from crossing jurisdictional boundaries (Clement and Obar 2015). Adding more routes decreases overall congestion in an area, leading to quicker connections and less instances of dropped packets (or incomplete requests), the end result being a better experience for all users of local networks. The City of Calgary hosts some of the exchange's switches in their data centres, and any other entity leasing City fibre is able to cross-connect at no charge (City of

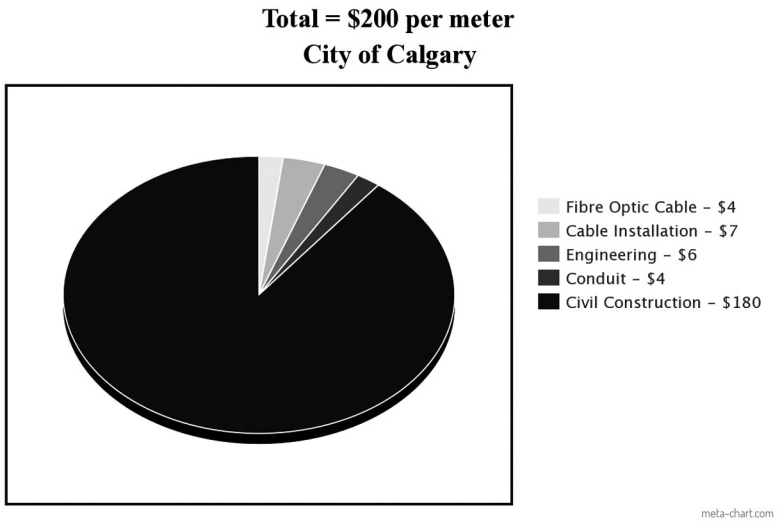

Figure 2: City of Calgary (2015).

Calgary 2020b). Broadly, the City sees the non-profit internet exchange point (IXP) as a success: '[t]he Calgary Internet Exchange is rapidly growing, in part, due to City fibre, making [the] internet faster for everyone' (City of Calgary 2020c: 5). Despite the benefits, YYCIX is a non-profit IXP that faces significant technical and fiscal challenges. The City of Calgary has been an active promoter of the IXP as a service that 'enables new business capabilities' (Basto 2020a: 2). Access to City fibre has assisted the growth of YYCIX. Figure 3, from Calgary's Internet Exchange, demonstrates the jump in data traffic in Calgary in March and April of 2020.

Calgary is also in a unique position because it has the option to connect to a publicly conceived provincial backbone, the Alberta SuperNet (Government of Alberta 2020). The provincial fibre-optic internet backbone was finished in 2005, and is open access (Kozak 2014), providing points of presence into 429 communities, including 4200 schools, libraries, hospitals and government offices (Rajabiun and Middleton 2013). As the only provincial internet backbone in Canada, one might expect to find lower prices and higher penetration rates for landline internet in Alberta, however, service remains on par, or more expensive, than in comparable jurisdictions (CRTC 2019; Rajabiun and McKelvey 2019). While the SuperNet extends into the communities, it is up to incumbent ISPs, or the communities themselves, to build out the last mile and connect homes and businesses within the municipality. Across Canada, provincial governments have generally struggled to come up with a cohesive and feasible broadband plan (Evelyn 2017). When considering both the structure of the backbone network, including its application of open-access principles on the edges of the network (Rajabiun and Middleton 2013), as well as affordability when comparing prices in the province to other Canadian jurisdictions (CRTC 2019), the provincial network has not had the intended impact. While the City itself does not make substantial use of the internet backbone, it adds a layer of competition at the infrastructure level, and is used by many of its civic partners, including the Calgary Public Library and school boards, as well as by other Albertan municipalities such as Olds.

The City of Calgary has been one of the few local governments to regularly engage in national telecommunications regulatory hearings, advocating for telecommunications policies that consider the unique needs and jurisdictional issues of municipalities. One way the City of Calgary sees a role for municipalities is in offering wholesale, open access to their network at fair rates, while advocating that they be forborne from the same level of regulation as their

