

The background is a deep blue with a subtle, glowing grid pattern. Overlaid on this are several bright, white, horizontal lines that appear to be part of a network or data stream. A large, semi-transparent globe is visible in the upper right, and a series of white dots connected by thin lines forms a network structure on the left side.

# Broadband: the essential utility

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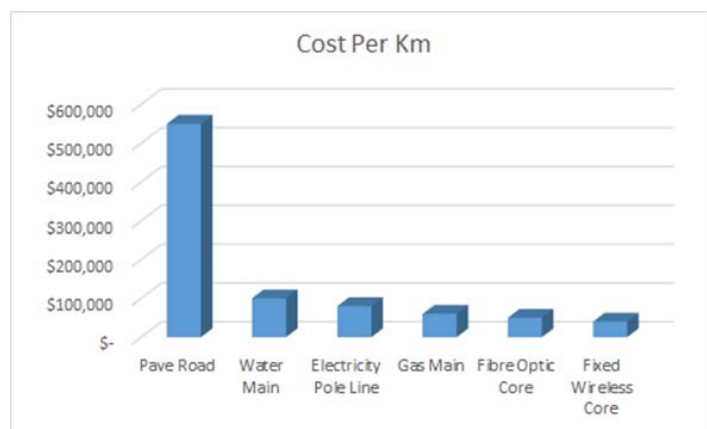
## 1 Purpose of this paper

The Intelligent Community Forum Canada (ICF Canada) is providing this paper for the purposes of making an evidence-based case that broadband should be declared an essential utility and that equitable access to the Internet be a right of every Canadian as entrenched in the Charter of Rights and Freedoms based on the principle of “equality before and under law and equal protection and benefit of law,”(*Canadian Charter of Rights and Freedoms*), because in the digital age equitable access to the Internet is a determinant of one’s equal access to healthcare, education, government, marketplaces and the Right to “pursue the gaining of a livelihood.”(*Canadian Charter of Rights and Freedoms*). It is noteworthy to consider that United Nations, as far back as June 29, 2012, declared that, “The promotion, protection and enjoyment of human rights on the Internet,” to be fundamental to, “all Rights under Promotion and protection of all human rights, civil, political, economic, social and cultural rights, including the right to development.”<sup>i</sup>

## 2 Broadband as the next essential utility

In our view, broadband is the next essential utility, as vital to economic growth as reliable electricity, clean water and good roads. These utility “systems are engineered for scalability, can support new uses, and upgrades do not typically require changes to the ways that people engage with the services. As broadband becomes more essential to the economy and everyday life, should not expectations for ease of use and availability and affordability be the same as those for water or electricity? If so, it seems that simple, unconstrained, upgradable models for broadband provision will be the preferred choice in future.”<sup>2</sup>

**Figure 1 Cost of broadband compared to other utility infrastructures**



Broadband connects your computer, mobile phone and sensors to billions of devices and users around the corner and across the world, creating a digital overlay to our physical world that is revolutionizing how we work, play, live, educate and entertain ourselves, govern our citizens and relate to each other. Particularly in higher income countries, Internet access has evolved to become a human right and a basic service<sup>3</sup>. As shown in Figure 1(City of Kingston), the average cost of deploying Internet access infrastructure is substantially lower (up to 10 times less) than traditional public infrastructure such as roads, water, electricity and gas, while the economic impact of Internet access far outstrips the impact of these other infrastructures, accounting for about 3.4% of GDP and over 21% in GDP growth<sup>4</sup>.

The broadband economy is the product of the build-out of the 21st century’s low-cost, high-speed communications and information technology on both the global and local levels. This has resulted in societies acquiring innovative and sustainable ways of working and living. There is growing collaboration and cooperation across time zones and cultures that creates open markets, boosts productivity, improves efficiency, promotes sharing of limited resources, generates employment, and improves living standards.

The federal government is taking conscious steps to build the infrastructure necessary “to help Canadian businesses grow, innovate, and export so that they can create good quality jobs and wealth for Canadians”<sup>5</sup>.

Moreover, Innovation, Science and Economic Development Canada (ISED) concluded that, “We must begin by acknowledging that broadband has become an essential service. Estonia (2004), Australia (2006) and Finland (2009) have declared broadband Internet access to be a legal right. Canadians should not only have a legal right to broadband service but also to service that is robust enough to support social and economic applications essential to community sustainability.”<sup>6</sup>

As shown in Figure 2(ICF), the first indicator of Intelligent Community Forum (ICF) Canada and ICF is that everyone in a community needs equitable access to affordable and reliable broadband Internet to enable participation in the subsequent indicators of an intelligent community. Commonly called the “digital divide,” the lack of equitable access to the Internet is most pronounced for lower income families, single-parent households, seniors, new Canadians, First

Nations peoples, and people with physical or mental challenges – these people often do not have equitable access to either the Internet or the devices that connect to the Internet or the applications available on the Internet and/or the skills to use the Internet effectively. Therefore, the digital economy has created a new underclass made up of people that already face many obstacles and the gap is growing at Internet pace; so, the question for this generation is what are we doing as individuals, communities, municipalities, regional, provincial and federal governments to fix this problem?

The Virtuous Circle, designed to counter the “vicious circle,” many of our citizens and communities have been caught in for years, works as follows:

1. Broadband access by knowledge workers to connect with each other.
2. Connected workers create new products, services, and applications.
3. The creation and distribution of these new products service and apps drives innovation and innovation drives economic growth in the digital economy;
4. To drive growth faster still, communities that ensure all of their citizens have an equal ability to participate in the digital economy regardless of their socio-economic, physical or mental acquity, or geographic location will ensure all boats rise with the tide.
5. These intelligent communities connect all of their community assets digitally to create a smart sustainable ecosystem.
6. Then these intelligent communities advocate all of these capabilities to the world in order to leverage their burgeoning reputations, attracting and retaining skilled workers, investment capital, and business startups and relocations.

**Figure 2 ICF Virtuous Circle**



These intelligent communities will be the economic and social leaders of the 21<sup>st</sup> century. What is true for a community is true for a province or state and a country.

### 3 What is broadband?

There is no single, standardized, worldwide definition for broadband. Defining broadband as a fixed bandwidth target, like the federal government’s current target of 5Mbps down/1 Mbps up, is bound to be inadequate the moment it is published because of the rapidly changing nature of information and communications technology (ICT) and because of the continuously scaling requirements of users and their applications for bandwidth. According to several recent studies, broadband consumption is growing at a compound annual growth rates up to 50%<sup>8</sup>. How can a bandwidth target be established in an environment of such explosive increases?

