HOUSE OF COMMONS STANDING COMMITTEE ON INDUSTRY, SCIENCE AND TECHNOLOGY - BROADBAND CONNECTIVITY IN RURAL CANADA BRIEF

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Introduction and Executive Summary

As then Canadian Radio-television and Telecommunications Commission (CRTC) Chair, Jean-Pierre Blais, noted during the 2016 hearing on broadband as a basic telecommunication service, "Today, in Canada, broadband is vital."[1] Broadband connectivity will be as essential in the 21st century as electricity in 20th century. The following brief addresses the House of Commons Standing Committee on Industry, Science and Technology's "Broadband Connectivity in Rural Canada Study."

The brief is divided into three sections dealing with each of the Committee's key questions: a) what constitutes acceptable high-speed service, b) the financial challenges of implementing high-speed services, and c) the regulatory changes to encourage the implementation of high-speed service. It concludes with a short section about the Van Horne Institute and the brief's author, Dr. Michael McNally.

In regards to what constitutes acceptable high-speed service, it is recommended that fibre optic networks be the preferred choice of infrastructure to ensure quality service. In terms of cost, expanding fibre coverage to rural and remote Canada, will be costly, but these costs can be mitigated to a degree by empowering local communities to develop local solutions and through certain policy and regulatory decisions.

There exist several regulatory barriers to ensuring high quality services in rural and remote Canada; however, suggested policy and regulatory actions include:

- Developing a national broadband strategy; abandoning the 2006 Policy Direction from the Federal Cabinet (Governor in Council) to the CRTC;
- Better aligning the policy and regulatory functions for both wired and wireless broadband services between Innovation, Science and Economic Development and the CRTC;
- Developing a strategy for rural mobile-wireless deployment; instituting demand-side (in addition to supply-side) policies to stimulate demand for broadband services; and
- Creating community capacity for both broadband network development and decision making around broadband networks.

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[1] Jean-Pierre Blais. 2016. "Transcript, Hearing April 18, 2016 [CRTC Telecom Notice of Consultation 2015-134]." Canadian Radio-television and Telecommunications Commission. 18 Apr. 2016. http://www.crtc.gc.ca/eng/transcripts/2016/tt0418.htm ln. 7564.

I.   Acceptable High-Speed Service

The Canadian Telecommunications Policy Objectives outline what are the three most important elements for acceptable high-speed services – reliable, affordable and high quality – and as indicated by the objectives these should be for both urban and rural Canadians.[2] Within these three broad elements several factors must be considered, specifically around quality, including quality of service (e.g. jitter, packet loss, latency) and connection speed.

In addition to the Canadian Telecommunications Policy Objectives, the CRTC's recent basic service objective (BSO) further qualifies some aspects of these elements. In its decision the Commission stated its new basic services objective as, "Canadians in urban areas as well as in rural and remote areas, have access to voice services and broadband internet access, on both fixed and mobile networks"[3] and "Canadians living in rural and remote areas should have broadband internet access services similar to those available in urban areas."[4] Furthermore the decision prioritises fixed broadband services to meet its objective,[5] and sets a goal of having broadband available to 90% of Canadian premises at download speeds of 50 Mbps and upload speeds of 10 Mbps by the end of 2021, with the remaining 10% of premises to be connected at these speeds within 10 to 15 years.[6] Quality of service standards (jitter, packet loss and latency) will be determined by the CRTC Interconnection Steering Committee (CISC).[7]

While the CRTC's BSO provides some guidance on acceptable high-speed services, some points are not addressed by the BSO and others require further elaboration including speed and future capacity/scalability, reliability, affordability, speed and most significantly network infrastructure.

a.   Network Infrastructure

A crucial factor in assessing what is "acceptable high-speed service" in rural and remote areas is network infrastructure, as the connection type has significant impact on other factors (e.g. reliability, speed, etc...). There are six primary means through which Canadians can be connected to broadband networks – copper cable, coaxial cable, fibre optic cable, fixed wireless, mobile wireless and satellite (the former three of which are fixed (e.g. wired) broadband connections and the latter

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[2] Telecommunications Act, (S.C. 1993, c. 38) s. 7(b).
[3] Canadian Radio-television and Telecommunications Commission (CRTC). 2016. *Telecom Regulatory Policy CRTC 2016-496*. http://www.crtc.gc.ca/eng/archive/2016/2016-496.htm para. 37.
[4] CRTC. 2016. *Telecom Regulatory Policy CRTC 2016-496*. para. 38.
[5] CRTC. 2016. *Telecom Regulatory Policy CRTC 2016-496*. para. 64.
[6] CRTC. 2016. *Telecom Regulatory Policy CRTC 2016-496*. paras. 80 and 114.
[7] CRTC. 2016. *Telecom Regulatory Policy CRTC 2016-496*. para. 109-111. Note that CISC has already reported these standards to the CRTC; however, the report does not appear to be publicly available at the time of writing.