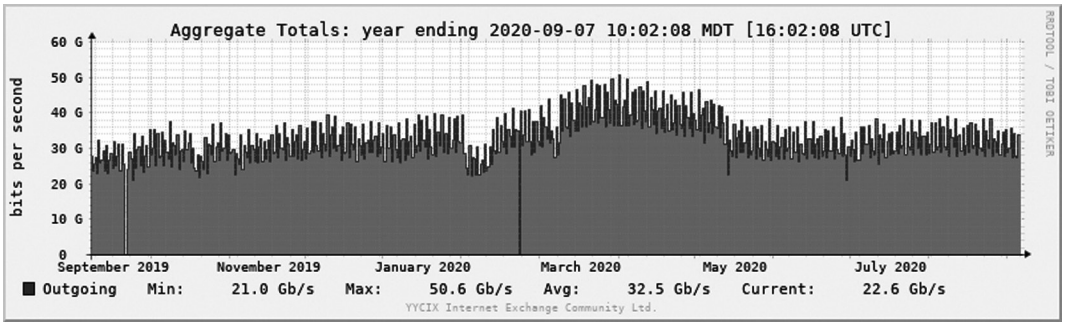

Figure 3: YYCIX Internet Exchange Community Ltd (2020).

private counterparts (City of Calgary 2015). The argument being that municipalities' primary role is to provide municipal services: building out a network is a positive externality and as such government, or non-dominant, broadband wholesalers are penalized when they are subject to regulations designed for incumbent telecommunications companies. The City has also challenged the status quo of Canada's telecommunications framework by asserting authority over rights-of-way access, bringing about questions of jurisdiction. The deployment of 5G, or small cell, infrastructure is expected to greatly exacerbate already-present rights-of-way challenges created by both private and public fibre-optic infrastructure roll-outs as it will require building pervasive infrastructure and accessing existing City infrastructure (City of Calgary 2019).

DIGITAL DEMAND AND COVID-19

Internet service in Canada is a political football that is often kicked back and forth between the national media regulator and the sitting government. In 2019, the CRTC set lower broadband wholesale rates to try and encourage smaller players in the ISP market (CRTC 2019), only to see that decision opposed by the sitting Liberal government a year later. Despite Canadians' readiness to criticize their ISPs (OpenMedia Engagement Network 2016), there is reason to commend the efforts of incumbent providers to increase their data capacity during the COVID-19 outbreak.

CRTC Chair Ian Scott praised the efforts of ISPs in August 2020, saying the telecoms have 'kept a level of service that is admirable' (Karadeglija 2020: n.pag.). Early in the pandemic, Canadian telecom news site, The Wire Report, noted 'no indication that Canada's networks could not cope with the current increase in capacity' (Langenberg 2020: n.pag.). That is not to say Canadian service was seamless. There was a notable internet outage for Bell and Telus customers in Ontario in August 2020 (Canadian Press 2020). However, news stories that explored Canadian digital service issues during the pandemic contained some examples of slowdowns but few of the system crashes that were feared in the rise of home-based employment and education during the continuing COVID-19 period (Daigle 2020).

We found no evidence of a system straining to maintain service in Calgary. Recent infrastructure investments by Telus and Shaw appear to have helped provide Calgarians with reliable internet service despite the dramatic change in demands. In addition, Telus and Shaw have continued programmes – supported by the Government of Canada's Connecting Families initiative – to offer lower rates, often as low as $10 per month, for low-income Canadians (Government of Canada 2020). Data have shown COVID outbreaks in Canada are highest in areas of low income, where working from home is often not an option and the cost of high speed can be a barrier (Carman 2020). Support for low-income Canadians is a key to closing the digital divide, as Canadians in the lowest income brackets are far more likely to report they do not have access to reliable, high speed even where networks are available because of prohibitive costs (CRTC 2019). While monthly programmes for low-income Canadians are encouraging, this partnership with government illustrates how public intervention was needed in order to motivate more private providers to act. Federal government participation was key in expanding service provision to low-income Canadians.

The local Telus-Shaw duopoly also benefitted from decisions made by foreign-based internet service behemoths like Netflix, as described in an interview with a network engineer from Shaw:

> Initially we saw a bit of a bump or an increase in traffic, on the downstream, that ranged from both 10 to 20 per cent. But one thing that has happened is Netflix has dropped their highest coding rate down a little […] because it represents such a huge proportion of our traffic, particularly during the busy hour, which is from 7–11 p.m., right now what we're seeing is more or less the same amount of traffic in the downstream that we were seeing earlier.
>
> (Morley 2020)

Outside home service, the private sector also proved a key behind-the-scenes partner for essential pandemic services, including in the health sector. A representative of Telus noted:

> We continued our dedicated focus on wireless cell site to provide coverage to the most vulnerable in the critical Canadian, which are the hospitals and the COVID-19 screening center. We augmented the capacity 238 hospitals, which included four main hospitals in category as well, and 75 COVID screening sites across the Western Canada, also 12 temporary hospitals for COVID-19 screening, so that they never had coverage and capacity issues. This was not in the plan, but we very quickly stepped up to make sure that we [were] there to support it, also to make sure that the families and everybody within this circle had the increased capacity.
>
> (Sobani 2020)

Telus announced a $16-billion multi-year investment in the province of Alberta in 2019, and as a response to the pandemic, said it planned to expedite $3.5 billion of that capital investment within 2020 (Malik 2020). Shaw noted: 'we've actually seen very little congestion as a result of the increase, partly because we started with some capacity upgrades to our network a couple of years ago' (Morley 2020). Substantive recent investments from the private sector have proven timely for the unforeseen developments of 2020.