Furthermore, broadband is more than bandwidth. Broadband connections must support millions of applications used simultaneously and concurrently by billions of users and IP-based devices at a moment in time. Increasingly access to education, healthcare, government services, and market places depend on an Internet connection. These information sessions must co-exist together and function properly. In addition to high symmetric speeds, these applications increasingly require verifiable minimum Quality of Service (QoS) guarantees. Moreover, with the advent of exponential growth of microchip capacity,<sup>9</sup> point-to-point communications, cloud computing and the Internet of Things, broadband needs to be defined by a set of standardized, universal attributes. Adherence to these standards ensures that these sessions operate reliably and that the broadband connection will scale to these growing requirements dynamically so it is

always available when every person, place or thing needs it.

Therefore, based on these requirements, we recommend that the federal government adopt the following “Guiding Principles” in defining broadband as an operational construct.

## 4 Guiding Principles of Broadband Internet

An Internet connection must support these guiding principles<sup>ii</sup> to be designated “broadband,” (see “Endnotes” for technical specifications that underpin guiding principles). The Internet connection must be:

1. Standards-Based Architecture<sup>iii</sup>: The system will interoperate with all other systems and is easy to support.
2. Highly Available<sup>iv</sup> and Scalable: The network connection is available at any moment in time, wherever users, places or things need it, any time they need it, and the system can scale in capacity to all sessions and applications dynamically without significant additional capital outlays or system delays.
3. Symmetrical: the bandwidth (information carrying capacity) of the network connection is symmetrical. This means the speed and capacity of data download and upload are equal. Symmetry is necessary to support point-to-point and cloud-based applications. Low latency<sup>v</sup> of the symmetrical signal is essential to effective applications performance over the symmetrical connection.
4. Supports differentiation: A differentiated system is one that supports multiple Classes of Service (CoS)<sup>vi</sup> and Quality of Service (QoS)<sup>vii</sup> for all applications that require it.
5. Neutral and Open Access: There are no barriers to entry for users and providers to access each other. The playing field is level, meaning there are facilities, contractual mechanisms, published rates, and oversight in place to ensure access is open to all users and providers.
6. Ubiquitous and Equitable: Ubiquity means physical accessibility of the network to *everyone*, and equitability means costs are the same for everyone to provide applications and services over the system or use applications and services on the system regardless of geographic point of ingress/egress or demographic characteristics of the locale.
7. Balance Competition and Cooperation: The system and processes promote competition in services and applications. More competition between providers leads to better services and lower prices for everyone, while cooperation can be critical for fixed cost sharing in deploying Next Generation Networks (NGN).
8. Broad Participation: means community leaders advocate that public-sector organizations, private enterprises, small and medium sized business, farmers and residents connect to the network and use it. The value of a telecommunications network is proportional to the square of the number of connected users of the system ( $n^2$ ).<sup>viii</sup>
9. Sustainability: If the foregoing principles of the network are in force then the network will be sustainable over the long term and serve the country well for years to come and require less taxpayer funded subsidization. Moreover, lack of equitable access to the Internet will cease being a barrier to economic prosperity and social well-being for everyone.

### 4.1 Bandwidth targets

If the federal government feels it requires a bandwidth target as matter of public policy, we recommend that these targets be set either annually to stay current or pick targets with a fixed future date that will guide policy of government funders and trigger investments by service providers that will result in next generation infrastructure building or both. On this basis, ICF Canada recommends a target for 2017 of 100 Mbps symmetrical access for residents and small business and a target for 2020 of 1Gbps based on the current trends in bandwidth utilization. An excellent article by Professor Catherine Middleton presents, “a vision for next generation broadband and poses questions as to whether the technologically neutral stance that generally guides policymaking should be set aside to actively advance the deployment of fibre.”<sup>2</sup> As she posits in her paper, a fibre connection means bandwidth targets can be more aggressive and scale as users’ needs demand.

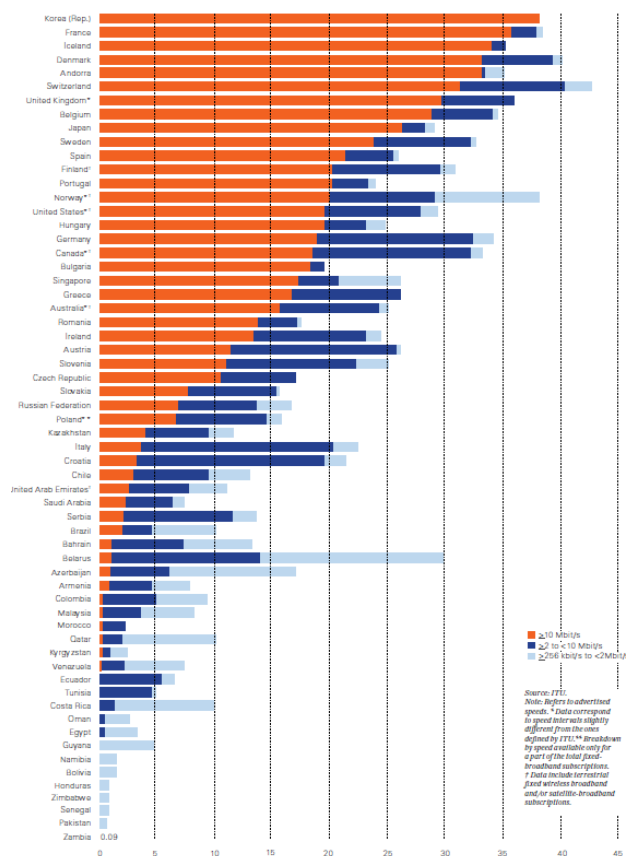
## 5 Funding broadband infrastructure

ISED is currently developing a broadband funding program for the funds identified in the 2016 Federal budget, “Budget 2016 proposed up to \$500 million over five years, starting in 2016-17, for a new program to extend and enhance broadband service in rural and remote communities.”(FAQs for Canadians - Digital Canada 150) In addition, the “Fall 2016 Economic Statement,” the federal government earmarked \$2 billion for rural infrastructure, including broadband and identified funding to be announce later for communities wanting to enter into a “Smart Cities Challenge”(Fall Economic Statement, 2016).

We understand the historical basis for the \$500 million budget figure is the notion of providing 5/1 Mbps to every Canadian as the goal. Consequently, federal funders have operated on the premise that only a “few” Canadians in rural and remote areas are without this level of connectivity then achieving 100% coverage is about a \$500 million to-do. However, the program recently announced by ISED will state that the \$500 million budget is to be spent on “middle-mile” infrastructure to rural and remote communities who are unserved and underserved by broadband today based on information the authors have seen from ISED. This change in goal should lead to build out fibre optic facilities to fill these gaps and ICF Canada strongly endorses this new approach.