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three of which are wireless connections).[8] Of the six types of connections fibre optic networks offer superior performance (as discussed below), and align with the CRTC's emphasis on fixed over mobile broadband to meet the BSO.[9] Fibre optic networks also offer the distinct advantage of symmetrical upload and download speeds, which are particularly advantageous in certain sectors (e.g. health and education) and also ensure that citizens and businesses can be active uploaders of content rather than simply passive consumers.[10] The Organisation for Economic Cooperation and Development (OECD) is clear when it states that, "Eventually, fibre will almost certainly be the dominant carrier technology in fixed networks"[11] and several commentators have suggested that fibre is the only "future proof" technology.[12] Finally, while fibre is the best technology for network design, this fact does not preclude the necessity for combinations of fixed (fibre) networks along with mobile wireless networks.

b.   Capacity/Scalability and Speed

A key consideration for acceptable high speed service should be ensuring that the network technologies deployed are scalable for future needs. That said, it is important to recognize that predicting these needs is extremely challenging; however, a useful historical comparator is the electricity grid. When considering universal electrification in the mid-20th century grid planners could have possibly foreseen the high demand for electricity from air conditioning and television, but would have been unable to forecast increased demand from a range of household electronic devices produced after the 1970s (e.g. personal computers, VHS/DVD players, broadband modems, and a variety of personal electronic devices).[13] In regards to considering future needs for broadband Alyssa Moore, Policy and Strategy Analyst at Cybera has stated:

> All Canadians will need the capability to transmit gigabits per second of data and process terabytes of information. While this scenario will not be the case tomorrow, we maintain that this is the future our communications infrastructure must be prepared to handle. New

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[8] For a general review of these connection types including please see: McNally, Michael B., Rob McMahon, Dinesh Rathi, Hanne Pearce, Jennifer Evaniew and Chardelle Prevett. 2016. *Understanding Community Broadband: The Alberta Broadband Toolkit*. p. 20. https://era.library.ualberta.ca/files/c247dw24x#.WUQ0HOvytaQ p. 16-21.

[9] CRTC. 2016. *Telecom Regulatory Policy CRTC 2016-496*. para. 64.

[10] Organisation for Economic Cooperation and Development – Working Party on Communication Infrastructures and Services Policies (OECD-WPCISP). 2009. *Network Developments in Support of Innovation and User Needs*. http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2009)2/FINAL&docLanguage=En p. 37.

[11] OECD-WPCISP. 2015. *The Development of Fixed Broadband Networks*. http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2013)8/FINAL&docLanguage=En p. 8.

[12] OECD-WPCISP. 2015. *The Development of Fixed Broadband Networks*. p. 22; Middleton, Catharine. 2016. "Moral Fibre." *InterMEDIA, 44*(1): 31-34, p. 34; and, McNally et al. 2016. *Understanding Community Broadband*. p. 20.

[13] OECD-WPCISP. *Network Developments in Support of Innovation and User Needs*. p. 9-10.

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infrastructure builds must anticipate and accommodate future needs. This means scalability, flexibility, and shareability of networks.[14]

While the CRTC's BSO decision does underscore the importance of developing scalable networks for future needs with speeds of up to 1 Gbps (1000 Mbps) it notes that this can be achieved through either fibre optic or coaxial cable (using the DOCSIS 3.1 standard).[15] However, according to the International Telecommunications Union (ITU), by 2020 fibre networks (using the NG-PON3 standard) could be capable of download speeds in the 100-250 Gbps range,[16] and researchers have already demonstrated speeds on fibre optic cables in excess of 100,000 Gbps.[17] The maximum download and upload speeds with full duplex DOCSIS 3.1 coaxial cable are 10 Gbps.[18] With regards to mobile wireless speeds, the ITU has tentatively calculated the maximal download speed for the new 5G (IMT-2020) wireless standard as 20 Gbps (and only 10 Gbps for the maximum upload speed), though this can only be achieved under ideal conditions.[19] In some cases performance could be closer to 100 Mbps.[20] Furthermore, to support such wireless networks fibre optic transport networks would be necessary. Fibre also offers a distinct advantage in that fibre networks are built to operate for at least 25 years.[21] While it should be noted that there are no end user needs for such speeds at this time, considering future potential demand from developments such as the Internet of Things, Wireless Sensor Networks, and Machine-to-Machine (M2M) Communication and the inherent unpredictability of future uses, fibre offers the greatest future proofing.

c. Reliability and Redundancy

Another key factor in ensuring rural and remote Canadians have acceptable high-speed service is ensuring reliability, and particularly redundancy. There have been several news stories over the past few years of severed cables that have resulted in swathes of the Canadian population without

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[14] Moore, Alyssa. As quoted in: CRTC. 2016. *Transcript, Hearing April 27, 2016 [Hearing for Telecom Notice of Consultation 2015-134]*. 27 Apr. 2016. http://www.crtc.gc.ca/eng/transcripts/2016/tt0427.htm ln. 18375.

