



# CANADA'S INTERNET PERFORMANCE: NATIONAL, PROVINCIAL AND MUNICIPAL ANALYSIS APRIL 2016



For more information on this report or to request data for your own region, please contact CIRA at [info@cira.ca](mailto:info@cira.ca) or 1-877-860-1411.

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*The average upload and download speeds specified in this report have been calculated by averaging the results achieved by users of CIRA's .CA Internet Performance Test in the applicable region over the applicable time period. Test results and statistical data validation was completed by Daisy Intelligence Corporation. Based on these results, CIRA has made various conclusions in the report. Notwithstanding, upload and download speeds can be affected by many factors, including, the Internet Service Provider (ISP) being used, the package purchased by the user, and network traffic dynamics (such as service availability, the number of users accessing the ISP's network, and the time of day when the user is accessing the ISP's network).*

*CIRA does not represent that the average upload and download speeds in each region in this report is reflective of all users of that region. Any reliance upon the information in this report is at your sole risk, and CIRA shall not have any responsibility or liability for your reliance on this report.*

## INTRODUCTION

The Canadian Internet Registration Authority (CIRA) manages the .CA domain on behalf of all Canadians and works to build a better online Canada with products, services and tools that support Canada's Internet community. As part of these efforts, CIRA has built the CIRA Internet Performance Test with test nodes across Canada.

To date, the test has collected data from more than 140,000 tests from individual users across the country. CIRA is indebted in this communal commitment to building a better Canadian Internet. CIRA's test continues to collect data and reports and data will continue to be released at regular intervals.

This report is made up of 126,000 tests collected between May and December 2015.

### Why measure Internet performance?

There is a growing national consensus in Canada that access to fast, reliable and affordable Internet service is not only critical to economic development, but also represents an important social good. Understanding how Canadian users experience services in their homes and offices is an important first step in improving Canada's Internet performance.

CIRA's Internet Performance Test is designed with the public interest at its core. The test nodes are located in Internet exchange points, rather than within an ISP's architecture. This allows CIRA to measure the actual performance of an Internet connection in real network conditions, closely representing the actual Internet experience of Canadian users.

[Take the test](#)

## PERFORMANCE IS MORE THAN SPEED

Like a finely tuned automobile, the lap time around a track is about more than just the top speed. Cornering, acceleration, braking, and driver skill all contribute to a car's result. On the Internet, raw top speed is important, but so are other measures like ping time, jitter, packet sequence, congestion, and more. In fact the CIRA Internet Performance Test measures dozens of different attributes about your connection and makes them available in the advanced view.

**"What we want to see is a better online Canada. Where Canada not only competes with, but tops the global leaders in access speed, quality, and data sovereignty."**

**-Byron Holland,  
president and CEO, CIRA**

## CANADA'S OVERALL PERFORMANCE

Average download speed:	18.64 Mbps
Average upload speed:	7.26 Mbps
Average round trip time for a data packet:	96.43 ms
Average jitter:	304.66 ms
IPv6 Support:	2.4 %
DNSSEC Support:	14.93 %