In our view, the goal of 5/1 Mbps may have been a worthy goal in 2000; however, it is wholly inadequate today. For example, Ward 1 Regional Councilor Barb Shaughnessy of the Town of Caledon (a SWIFT Network member community) said she has, “two kids home from university, and in Ward 1, where little development is happening. I’ve now kicked them out and make them go to Tim Horton’s in Caledon Village [to connect to their Wi-Fi],” she said. “I have one doing a course online. It’s a real issue.” Today, even grade-schoolers are required to view video content as well as download and upload their assignments online. Indeed, Ms. Shaughnessy’s local Tim Horton’s now restricts the amount of time students can use their free WiFi service because of the number of students doing so. No wonder Tim Horton’s is growing so fast.

**Figure 3 Bandwidth speeds by country**



As Figure 3 shows, from the International Telecommunications (ITU) Facts and Figures 2015 Report, at 15<sup>th</sup> in the world, Canada lags well behind other developed nations in bandwidth capacity. Most worrisome is the fact that Canada’s ranking has been on a downward slide since deregulation in 1993 through the 2000s, where Canada ranked 3<sup>rd</sup>. The lack of capacity is a reflection of the low expectations regulators and policy makers have set for the telecom service providers by focusing regulation and funding at achieving minimum speeds instead of setting aspirational targets to spur innovation. Moreover, with a few exceptions, the dearth of competition between telecom providers, in our duopolistic marketplace, leads to the inertia of the status quo as service providers “sweat the copper” to maximize ROI where no competition or regulatory imperatives exist to motivate them to deploy fttp. CRTC’s standards are so far below that of the FCC in the U.S., the European Commission, and various other regulators in high-income countries that this result speaks for itself. With a number of notable exceptions, communities receiving significant fibre-to-the-premises/node/cabinet (FTTx) investments are our largest cities or communities with demographically attractive profiles, who already enjoy an enormous advantage in bandwidth, services and rates.<sup>12</sup>

Given the Commission’s low bandwidth targets, it is not surprising that actual broadband speeds in Canada lag substantially behind a large number of leading countries where governments have been more committed to building



a world-class digital infrastructure.<sup>13</sup> For example, in 2013 Canada was ranked 30<sup>th</sup> in the world behind Venezuela in affordable broadband access<sup>14</sup>. Notably, Canada has been falling in the rankings every year for 10 years. Almost a decade ago, the Telecommunications Policy Review Panel (TPRP) recognized the start of Canada's comparative decline as a broadband leader and warned policymakers. Until recently, despite this and other warnings, little has been done to reverse this trend by the federal government through adjustments to wholesale and/or retail regulatory frameworks.

More generally, other governments such as the US<sup>15</sup>, Korea<sup>16</sup>, Australia<sup>17</sup>, and Japan<sup>18</sup>, have developed broadband strategies and plans that are far more robust than the current Digital Canada 150 Strategy published by the former Industry Canada.<sup>19</sup> The absence of a coherent plan to reverse Canada's comparative decline by federal policymakers makes it even more imperative for the CRTC to define broadband as a basic service and institute service/speed targets that encourage service providers to increase the quality of service they offer to end users in both urban and rural areas.

These broadband strategies have led to an emphasis on fibre-to-the-premises (fttp) networks such that fttp is fastest growing form of deployment and the defacto standard deployment for all new infrastructure. In the absence of a federal strategy, Figure 4<sup>20</sup> shows just how far Canada is behind other OECD countries and the OECD average for fttp penetration:

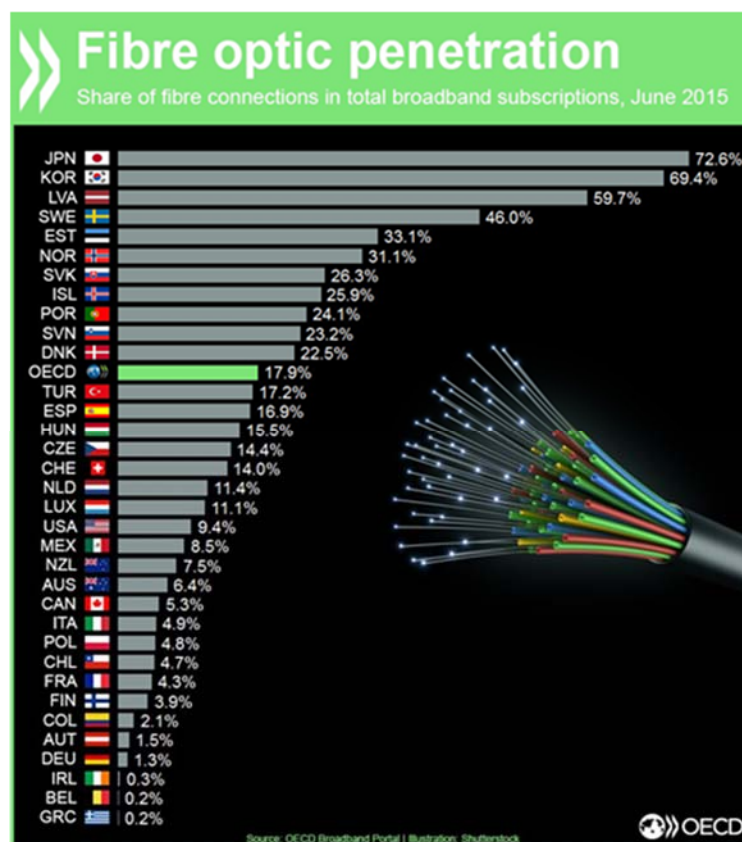
- Japan 72.6%
- Korea 69.4%
- Latvia 59.7%
- Sweden 46.6%
- Canada 5.3% or 24th
- OECD Average 17.9%

Another problem is the idea that only rural and remote communities need to be fixed. Recently, the City of Montreal was chosen as the Intelligent Community of the Year for 2016 against over 400 applicants from around the world<sup>21</sup>. Yet, 36% of the area of Montreal is designated as "rural," according to Census Canada<sup>22</sup> as part of the metropolitan influence zone (MIZ). A few minutes' drive outside of urban Montreal Internet accessibility and quality is not much better than in northern Quebec. This is the case for virtually all Canadian cities. Small cities and rural communities face still greater disparity of service choices, quality and rates where in many communities only one service provider is available.