[15] CRTC. 2016. *Telecom Regulatory Policy CRTC 2016-496*. para. 79 and ft. 30.

[16] International Telecommunications Union – Broadband Commission (ITU-BC). 2016. *The State of Broadband: Broadband Catalyzing Sustainable Development*. http://www.broadbandcommission.org/documents/reports/bb-annualreport2016.pdf p. 26.

[17] OECD-WPCISP. 2015. *The Development of Fixed Broadband Networks*. p. 8.

[18] CableLabs. 2017. "Full Duplex DOCSIS 3.1." http://www.cablelabs.com/full-duplex-docsis/

[19] International Telecommunications Union – Radiocommunication Study Groups – Working Party 5D. 2017. *Minimum Requirements Related to Technical Performance for IMT-2020 Radio Interface(s)*. https://www.itu.int/dms_pub/itu-r/md/15/sg05/c/R15-SG05-C-0040!!MSW-E.docx p. 3.

[20] International Telecommunications Union (ITU). 2015. IMT Vision – *Framework and Overall Objectives of the Future Development of IMT for 2020 and Beyond*. https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf p. 14.

[21] OECD-WPCISP. 2009. *Network Developments in Support of Innovation and User Needs*. p. 11.

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access to internet.[22] While cuts to fibre transport cables are a reality, the best mechanism to counter their effects is to ensure that networks included redundant loops, such that a single cut will not result in a loss of service. Redundancy is particularly important for institutional users of broadband such as the hospitals and schools.[23]

When considering reliable high-speed service an important factor to consider is that having both fixed (specifically fibre) and mobile wireless networks in rural and remote regions can safeguard against service disruptions.

d. Affordability

As indicated by the Canadian Telecommunications Policy Objectives, affordability is a key consideration in determining acceptable high-speed service. While the issue of affordability was discussed significantly in CRTC's BSO consultation, the Commission took no direct action in addressing affordability as part of its decision.[24] However, the Government of Canada has announced $13.2 million over five years as part of the Affordable Access program to help internet service providers offer internet packages to low-income families.[25] Although these funds will assist low-income families, significant work will need to be done to ensure affordability for rural and remote Canadians.

It was noted by the CRTC, "Urban households generally paid lower Internet service prices and had a greater number of service providers to choose from than rural households."[26] In regards to determining an acceptable price for broadband internet service, the ITU notes that in developed countries the cost of fixed broadband packages averages 1.7% of average income. Statistics Canada

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[22] CBC News. 2016. "Feds Apologize after Contractor Knocks out Internet in Yukon, Nunavut." *Canadian Broadcasting Corporation (CBC)*. 3 Aug. 2016. http://www.cbc.ca/news/canada/north/federal-government-apologizes-yukon-internet-1.3706366; CBC News. 2016. "Cellphone, Internet Service Restored in North as Fibre Line Repaired." *CBC*. 16 Aug. 2016. http://www.cbc.ca/news/canada/north/fibre-cut-edmonton-nwtel-1.3723220; CBC News. " MTS Internet, TV Outage in Winnipeg Caused by Cable Cut." *CBC*. 14 Aug. 2014. http://www.cbc.ca/news/canada/manitoba/mts-internet-tv-outage-in-winnipeg-caused-by-cable-cut-1.1369630; CBC News. 2014. "Cellphone Service Restored in Yukon and Northern B.C." *CBC*. 19 Mar. 2014. http://www.cbc.ca/beta/news/canada/north/cellphone-service-restored-in-yukon-and-northern-b-c-1.2579323.
[23] OECD-WPCISP. 2009. *Network Developments in Support of Innovation and User Needs*. p. 24; and, United States – Department of Education – Office of Educational Technology. 2014. *Future Ready Schools: Building Technology Infrastructure for Learning.* https://tech.ed.gov/wp-content/uploads/2014/11/Future-Ready-Schools-Building-Technology-Infrastructure-for-Learning-.pdf p. 27 and 32.
[24] CRTC. 2016. *Telecom Regulatory Policy CRTC 2016-496*. para. 204.
[25] Canada. 2017. *Building a Strong Middle Class [Budget 2017]*. http://www.budget.gc.ca/2017/docs/plan/budget-2017-en.pdf p. 73.
[26] CRTC. 2016. *Communications Monitoring Report 2016*. http://www.crtc.gc.ca/eng/publications/reports/PolicyMonitoring/2016/cmr.pdf p. 253.