MUNICIPAL PARTNERS' ROLE IN EQUITABLE TECHNOLOGY ACCESS

The actors involved in providing municipal broadband service extend beyond traditional incumbents and governments. Early in our research, we considered the role public libraries were playing in Calgarians' broadband connectivity. Studies in other countries have demonstrated the central role of public libraries in bridging the digital divide, particularly their ability to act as wi-fi hotspots for those in need of internet connectivity (Strover et al. 2020). In the first month of the global pandemic in the small southern Alberta town of Airdrie (30 minutes from Calgary) the town library sent a news bulletin to citizens to come and park in front of their library to connect to wi-fi if citizens needed because of poor home connections (Airdrie Public Library 2020). A similar public outreach happened in the larger city of Regina in the neighbouring province of Saskatchewan (Sawatzky 2020). Across North America, reports have surfaced of people flocking to library, school and coffee shop parking lots in order to access the internet (Anon. 2020a, 2020b; Kang 2020). When we broached the idea of libraries as wi-fi hotspots with the manager of information technologies (IT) for Calgary Public Libraries, we were notified that the City of Calgary had the ability to significantly increase libraries' wi-fi radii; however, the City had decided not to encourage citizens to congregate

outside of libraries due to uncertainties about the spread of COVID-19 in such gatherings. Significantly, there had also been little demand from the public in Calgary for the library to offer expanded wi-fi service. How had Calgary avoided the parking lot wi-fi scenarios that had been playing out in so many other jurisdictions?

We believe this unique position is the product on a combination of successful public and private initiatives. In Calgary, demand for centralized wi-fi hotspots was kept in check when Shaw decided to make their extensive wi-fi network publicly accessible in the spring of 2020. Shaw has 100,000 wi-fi hotspots cross Canada, largely in western Canada, so this temporary avenue of access proved significant in the early months of the pandemic. Despite the opening of their wi-fi network, Shaw actually saw a substantial drop in traffic at their hotspots. In May of 2020, a network engineer from Shaw noted:

> I just got some feedback on our Shaw Go wi-fi traffic and, apparently, the total traffic has decreased by roughly 50 per cent since mid-March. This makes sense because Shaw Go wi-fi is deployed in high traffic areas where people congregate (e.g., malls, restaurants, LRT platforms, etc.), which are either closed or operating at significantly reduced capacity.
> (Morley 2020)

So, despite offering wi-fi to all citizens, Shaw still saw a drop in traffic since Calgarians were staying home. The same Shaw representative said that the public wi-fi offering now constituted about 15–20 per cent of Shaw's overall data traffic in May 2020. This significant public service was easily absorbed by the system capacity.

Demand for limited, centralized internet hotspots also did not materialize in this case because of a forward-thinking piece of municipal policy. The City of Calgary had the foresight in 2013, to put out a request for proposals to construct a publicly accessible wi-fi network to be available at numerous Calgary-owned sites, including recreation facilities, parks and Calgary Transit stations. The contract was awarded to Shaw, who in exchange for this service received access to City facilities and shared marketing opportunities (City of Calgary 2013). Due to this policy initiative, the City of Calgary was able to offer citizens a wide range of access points and avoid people congregating around limited hotspots that would have caused COVID-19 transmission concerns. The combination of the private sector opening its system and a municipal government that had long recognized the potential need for public internet access meant that there was not the same requirement for centralized free access seen in other jurisdictions. This ability to come together while physically staying apart has been a key part of the COVID-19 response in Calgary, traditionally one of Canada's most prominent politically conservative cities.

What the Calgary example shows for municipal broadband policy following the declaration of a global pandemic from the COVID-19 virus, is the ways in which multiple stakeholders in a municipality can work together to ensure a high quality of service internet and overall digital access. In her book, *Fiber: The Coming Tech Revolution – and Why America Might Miss It*, Susan Crawford identifies how a sustainable broadband infrastructure technology – meaning fibre-optic cables – can uplift communities through holistic sustainable development policies and initiatives (Crawford 2018). A key theme throughout her book is that of collaboration between multiple stakeholders. In order for sustainable broadband development to take place, the interests of all groups

in a jurisdiction must be considered. What the Calgary example continues to show as the global pandemic continues is one of stakeholders cooperating and/or complementing each other's services. As identified in this section, Calgary Public Libraries, the two primary incumbent ISPs and Calgary's municipal fibre development have worked together to promote a resilient and sustainable action plan.