Finally, the budget of \$500 million over five years to address the lack of equitable access to the Internet is low by an order of 100 times based on estimates developed for the SWIFT project. SWIFT estimated in their feasibility study for that the gap to connect every dwelling and business in Southwestern Ontario and Niagara to fibre optics to be about \$4 billion. The region is about 44 thousand km<sup>2</sup> and has a population of 3.5 million. By contrast, Canada is 9.985 million km<sup>2</sup> with a population 35.16 million. On that basis, the total funding to fibre wire Canada is about \$40 - \$60 billion or \$1,422 per person or \$3,754 per occupied private dwelling. Staff at ISED has confirmed these figures are about right.

By comparison, Australia is 7.7 million km<sup>2</sup> with a population of 22.6 million. Their National Broadband Network investment is estimated at \$43 billion or a cost per person is \$1,900<sup>23</sup> to connect 97% of citizens to fibre optics. As Dr. Middleton

Figure 4 FTTP penetration by country

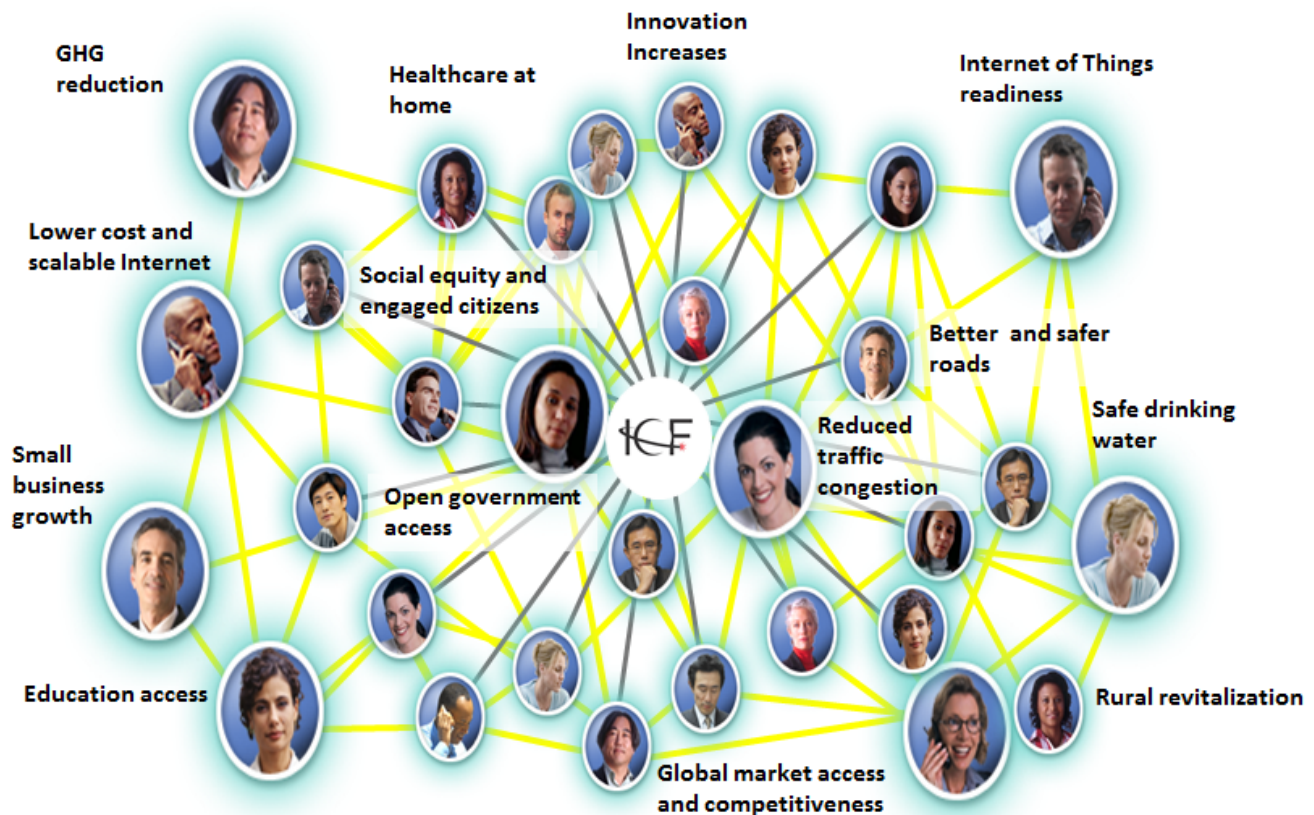


argues, “fibre offerings are simple and guided by the principle of abundance, rather than constraint...why not challenge regulators and policymakers to encourage the supply of broadband networks in ways that can foster innovation and enable future prosperity? To do so will require a shift away from thinking about broadband in terms of minimum acceptable speeds in favour of recognizing the importance of building capacity for the future.”<sup>2</sup>

Another way to look at funding broadband, given the enormity of challenge fiscally and geographically, would be to consider that connectivity affects most or all of the federal government’s priorities as set out in the Prime Minister’s mandate letters. The Prime Minister stated that, “we will direct our resources to those initiatives that are having the greatest, positive impact on the lives of Canadians.”<sup>24</sup>

If every dwelling, business and public sector site had a fibre optic connection the federal government could save money, avoid investments and reduce operating costs for everyone, including the federal government. Moreover, this capacity would enable *Real Change* and a *Strong Middle Class* as envisioned in the Liberal policy platform. Take healthcare as one example as shown in Figure 5 below. With a fibre optic connection at home a grandmother, her doctor and a specialist can be in a session together to discuss a course of treatment, while her daughter is completing a bank transaction and her granddaughter is uploading her homework and her grandson is playing an online video game. To enable this scenario a reliable, symmetrical, scalable connection that provides quality of service (QoS<sup>ix</sup>) and is covered by an SLA is required. A fibre optic connection supports simultaneous and concurrent sessions for each user such that every application operates as expected, fully secure, each time, every time, anytime of the day or night. This scenario will play out millions of times each day could save the healthcare system billions of dollars over time and providing better outcomes for patients. The opportunities for innovative new healthcare products, services and applications would generate boundless economic growth. The same is true for files like First Nations, innovation, industry, small business, education, energy, water, transportation, and government services.