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reports average expenditure per household on communications (which includes broadband, but also other communication services (e.g. voice and mobile)) is $2,187 in 2015.[27] With total average household expenditure equaling $82,697,[28] communications spending represents 2.64% of all spending. Furthermore, median household income in Canada is $80,940,[29] which is relatively similar to average household expenditure.[30] Given the ITU global average, and Canadians current spending on communication services relative to other spending (with a note that this category includes more than broadband spending), one way to estimate what constitutes affordable internet would be to consider broadband internet service affordable when it makes up no more of 2% of income (or expenditure).   A further advantage of using the 2% threshold for affordability is that it can take advantage of regional (as opposed to national) expenditure/income data.[31]

While the Canadian Telecommunication Policy Objectives provides some general guidance on what constitutes acceptable high-speed service, a closer examination demonstrates that acceptable service can best be met through fibre networks (which in turn can support mobile wireless networks). The following section comments on the cost challenges that will result from increasing fibre penetration.

II.   Financial Challenges in Implementing High-Speed Service

Implementing high-speed service for rural and remote Canadians via fibre optic and wireless networks will be costly. In 1994, Industry Canada estimated the cost of a universal fibre optic network to be as high as $30 billion.[32] The CRTC in its BSO decision notes that "Closing the gap in broadband Internet access service availability in Canada is an enormous financial challenge, requiring billions of dollars..."[33] The OECD estimates that capital costs for connecting homes to a fibre network exceed $1000 USD per premises.[34] While the costs are high, total direct public

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[27] Statistics Canada. 2017. *Survey of Household Spending (SHS). CANSIM Table 203-0021*.
http://www5.statcan.gc.ca/cansim/a26?lang=eng&id=2030021
[28] Statistics Canada. 2017. *Survey of Household Spending (SHS). CANSIM Table 203-0021*.
[29] Statistics Canada. 2017. *Median Total income. CANSIM Table 111-009*. http://www.statcan.gc.ca/tables-tableaux/sum-som/l01/cst01/famil108a-eng.htm
[30] It is acknowledged that comparing average expenditure and median income is limited as the two measures are not different.
[31] Ideally the 2% threshold could function on a personal/household level through changes to the Income Tax Act to afford individuals/households whose spending on basic broadband programs exceeds the threshold. However, doing so would require the establishment of a new tax expenditure and also a means for individuals to report their broadband spending and type of plan/subscription.
[32] Industry Canada – Spectrum, Information Technologies and Telecommunications Sector. 1994. *The Canadian Information Highway*. Ottawa: Minister of Supply and Services Canada). p. 21.
[33] CRTC. 2016. *Telecom Regulatory Policy CRTC 2016-496*. para. 128.
[34] OECD-WPCISP. 2015. *The Development of Fixed Broadband Networks*. p. 5.

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investment in broadband by the Government of Canada from 1994-2016 has been modest totalling roughly $2.5 billion.[35]

Although fibre optic networks are expensive, they do generate significant returns (both economic and social) that justify the upfront investment. The OECD estimates that the construction of a national point-to-point fibre network will generate cost savings between 0.5% and 1.5% in the electrical, health, transportation and education sectors, which can justify the cost of building such a network.[36] It goes on to note that the initial investment in a fibre network will be amortised over a 8-10 year range, but the network will operate considerably longer.[37] Fibre has also been shown to correlate with 1.1% higher employment rates in areas that are the least urbanized.[38]

Although the costs for fibre networks are high, direct government funding to cover the entire capital cost to construct such a network is not necessary if the proper regulatory and policy changes are put in place to empower communities and incent the private sector with an enabling regulatory framework and targeted public investment.