We draw upon the Calgary case study for the following five recommendations for municipalities facing uncertain questions of their own digital capacity in the post-COVID era (see also Taylor 2021).

RECOMMENDATIONS

1. A multi-level government approach is needed. A resilient and sustainable policy framework requires a shared mission and vision between various levels of government. One of our interview participants from the City of Calgary echoed this sentiment,

   > What we've been doing is trying to advocate both provincial and federal governments and the need to really look at this strategically and trying to come up with more rapid solutions to meeting these demands, and that should involve aligning our digital infrastructure strategy. In other words, we should [at] all levels of government: municipal, provincial and federal, get together and come up with a cohesive, coherent, digital strategy infrastructure strategy to try and fill the gaps that aren't being filled right now.
   > (Basto 2020)

   Collaboration across all levels of government, with particular attention paid to engaging often left out municipalities who bare the direct brunt of policies, is key to building the robust, sustainable networks central to ensuring high-quality, affordable broadband access.
2. Private providers need to work with local government. The Calgary example provides clear evidence of a mutually beneficial relationship. A representative from Telus offered praise to the municipal administration: '[t]hey're [the City of Calgary] helping us better understand what their bylaws are so that we can stay very, very compliant with that […] they are giving us the support with the approval of our permits'. The City's network specialist echoed this sense of bureaucratic support: '[w]e are assisting [ISPs] in terms of streamlining the process. So that should speed up deployment as well'. The exchange of information between providers and municipalities, which are often more directly impactful than federal policy-makers, reduces the cost of confusion and time to both parties, thereby benefitting citizens.
3. Local governments must build broadband infrastructure. Fibre is affordable, digging is expensive. The policies Calgary has put in place since 2001 to deploy fibre when digging up municipal rights of way has paid clear, measurable dividends. This should be common practice.
4. Access bottlenecks should be avoided wherever possible. While the idea of people sitting in cars by public libraries of coffee shops to access wi-fi may be necessary in some jurisdictions, there is no excuse for this in larger cities. Calgary's vision to seek an industry partner to help

construct freely accessible wi-fi hotspots across a broad range of places where citizens congregate will help to ensure that no one is left behind.

5. Research on municipal and community broadband infrastructure is sorely needed and should be supported. This Calgary case study shows a successful government–industry partnership at a local level. This research in critical telecommunications infrastructure identifies ways of improving high-quality broadband availability, while showing current availability as meeting citizen needs. Research in other municipalities may prove different, thereby encouraging active decision-making by municipal policy-makers to engage with broadband policy, work with providers and consider the benefits of building broadband networks into their existing infrastructure.

CONCLUSION

Digital policy scholars who seek confirmation of an anti-industry position in internet service will no doubt be disappointed with this case study where incumbent providers adapted to the upheavals caused by the COVID-19 pandemic and continued to offer a similar quality of service to the pre-pandemic levels. Shaw's opening of its wi-fi hot spots to the public, Telus' quick response to increasing demands in the health-care vicinities and both networks attention to increased traffic 'peaks' proved key to ensuring Calgarians stayed connected in the early months of the COVID-19 pandemic.

Likewise, market advocates must recognize the essential role played by the municipal government of Calgary in maintaining and expanding broadband capacity in the city. As previously noted, competition in the ISP sector in Calgary is limited. Forward-thinking policy for nearly two decades has helped Calgary continue to offer municipal services via a dedicated fibre network that ensures Calgary has a surplus of fibre capacity that can be used for current requirements and for future developments. The City of Calgary also took the policy lead several years ago on initiatives such as incorporating the build out of broadband networks into existing infrastructure work, city-wide public wi-fi hotspots and working together with the private sector to bring the concept to fruition and help, at least partially, alleviate concerns over lack of access for Calgarians. The Calgary policy in the early months of the COVID pandemic appears to be both resilient and sustainable. Provincial government policy to build a far-reaching fibre backbone in Alberta and federal initiatives to ensure affordable internet access was available to low-income Canadians have also been key to Calgary's relatively strong response to internet demands in the early months of the pandemic.

COVID-19 has highlighted how high-quality, affordable internet access is central to work, education and the economy, as well as engagement with health-care information, our communities and governments. Policy-makers and governments at all levels must prioritize closing the various digital divides. As the City of Calgary illustrates, decision-makers at local levels are especially well positioned to advance policy that can bring quality internet service to all citizens.

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