**Figure 5 Connecting the dots between policy and people**

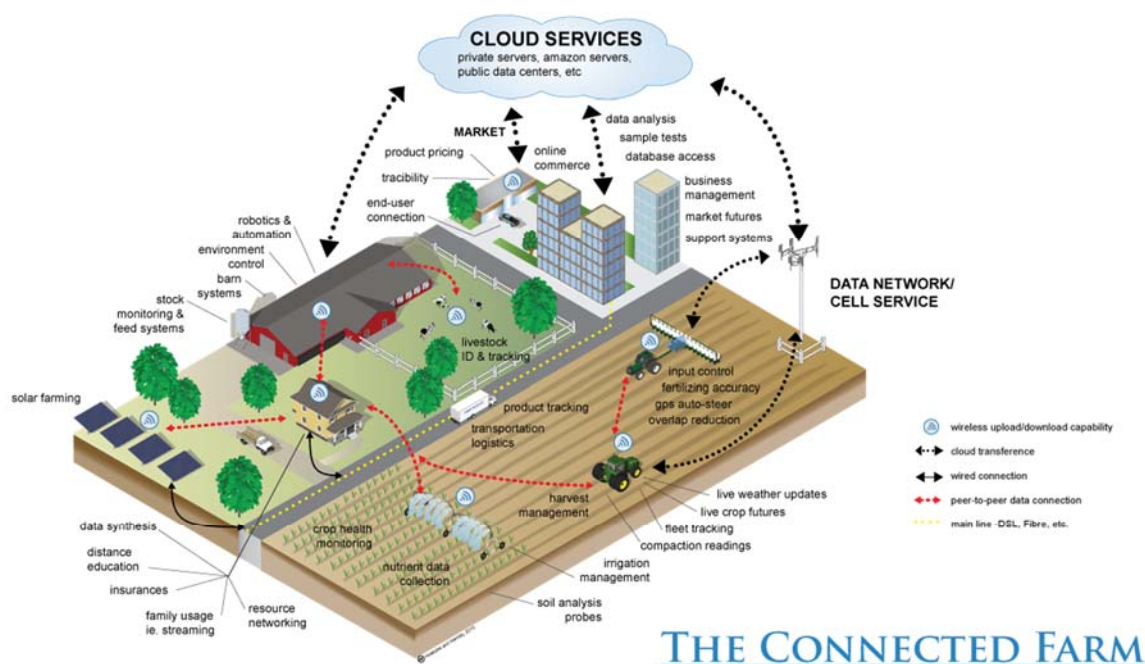


Improved connectivity also drives new environmental and economic opportunities. ITU’s 2016 State of Broadband Report states that the world’s sustainable development goals will not be met without next generation broadband technologies.



The world's future agri-food systems depend on new applications made possible by sensors and Wireless Sensor Networks (WSN) for monitoring and improving agricultural yields, water irrigation, fires and tsunamis. In Ontario alone, the use of new precision agriculture technologies is expected to increase 500% within the next two years and thousands of new jobs are expected to emerge in the development and adoption of new precision agricultural technologies.<sup>x</sup> The future of the “connected farm” as illustrated in Figure 6, suggests ever-increasing systems integration that realizes cost-efficiencies within Canadian agri-food chains as well as environmentally-sound resource use.

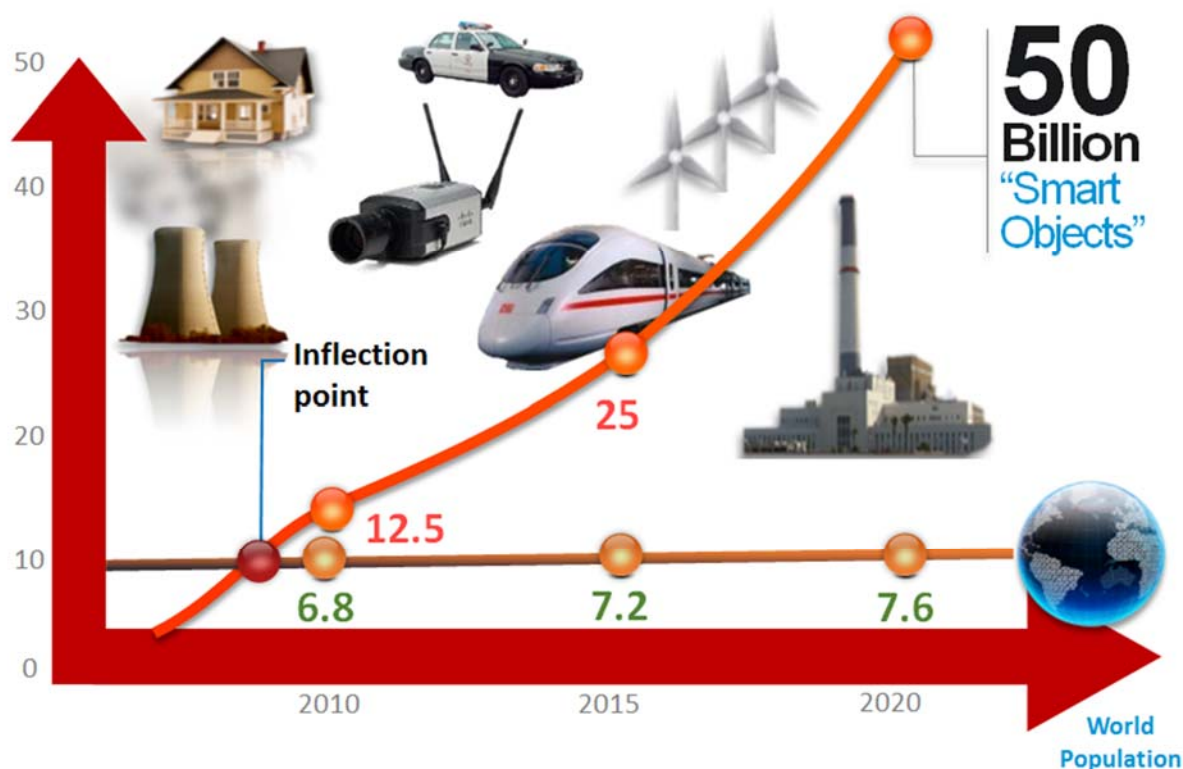
**Figure 6 The Connected Farm**



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So, what if every federal department contributed 1% of the \$120 billion federal infrastructure budget over the next 10-years and every province and municipality matched those funds out of their infrastructure budgets to ensure every home, farm, business and public sector site/asset had a fibre connection. We could have every person, place and thing connected to fibre by 2025 and surf the wave of the Internet of Things, rather than being overwhelmed by the coming wave, which will drive our economy for years to come as shown in Figure 7. Canada could reverse 20-years of digital decline, become a world-leader in the global digital economy where every Canadian regardless of geographic or demographic characteristic has an equal opportunity to participate and thrive in it.

Figure 7 The Internet of Things



Source: Cisco

## 6 Broadband – the essential utility

We could not agree more that, “broadband networks provide access to crucial social and economic infrastructure.”<sup>25</sup> While we agree, “private sector investment, in some cases with targeted government support is making progress,”<sup>25</sup> the progress is very slow and inadequate for the reasons stated in the above section.