III.   Regulatory Changes to Encourage Rural High-Speed Service

There are numerous regulatory and policy changes that can be considered in order to encourage rural high-speed service. Foremost, the objective should be to develop an enabling framework as part of a national broadband strategy, which allows governments (all levels) the private sector and community groups to develop broadband infrastructure in rural communities. Partnership between government, industry and other stakeholders coordinated through a national strategy is essential according to the ITU.[39] However, it should also be noted that infrastructure development is only one piece of a comprehensive digital connectivity strategy that must also include efforts to ensure the availability of broadband and foster digital skills/literacy. An enabling framework is also a

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[35] McNally, Michael B., Dinesh Rathi, Jennifer Evaniew, and Yang Wu. 2017. "Thematic Analysis of Eight Canadian Federal Broadband Programs from 1994 to 2016." *Journal of Information Policy, 7*: 38-85. http://www.jstor.org/stable/pdf/10.5325/jinfopoli.7.2017.0038.pdf, p. 48 and 53. Note this figure does include the $500 million invested through Connect to Innovate, but does not include indirect funding through the CRTC's deferral accounts program or the newly announces (and still under-development) CRTC fund of $750 million.

[36] OECD-WPCISP. 2009. *Network Developments in Support of Innovation and User Needs*. p. 4.

[37] OECD-WPCISP. 2009. *Network Developments in Support of Innovation and User Needs*. p. 15.

[38] OECD-WPCISP. 2015. *Development of High Speed Networks and the Role of Municipal Networks.* http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP%282015%291/FINAL&docLanguage=En p. 23.

[39] ITU. 2013. *Planning for Progress: Why National Broadband Plans Matter*. http://www.broadbandcommission.org/documents/reportNBP2013.pdf p. 49; ITU-BC. 2016. *The State of Broadband*. p. 32.

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recognition that "one size does not fit all" with respect to incenting rural high-speed service,[40] and also reflects the need that a more active policy/regulatory approach is needed in Canada.[41]

a. A Policy and Regulatory Obstacles

In order to develop an enabling framework to encourage rural high-speed service there are two important policy considerations that must first be addressed. The first is the policy and regulatory bifurcation that characterizes Canadian broadband. Broadband policy is primarily set by Innovation, Science and Economic Development (ISED), with the CRTC responsible for regulation. However, with respect to wireless, much of the regulation (specifically of radio-spectrum) is the responsibility of ISED. One mechanism to streamline Canadian policy and regulation with respect to broadband would be to transfer the licensing of spectrum from ISED to the CRTC and create a clearer distinction between policymaker (ISED) and regulator (CRTC) as recommended by the OECD.[42]

A second major policy change that should be considered is the removal of the 2006 Policy Direction from the Governor in Council (the Federal Cabinet) to the CRTC.[43] The Policy Direction, which compels the CRTC to rely on market forces to the maximum extent possible. The existing Canadian Telecommunications Policy Objectives already aim to foster increased reliance on market forces.[44] The Policy Direction's accentuation on market forces inhibits the CRTC's ability to properly decide the balance between regulation and market forces. The emphasis on market forces is particularly disadvantageous for rural and remote communities where market forces may be nascent at best or completely non-existent.[45] There have been repeated calls for the elimination of the Policy Direction and critiques of the bias on market forces in Canadian telecom policy.[46] Eliminating the Policy Direction would not undermine the Canadian Telecommunications Policy Objectives, as the

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[40] OECD-WPCISP. 2015. *Development of High Speed Networks and the Role of Municipal Networks.* p. 27.

[41] Van Gorp, Annemijn F., and Catherine A. Middleton. 2010. "The Impact of Facilities and Service-Based Competition on Internet Services Provision in the Canadian Broadband Market." *Telematics and Informatics, 27*: 217-230. p. 226.

[42] OECD. 2002. *Regulatory Reform in Canada: From Transition to New Regulation Challenges.* http://www.oecd.org/regreform/1960562.pdf p. 12.

[43] Canada. 2006. *Order Issuing a Direction to the CRTC on Implementing the Canadian Telecommunications Policy Objectives.* SOR/2006-355. http://laws-lois.justice.gc.ca/PDF/SOR-2006-355.pdf

[44] Telecommunications Act, (S.C. 1993, c. 38) s. 7(f).

[45] McNally, Michael B., and Samuel E. Trosow. 2013. "The New Telecommunications Sector Foreign Investment Regime and Rural Broadband." *Journal of Rural and Community Development, 8*(2): 23-43, p. 38; and Rajabuin, Reza and Catherine A. Middleton. 2013. "Multilevel Governance and Broadband Infrastructure Development: Evidence from Canada." Telecommunications Policy, 73: 702-714. p. 710, 711 and 712.

[46] Van Gorp and Middleton. 2010. "The Impact of Facilities and Service-Based Competition on Internet Services Provision in the Canadian Broadband Market." p. 226; McNally and. Trosow. 2013. "The New Telecommunications Sector Foreign Investment Regime and Rural Broadband." p. 38; McNally et al. 2017. "Thematic Analysis of Eight Canadian Federal Broadband Programs from 1994 to 2016." p. 64-65.

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Commission would still be bound by these, but such an approach would broaden the scope of potential regulatory involvement the CRTC could engage in.

b. Macro-level Policy Considerations

While correcting the problem of regulatory fragmentation and removal of the Policy Direction are first steps in developing an enabling regulatory framework, there are several macro-level policy considerations that could be introduced to further encourage rural high-speed service. One of the most significant policy moves would be to implement some sort of either structural or functional separation into the Canadian broadband ecosystems, thereby separating the ownership and operation of broadband networks from the delivery of services over those networks; however, despite foreign jurisdictions' successes with this approach, it would create a significant regulatory burden to now implement on the Canadian telecom sector.[47]

A more reasonable approach would be to strengthen infrastructure sharing and emphasize to a greater degree services based competition rather than facilities based competition. Infrastructure sharing mechanisms are seen as a proven means for increasing connectivity[48] and supported as a primary recommendation by the ITU.[49] Empirical literature on whether services versus facilities based competition is superior is mixed.[50] However, according to the World Bank, infrastructure sharing is particularly effective in rural areas.[51] In rural areas there are weak market forces and insufficient incentives for multiple companies to invest in infrastructure,[52] thus undermining facilities based competition as a viable policy approach. Although a degree of infrastructure sharing/services based competition is already present in Canada (in particular through the CRTC's

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[47] Middleton, Catherine. 2011. "Structural and Functional Separation in Broadband Networks." In *The Internet Tree: The State of Telecom Policy in Canada 3.0*. Marita Moll and Leslie Regan Shade (Eds.). p. 61-72. Ottawa: Canadian Centre for Policy Alternatives. p. 68.

[48] Nokia. 2016. *Government Broadband Plan: 5 Key Policy Measures that Proved to Make a Difference*. https://resources.ext.nokia.com/asset/193176 p. 17.

[49] ITU-BC. 2014. *The State of Broadband 2014: Broadband for All*. http://www.broadbandcommission.org/documents/reports/bb-annualreport2014.pdf p. 80.

[50] Rajabuin, Reza and Catherine A. Middleton. 2013. "Multilevel Governance and Broadband Infrastructure Development: Evidence from Canada." *Telecommunications Policy*, 73: 702-714. p. 704-705; [50] and, Van Gorp and Middleton. 2010. "The Impact of Facilities and Service-Based Competition on Internet Services Provision in the Canadian Broadband Market." p. 219-220.

[51] Kelly, Tim and Carlo Maria Rossotto. 2012. *Broadband Strategies Handbook*. Washington, DC: World Bank. https://openknowledge.worldbank.org/bitstream/handle/10986/6009/676200PUB0EPI0067882B09780821389454.pdf?sequence=1&isAllowed=y p. 57.

[52] Rajabiun, Reza and Catherine Middleton. 2013. "Rural Broadband Development in Canada's Provinces: An Overview of Policy Approaches." *Journal of Rural and Community Development, 8*(2): 77-22, p. 9 and 18-19; and, Rajabuin and Middleton. 2013. "Multilevel Governance and Broadband Infrastructure Development." p. 710, 711 and 712.

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decision on wholesale wireline services[53] and ISED guidelines on infrastructure sharing[54]), a more concerted emphasis can be placed on infrastructure sharing and services based competition in rural and remote communities.

Another macro-level policy consideration is the removal of foreign investment restrictions on the telecom sector. Removal of foreign investment restrictions was proposed by the Telecommunications Policy Review Panel in 2006[55] and in the Competition Policy Review Panel (the Wilson Panel) in 2008.[56] In 2012 the Government of Canada partially, though not fully, liberalized some aspects of the foreign investment restrictions in Canada's telecommunications sector.[57] The issue of foreign investment restrictions has again surfaced as a key issue in upcoming renegotiations of the North American Free Trade Agreement (NAFTA).[58] While increased foreign capital may spur competition in the telecom sector in urban Canada, there is limited empirical evidence that foreign investment will benefit rural Canadians. Specifically, one study looking at mobile wireless broadband found that changes to foreign investment restrictions were unlikely to benefit rural Canadians.[59] Thus changes to the foreign investment regime, while potentially beneficial for the overall telecom sector, should not be viewed as a key means of encouraging rural high-speed service.