The telecom environment is not “dynamic,” as it is dominated by an oligopoly of facilities-based providers. According to the 2014 CRTC Communications Monitoring Report (CMR), nearly 90% of wireline and wireless network access market revenues accrue to a handful of incumbent operators. According to the ITU, “Canada’s fixed broadband pricing actually sits at 14<sup>th</sup> out of the 34 developed countries in the Organization for Economic Co-operation and Development, and sixth in the G8. According to OECD and CRTC, Canadian consumers have to pay some of the highest prices among advanced economies for fixed and mobile broadband services. Moreover, the country looks particularly bad when purchasing power parity – or the relative ability of people in one country to buy the same basket of goods as in another country – is factored in. Looking at just the Americas, Canada sits at a woeful 14<sup>th</sup> place; behind the likes of Uruguay and Guatemala. Prices are a reflection of the competition.”<sup>26</sup> ITU’s 2016 State of Broadband Report indicates that there are 36.41 fixed broadband per 100 inhabitants in Canada. We place 17<sup>th</sup> in the world which looks fine, except the fact that most of our inhabitants live in urban areas. Most Canadians who live outside metropolitan areas rely on fixed wireless and dial-up broadband access.

As reported in the Globe and Mail on October 06, 2016<sup>27</sup>, CRTC chairman Jean-Pierre Blais, who has tried to reposition the regulator as a consumer-friendly body during his tenure, said competitive ISPs “must have access to these services at just and reasonable prices.” “The fact that these large companies did not respect accepted costing principles and

methodologies is very disturbing” he said in a statement. “What’s even more concerning is the fact that Canadians’ access to a choice of broadband Internet services would have been at stake had we not revised these rates. As always, we strive to create a dynamic competitive telecommunications market for Canadians.” “The CRTC is of the view that the rates proposed by certain of the large companies were not just and reasonable and had to be revised downwards. The CRTC is very concerned that certain large companies have not conducted their cost studies in accordance with well-established costing principles and methodologies,” the commission said. It said it has reduced the rates some companies proposed for network access by up to 39 per cent and cut the proposed rates for the transport of Internet data by up to 89 per cent in some cases. The large companies that submitted rates the commission said were too high and had to be adjusted are Bell Canada, Cogeco, MTS, Rogers, Shaw, Telus and Videotron.

We strongly agree that, “*despite progress, persistent gaps in rural and remote areas*,” persist.<sup>25</sup> A lack of competition and control by an oligopoly of incumbents is even tighter across rural and remote Canada. In addition to substantially lower fixed broadband speeds, in rural and remote regions, our citizens have limited access to Long-Term Evolution (LTE) or 4th Generation (4G) mobile wireless services. The urban-rural digital divide has a direct impact on employment for our residents, the competitiveness of our businesses, and overall prosperity of our country.

The combination of incumbent hegemony in wireless and wireline infrastructure is at the heart of the problem. Incumbent providers use their dominance in infrastructure and content to reduce the scope for end users to competitively provision services and applications. This lack of access and competitive choice is an obstacle to our citizens’ social and economic well-being and an obstacle to the ability of public and private sector efforts to build a world-class communications infrastructure in Canada, which ultimately acts as a brake on GDP growth.

Therefore, the answer is to require open access of all facilities-based provider networks, end-to-end, to third-party providers consistent with CRTC Decision 2015 - 326. The CRTC decided that incumbent local exchange carriers (ILECs) must make their fibre-to-the-premises (FTTP) access networks open to third party providers on a wholesale basis. In their decision, the CRTC found that, “The Commission has made its determinations set out in this decision with a view to achieving various objectives, notably to provide Canadians with more choice for high-speed connectivity, thereby enabling them to fully leverage the benefits of the broadband home or business. Increased choice is expected to drive competition, resulting in further investment in high-quality telecommunications networks, innovative service offerings, and reasonable prices for consumers.”<sup>28</sup>

As Catherine Middleton states, “a look at other essential infrastructure helps to illustrate this point. These have evolved over time, but in the developed world, using electricity or water today is a simple matter. Turn on a tap and water is available. Plug in an appliance and the electrical system provides power to it. These systems are highly reliable, and service is easy to obtain. Customers do not have to choose whether they want regular, super, or ultra variants of electricity or water services. Electricity is simply electricity and water is simply water. The systems are engineered for scalability, can support new uses, and upgrades do not typically require changes to the ways that people engage with the services.” Moreover, there are many examples of municipalities stepping into the void left by incumbent telecom providers to build their own municipal broadband utilities. Kingston<sup>29</sup>, Stratford<sup>30</sup>, Muskoka<sup>31</sup>, Coquitlam<sup>32</sup> and Olds<sup>33</sup> are good models. What Canada lacks is broadband ubiquity; broadband as a utility needs to be equitably available to all Canadians, not just to those who are fortunate enough to live in a community where their leaders have the fortitude to undertake the telecom development.

Indeed, the principle of “facilities-based competition,” mandated by the Telecommunication Act of 1993<sup>28</sup> and enforced by the CRTC, has been an abject failure, because the idea at its core was unsound. The idea was that with regulation, incentives, and subsidies new telecom service providers would emerge to build new telecommunications infrastructure alongside incumbent former monopoly local exchange carriers (ILECs) networks and successfully compete with them. Of course, the only places this competition emerged was in our largest urban centres and even there virtually all of these competitors have either gone out of business or been acquired by the ILECs in order to maintain market share. In rural and remote areas, very few new wireline competitors emerged and the reason is very simple and obvious – it is too costly to build new infrastructure in rural and remote locations from scratch. Moreover, it makes no more sense to build multiple and redundant fibre lines along the same rights of way than it does to build multiple electricity, gas, and water lines. This is because broadband connectivity is a natural monopoly<sup>xi</sup> just like electricity, water, gas and roads. Like electricity, water and gas, broadband should be a utility that is equitably available to all Canadians. We need to move to recognize through policy that Internet is intrinsic to modern-day communication and every aspect of our lives. As William

Birdsall (1998) and others have pointed out, the notion of communication as a basic right in Canada is hardly a new idea given that it was acknowledged at a national level by Canada's Telecommission when it was formed in 1969.<sup>34</sup>

## 7 Recommendations and Conclusions

ICF Canada and its advisors recommend the following:

- a. That the Federation of Canadian Municipalities (FCM) and other similar municipal associations be asked to pass motions which declare that broadband is an essential utility and that equitable access to the Internet be a right of every Canadian as entrenched in the Charter of Rights and Freedoms based on the principle of "equality before and under law and equal protection and benefit of law,"(*Canadian Charter of Rights and Freedoms*), because in the digital age equitable access to the Internet is a determinant of one's equal access to healthcare, education, government, marketplaces and the Right to "pursue the gaining of a livelihood."(*Canadian Charter of Rights and Freedoms*). This effort should start with the all ICF designated Intelligent Communities in Canada.
- b. That municipalities are urged to include broadband infrastructure in their Official Plan and make plans for construction and deployment of this infrastructure into the future in conjunction with consulting service providers about their capital build programs and technology roadmaps to take them into account as a basis for working together to ensure every business and citizen has equitable access to the Internet.
- c. That municipalities develop Intelligent Community Plans and Broadband Development Strategies to provide each community with a roadmap for effectively competing in the global digital economy.
- d. Incorporate broadband infrastructure, connectivity and applications into the municipal Strategic Plans and develop strategies to enable the rapid deployment of fibre optic, WiFi and LTE infrastructure to every person, place and thing in and around all 5,600 municipalities in Canada.
- e. Develop strategies to deploy fibre optic and WiFi connectivity, controllers, and sensor devices to implement IoT in municipal systems across Canada such as roads, traffic signals, street lights, parking, transit, electricity, water/waste water, for example. A comprehensive inventory of municipal assets and strategies for each municipality to implement smart technologies and to manage them is needed.
- f. That national civil infrastructure standards for the construction of civil works necessary to support the deployment of fibre optic cables are developed.
- g. Develop nationally standardized municipal access agreement (MAA) and work to ensure it is implemented uniformly across Canada to make it easier, faster, and cheaper for facilities-based telecom service providers to deploy fibre optic infrastructure.
- h. Develop a national standard for support structure access (SSA) agreements for all attachment owners and work to ensure the standards are implemented uniformly.
- i. That the federal government or CRTC create an advisory panel of business, residential, Aboriginal peoples and farm users that that would inform the Cabinet or the Commission on the development of a policy and program framework to ensure adequate resources and funding be allocated on a predictable, long-term basis to achieve equitable access to the Internet for every Canadian.
- j. ISED and the CRTC consider declaring that broadband be defined by the Guiding Principles in this paper; that broadband be affirmed as an essential utility and that equitable access to the Internet be declared a basic right of every Canadian and expressed as such in government and commission policies and programs.

- k. The CRTC must have timely follow-through action on the regulatory framework for wholesale services setting out how all network facilities on an end-to-end basis should be accessed and configured and what rates, terms, and conditions will prevail based on the Guiding Principles or similar as set out this paper.
- l. Funding should be sought from all levels of government on a matching funds basis. As well, we suggest that contributions from other infrastructure projects of all levels of government be included to increase significantly the budget, expand the benefits for the project, and speed up the process of connecting every person, place and thing to fibre optics, LTE and WiFi.
- m. Funding requests should be made to other infrastructure funding programs and projects, especially those in rural and remote regions and economically depressed communities; and each department and ministry should contribute and account for their action towards equitable Internet access and uptake, as they and their partner networks will directly benefit from better intranet connectivity and by more effectively and efficiently serving Canadians when everyone has equitable access to the Internet, eliminating the growing digital divide between the haves and the have nots in Canada.
- n. Given that more than 45 years have passed since the first federal policy on the new age of media, information and communications, if anyone needs another reason for revitalizing Canada's digital future, "it's because it's 201[7]."<sup>35</sup>

## 8 End Notes

<sup>i</sup> United Nations, General Assembly, Human Rights Council, Twentieth Session, A/HRC/20/L.13, June 29, 2012.

<sup>ii</sup> Note: the principles as stated have been adopted by the Western Ontario Warden's Caucus for the South West Integrated Fibre Technology (ICF) project [www.swiftnetwork.ca](http://www.swiftnetwork.ca), The Ontario Association of School Board Officials, [www.oasbo.org](http://www.oasbo.org), in their "Manifesto for 21st Century Learning," and the London and Region Global Network (LARG\*net), [www.largnet.ca](http://www.largnet.ca), in their "Connected London" project.

<sup>iii</sup> Standards – the network must be standards-based such that it is compliant with current Metro Ethernet Forum standards (currently MEF 2 standard) and supports Internet Protocol and Ethernet specifications such as IEEE 802.1 and 802.2 and Internet Engineering Task Force (IETF) standards, Session Initiated Protocol (SIP), and Multi-protocol Label Switching (MPLS) also known as IP/VPN from Customer Edge (CE) to Provider Edge (PE). All electronics and equipment on the network must meet applicable standards, such as CSA, ULC, UL, EIA, ANSI, IEEE, FCC, CRTC, other Industry Canada requirements, FCC, Electric Safety Code general requirements and CSA, and other safety requirements.

<sup>iv</sup> High availability means the network is capable of supporting up to 99.9999% availability or 32 seconds of downtime per year.

<sup>v</sup> Supports a maximum average round-trip transmission, in 5-minute intervals, of 150msec from the subscriber to the Internet Exchanges in Toronto and/or Montreal (editorial note: this could be expanded to include major US or international Peering Points) with no more than 45 milliseconds pertaining to the core network of the provider and 105 milliseconds to the access layer from the provider to the subscriber, <http://www.verizonbusiness.com/about/network/latency>. Delivers 99.5 percent or greater of all packets for regional round trips within North America

<sup>vi</sup> Class of Service is a parameter used in data and voice protocols to differentiate the types of payloads contained in the packet being transmitted. The objective of such differentiation is generally associated with assigning priorities to the data payload or access levels to connection. To provide CoS the network electronics will be able to support multiple CoS and must support the use of Simple Network Management Protocol (SNMP) protocol for the purposes of network management and assessment and the provider shall provide around the clock network operation centre (NOC) surveillance and trouble-ticketing support.

<sup>vii</sup> Quality of Service (QoS) will be attained through the process of classification, traffic shaping, and invoking queuing disciplines on the ingress and egress ports at the access layer network elements, and compliance with accepted engineering standards.

<sup>viii</sup> Metcalfe's Law states that, "the value of a telecommunications network is proportional to the square of the number of connected users of the system (n<sup>2</sup>)." Robert Metcalfe, Co-Inventor of Ethernet

<sup>ix</sup> Quality of Service (QoS) in telecommunication networks, refers to traffic prioritization and resource reservation control mechanisms which have the ability to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow necessary to ensure every application operates properly every time.