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[53] CRTC. 2015. *Telecom Regulatory Policy CRTC 2015-326*. http://www.crtc.gc.ca/eng/archive/2015/2015-326.htm

[54] Industry Canada. 2013. *Revised Frameworks for Mandatory Roaming and Antenna Tower and Site Sharing*. https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/Revised-Frameworks_EN.pdf/$file/Revised-Frameworks_EN.pdf; and, Industry Canada. 2014. *Radiocommunication and Broadcasting Antenna Systems*. CPC-2-0-03. https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/cpc-2-0-03-i5.pdf/$file/cpc-2-0-03-i5.pdf

[55] Canada – Telecommunications Policy Review Panel. 2006. *Telecommunications Policy Review Panel: Final Report 2006*. https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/tprp-final-report-2006.pdf/$FILE/tprp-final-report-2006.pdf p. 11-24 to 11-26.

[56] Canada – Competition Policy Review Panel. 2008. *Compete to Win: Final Report – June 2008*. https://www.ic.gc.ca/eic/site/cprp-gepmc.nsf/vwapj/Compete_to_Win.pdf/$FILE/Compete_to_Win.pdf p. 49. Note the House of Commons Industry Committee also studied foreign investment restrictions in the telecommunications sector in 2010; however, its recommendations were more limited than those adopted by the two expert panels (Canada – House of Commons – Standing Committee on Industry, Science and Technology. 2010. *Canada's Foreign Ownership Rules and Regulations in the Telecommunications Sector*. 40th Parl. 3rd. Sess. http://www.ourcommons.ca/Content/Committee/403/INDU/Reports/RP4618793/indurp05/indurp05-e.pdf p. 45).

[57] Statutes of Canada 2012: Chapter 19 [Bill C-38]. 41st Parl. 1st Sess. http://www.parl.ca/Content/Bills/411/Government/C-38/C-38_4/C-38_4.PDF cl. 595-601.

[58] United States Trade Representatives. 2017 Summary of Objectives for the NAFTA Renegotiation. https://ustr.gov/sites/default/files/files/Press/Releases/NAFTAObjectives.pdf p. 8.

[59] McNally and Trosow. 2013. "The New Telecommunications Sector Foreign Investment Regime and Rural Broadband." p. 36. Note Rajabiun and Middlteon also suggest that changes to the foreign investment regime will not result in rural broadband investments (Rajabiun and Middleton. 2013. "Rural Broadband Development in Canada's Provinces." p. 11.)

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c.   Mobile Wireless Considerations

While fibre networks should be prioritized, there are several specific policy and regulatory measures that can help ensure mobile wireless broadband in rural Canada. Spectrum license deployment requirements can be increased to ensure that spectrum licensees are obligated to serve greater proportions of the population living in the spectrum tiers (i.e. geographic areas) for which they have obtained licenses.[60] ISED should conduct a review and consider expansion of Radio System Policy 019[61] – a 'use it or lose it' type policy – that it committed to in 2012,[62] and has still not acted on. Another mechanism which enhances rural broadband is mandating that new wireless towers are connected by fibre. While microwave backhaul is cheaper in the short term, mandating fibre fed towers ensures greater deployment of fibre transport infrastructure and ensures long term capacity for towers.[63]

d.   Importance of Demand Side Policies

Although many of the policy and regulatory options for encouraging rural high-speed services are infrastructure based (also known as supply side), it is equally important to consider demand-side policies. Even if individuals have the infrastructure to access they must have the motivation to become connected.[64] Some key elements of demand side policies include greater study and understanding of digital literacy along with programs aimed to encourage digital literacy.[65] Digital literacy remains a significant barrier for many Canadians in using the internet.[66]

There is also a need for greater data about broadband uptake and use in Canada. In enhancing rural high-speed services there should be an emphasis on not only increasing availability and penetration, but also collecting information on how people use broadband. In this regard reinstating the Canadian Internet Use Survey from Statistics Canada, last undertaken in 2012, would be part of an

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[60] McNally and Trosow. 2013. "The New Telecommunications Sector Foreign Investment Regime and Rural Broadband." p. 36.

[61] Industry Canada. 1998. *Policy for the Provision of Cellular Services by New Parties*. RP-019. https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/rp019.pdf/$FILE/rp019.pdf

[62] Industry Canada. 2012. *Policy and Technical Framework: Mobile Broadband Services (MBS) – 700 MHz Band and Broadband Radio Service (BRS) – 2500 MHz Band*. SMSE-002-12. https://www.ic.gc.ca/eic/site/smt-gst.nsf/vwapj/700MHz-e.pdf/$file/700MHz-e.pdf p. 32.

[63] McNally et al. 2016. *Understanding Community Broadband.* p. 36.

[64] van Dijk, Jan A. G. M. 2013."A Theory of the Digital Divide." In *The Digital Divide: The Internet and Social Inequality in International Perspective*. Massimo Ragnedda and Glenn W. Muschert (Eds.). p. 29-51. London: Routledge. p. 35.