<sup>x</sup> Hambly, et. al (2016). The Role of Broadband Internet Access on the Adoption of Precision Agriculture Applications. Draft Report to AAFC. <http://www.r2b2project.ca>

<sup>xi</sup> [https://en.wikipedia.org/wiki/Natural\\_monopoly](https://en.wikipedia.org/wiki/Natural_monopoly). A natural monopoly is a monopoly in an industry in which high infrastructural costs and other barriers to entry relative to the size of the market give the largest supplier in an industry, often the first supplier in a market, an overwhelming advantage over potential competitors. This frequently occurs in industries where capital costs predominate, creating economies of scale that are large in relation to the size of the market; examples include public utilities such as water services and electricity.



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## References

1. *Canadian Charter of Rights and Freedoms*. <http://laws-lois.justice.gc.ca/eng/Const/page-15.html>.
2. Middleton C. Moral Fibre. *InterMedia*. 2016;44(1). <http://www.iicom.org/intermedia/intermedia-past-issues/intermedia-apr-2016/moral-fibre>.
3. UN Human Rights Council. The promotion, protection and enjoyment of human rights on the Internet. In: *UN Doc A/HRC/20/L.13*. ; 2012. doi:10.1093/oxfordhb/9780199560103.003.0005.
4. Péliissié Du Rausas M, Manyika J, Hazan E, Bughin J, Chui M, Said R. Internet matters : The Net's sweeping impact on growth, jobs, and prosperity. McKinsey Global Institute. [http://www.mckinsey.com/mgi/publications/internet\\_matters/pdfs/MGI\\_internet\\_matters\\_full\\_report.pdf](http://www.mckinsey.com/mgi/publications/internet_matters/pdfs/MGI_internet_matters_full_report.pdf). Published 2011.
5. Office of the Prime Minister. Minister of Innovation, Science and Economic Development mandate letter. <http://pm.gc.ca/eng/minister-innovation-science-and-economic-development-mandate-letter>. Published 2015.
6. Telecommunities Canada. Towards a 21st Century Communications Strategy for All Canadians: A Policy Proposal from Telecommunities Canada - Digital Canada 150. <https://www.ic.gc.ca/eic/site/028.nsf/eng/00224.html>. Published 2010.
7. ICF. ICF. [www.intelligentcommunity.org/index.php?src=gendocs&ref=Research\\_Intelligent\\_Community\\_Indicators&category=Research](http://www.intelligentcommunity.org/index.php?src=gendocs&ref=Research_Intelligent_Community_Indicators&category=Research).
8. Cisco. *White Paper: Cisco VNI Forecast and Methodology, 2015-2020 - Cisco*.; 2016. doi:Jun 01, 2016.
9. Intel. Moore's Law and Intel Innovation. <http://www.intel.com/content/www/us/en/history/museum-gordon-moore-law.html>. Published 2015.
10. ISEC. FAQs for Canadians - Digital Canada 150. <https://www.ic.gc.ca/eic/site/028.nsf/eng/50010.html>.
11. A Plan For Middle Class Progress. In: *Fall Economic Statement 2016*. ; :19, 26. <http://www.budget.gc.ca/fes-eea/2016/docs/statement-enonce/chap02-en.html>.
12. Bell Gigabit Fibe bringing the fastest Internet to Toronto residents with a billion-dollar+ network investment, creation of 2,400 direct jobs. <http://www.bce.ca/news-and-media/releases/show/Bell-Gigabit-Fibe-bringing-the-fastest-Internet-to-Toronto-residents-with-a-billion-dollar-network-investment-creation-of-2-400-direct-jobs-1>.
13. No Title. <http://www.netindex.com/>.
14. International Telecommunication Union. *Measuring the Information Society*.; 2015. <http://www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2015/MISR2015-w5.pdf>.
15. National Broadband Plan. <https://www.fcc.gov/general/national-broadband-plan>.
16. World Bank. *Broadband Policy in South Korea*. [http://www.eclac.cl/socinfo/noticias/paginas/4/44864/Wonki\\_Min\\_Korea.pdf](http://www.eclac.cl/socinfo/noticias/paginas/4/44864/Wonki_Min_Korea.pdf).
17. National broadband network. Australian Government, Department of Communications and the Arts. <https://www.communications.gov.au/what-we-do/internet/national-broadband-network>.
18. *Japan's Broadband Policy*. <http://www.oecd.org/sti/ieconomy/1811750.pdf>.
19. Digital Canada 150. <http://www.ic.gc.ca/eic/site/028.nsf/eng/home>.
20. OECD. OECD Broadband portal. [http://www.oecd.org/document/54/0,3343,en\\_2649\\_34225\\_38690102\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/54/0,3343,en_2649_34225_38690102_1_1_1_1,00.html).
21. MARCHAND L. Montreal named Intelligent Community of the Year. *Montr Gaz*. 2016. <http://montrealgazette.com/news/local-news/montreal-named-intelligent-community-of-the-year>.
22. Statistics Canada - Government of Canada. Statistics Canada: 2011 Census Profile. *Stat Canada*. 2012.
23. *Nation Building Infrastructure, National Broadband Network*. <http://www.nbnco.com.au/assets/documents/about-nbn-brochure.pdf>.
24. Office of the Prime Minister. Minister of Canadian Heritage Mandate Letter. <http://pm.gc.ca/eng/minister-canadian-heritage-mandate-letter>.
25. ISEC. *Increasing High-Speed Broadband, Dialogue with Federal Government Departments*.; 2016.
26. No Title. <http://wordsbynowak.com/2013/10/16/itu-prices/>.
27. Dobby C. Pushing for competitive market, CRTC slashes wholesale fees charged by incumbent ISPs. <http://www.theglobeandmail.com/report-on-business/crtc-aims-to-boost-home-internet-competition-with-rate-cut/article32279440/>.
28. Telecom Regulatory Authority of Canada. Telecom Regulatory Policy CRTC 2011-291. <http://www.crtc.gc.ca/eng/archive/2011/2011-291.htm>. Published 2011.
29. Networks - Utilities Kingston. <https://utilitieskingston.com/networks>.
30. Rhyzome Networks | CONNECTIVITY FOR COMMUNITIES. <https://rhyzome.ca/>.
31. Lakeland Networks. <http://www.lakelandnetworks.com/>.
32. QNETBC. <http://www.qnetbc.net/>.
33. O-NET | Internet, Phone and Television. <http://o-net.ca/>.
34. Felczak M, Smith R, Glass G. Communicating with ( Some ) Canadians : Communication Rights and Government Online in Canada. *Can J Commun*. 2009;34(3):435-460. <http://www.cjc-online.ca/index.php/journal/article/view/2020>. Accessed November 11, 2016.
35. Trudeau's "Because it's 2015" retort draws international attention. *The Globe and Mail*. <http://www.theglobeandmail.com/news/politics/trudeaus-because-its-2015-retort-draws-international-cheers/article27119856/>. Published 2015.