[65] Kelly and Rossotto. 2012. *Broadband Strategies Handbook*. p. 48.

[66] Ekos Research Associates. 2016. *Let's Talk Broadband Findings Report*. http://madgic.library.carleton.ca/deposit/govt/ca_fed/crtc_letstalkbroadband_2016.pdf p. 33.

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effective enabling framework.[67] Consideration of barriers such as digital literacy, affordability (discussed above) and increased data collection on internet use are all keys aspects of increasing and enhancing rural high-speed connectivity.

e. Creating Community Capacity

Another key part of an enabling framework is having policy mechanisms that can reduce costs of fibre deployments, which can be implemented by lower level governments.[68] A key means of reducing the cost of future broadband deployments is to have "dig once" policies that require the construction of fibre-optic conduit as part of any public works project. A national "dig once" strategy that coordinates with both provincial/territorial and municipal governments could significantly reduce costs for future fibre deployments (particularly when coupled with infrastructure sharing provisions). "Dig once" policies and related policies requiring multi-tenant units to have duct work for easy broadband installation have many proponents.[69] There are also existing examples of such legislation. The European Union has existing legislation aimed at promoting "the dig once" approach and mini-ducts for multi-tenant buildings.[70]

The most important element of an enabling framework is to empower rural and remote communities to advance discussions of broadband connectivity (and the potential solutions) at the local level. Strengthening local capacity for discussion and decision making around broadband is key as the most effective solutions are those rooted in local needs and requirements.[71]

In Alberta, there has been significant discussion of broadband through the twice-yearly Digital Futures symposiums organized by the Van Horne Institute. Spilling over from these conferences has been the creation of *Understanding Community Broadband: The Alberta Broadband Toolkit*[72] funded by the Government of Alberta's Ministry of Economic Development and Trade. The

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[67] McNally et al. 2017. "Thematic Analysis of Eight Canadian Federal Broadband Programs from 1994 to 2016." p. 77.

[68]   ITU-BC. 2014. *The State of Broadband 2014.* p. 80; and, Nokia. 2016. *Government Broadband Plan.* p. 11.

[69] Next Century Cities. 2015. *Connecting 21st Century Communities: A Policy Agenda for Broadband Stakeholders.* http://nextcenturycities.org/wp-content/uploads/NCCPolicyAgenda_Web.pdf p. 4-5; New York State – Broadband Program Office. New York State Broadband Strategy Development Toolkit. https://nysbroadband.ny.gov/sites/default/files/documents/ToolkitFINAL_6-4-14.pdf p. 15; and, McNally et al. 2016. *Understanding Community Broadband.* p. 35.

[70] Directive 2014/61/EU of the European Parliament and of the Council. 2014. *Official Journal of the European Union, L155*: 1-14. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0061&from=en

[71] OECD-WPCISP. 2015. *Development of High Speed Networks and the Role of Municipal Networks.* p. 26; and, McMahon, Rob, Susan O'Donnell, Richard Smith, Brian Walmark, and Brian Beaton. 2011. "Digital Divides and the 'First Mile': Framing First Nations Broadband Development in Canada." *The International Indigenous Policy Journal, 2*(2): 1-15, p. 8.

[72] McNally et al. 2017. *Understanding Community Broadband*.

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combination of a provincial toolkit and Digital Futures conferences provides a key means through which knowledge about broadband challenges and solutions can be exchanged among community leaders. A key means of ensuring that an enabling framework will be successful is facilitating knowledge exchanges across sectors (government, industry, academia and community groups). Thus in addition to the regulatory and policy considerations noted above, there needs to be mechanisms by which local leaders can become knowledgeable to have local discussions about how rural communities can overcome problems with broadband connectivity. The development of a national strategy can serve as a key means of catalyzing inter-sectoral discussions around broadband.

IV.   About the Van Horne Institute

The Van Horne Institute is Canada's leading 'think tank' in trade, transportation, infrastructure and resource development. With a focus on network optimization, trade partnership, efficient transport operations, regulatory policy reform and innovation, Van Horne Institute members benefit from its contributions to strategic decision-making, stakeholder engagement, developing regulatory frameworks, promoting economic growth and fostering trade competitiveness.

The Van Horne Institute has been quite active in advancing broadband in Alberta. This has primarily been done through the organization of Digital Futures conferences held at several locations throughout Alberta (Calgary (2013), Calgary (2014), Edmonton (2015), Olds (2015), Medicine Hat (2016), Lac La Biche (2016), Cochrane (2017)), and Westlock (2017 – upcoming).

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