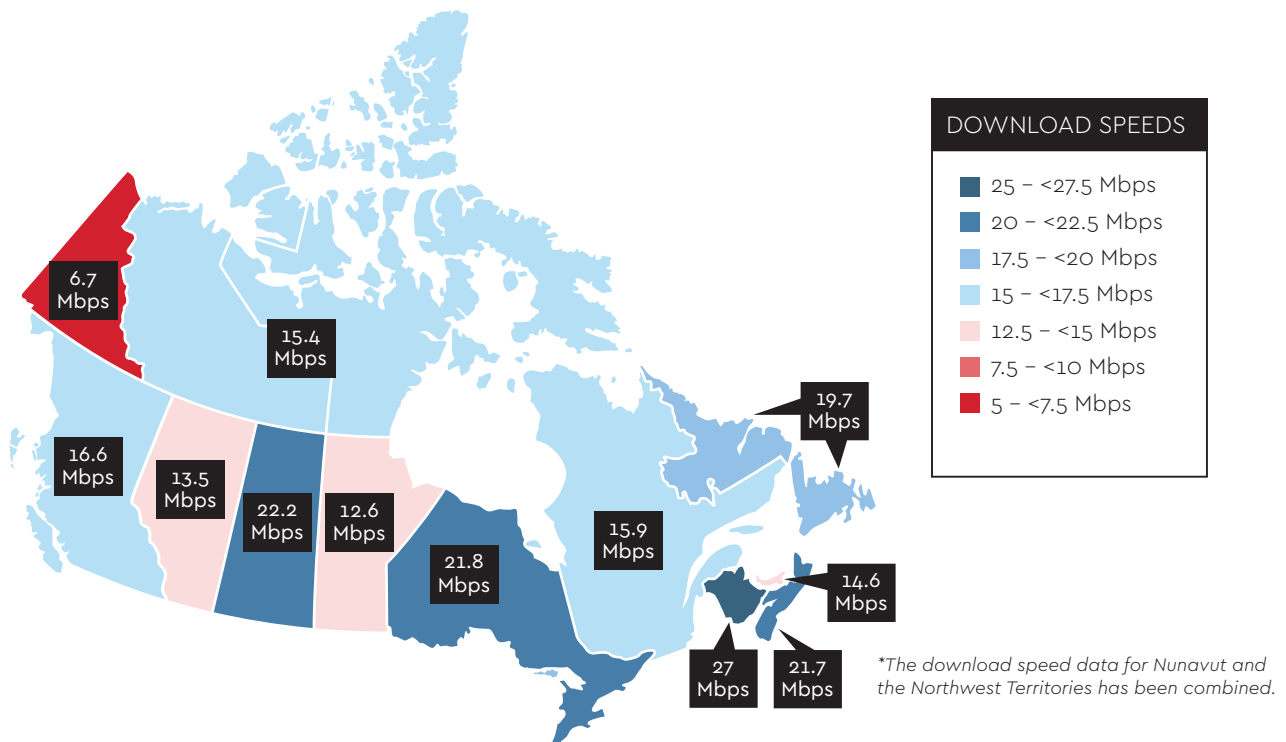
The Internet Performance Test data shows a national average download speed of 18.64 Mbps. To put this finding in context, it is well in excess of the 5 Mbps that Industry Canada has targeted for all Canadians. However, 18.64 Mbps is well below the 25 Mbps that some other widely-available speed test applications report. Why? Because the CIRA Internet Performance Test is based on performance of an Internet connection in real network conditions – including congestion, complex traffic routes or other network dynamics. This is a slightly different way to measure the real world experience of Canadians when using the Canadian Internet.

This is underscored by the [Akami State of the Internet report](#) that shows Canadians rank 21st globally with an average of only 11.9 Mbps. Similar to CIRA, Akami collects this data based on real world access to the content it hosts on its network – a perfect demonstration that there are multiple valid ways to test the Internet.

Using another data point for global context, Canada ranks 13<sup>th</sup> out of 92 countries on the [Berkman Center for Internet & Society's Internet Monitor](#). This ranking is based on a number of factors like adoption, speed, and price. Notably, this report shows that broadband adoption among households connected to the Internet is 83%. So how is Canada performing?

# COMPARING PROVINCES

Canada's provinces and territories did not perform equally. New Brunswick leads the way with an average download of 26.98 Mbps and an average upload speed of 12.39 Mbps. The Yukon Territory has the lowest average download speed at 6.68 Mbps.



It is important to note that in provinces and territories where a high concentration of tests originated in an urban center the data can over-estimate the experience of many in the entire region. This is of particular concern in the north. Yellowknife, where access is generally good, dominates the averages for the NWT + Nunavut combined. The experience of many in NWT and Nunavut will be well below the 15.4 Mbps reported here.

## COMPARING OVERALL SCORES OF 25 CANADIAN CITIES

CIRA analyzed municipal-level data to help create a picture of how Canadians experience the Internet across the country. To help understand the relative performance of Canadian cities, the following chart takes into account speed, quality, and future-readiness to create a single score for Internet performance.

Each factor is weighted based on its contribution to the overall Internet experience. Cities were scored based on whether they were above or below the Canadian average for each category. Speed metrics were given twice the weighting of the other two.

### Ranking of Canadian Cities' Internet Access

1	Toronto	14	Markham
2	Ottawa	15	Gatineau
3	Montreal	16	Lonqueuil
4	Fredericton	17	Burnaby
5	Saint John	18	Charlottetown
6	Quebec City	19	Vancouver
7	London	20	Victoria
8	St John's	21	Edmonton
9	Mississauga	22	Surrey
10	Brampton	23	Whitehorse
11	Calgary	24	Winnipeg
12	Hamilton	25	Regina
13	Halifax		

The following series of charts rank cities (provincial capitals + the larger cities) and compares their performance to national averages.

# SPEED – A COMPARISON OF UPLOAD AND DOWNLOAD SPEEDS AGAINST THE NATIONAL AVERAGE

It is interesting to note that the east is significantly represented in the top right as having users with fastest connections. Even more interesting is that three of the Atlantic capitals: Halifax, St John's and Fredericton are represented. The only other two cities in Canada that exceed the national average are Ottawa and Toronto. There is no representation of municipalities west of the Ontario border represented as above average in download.

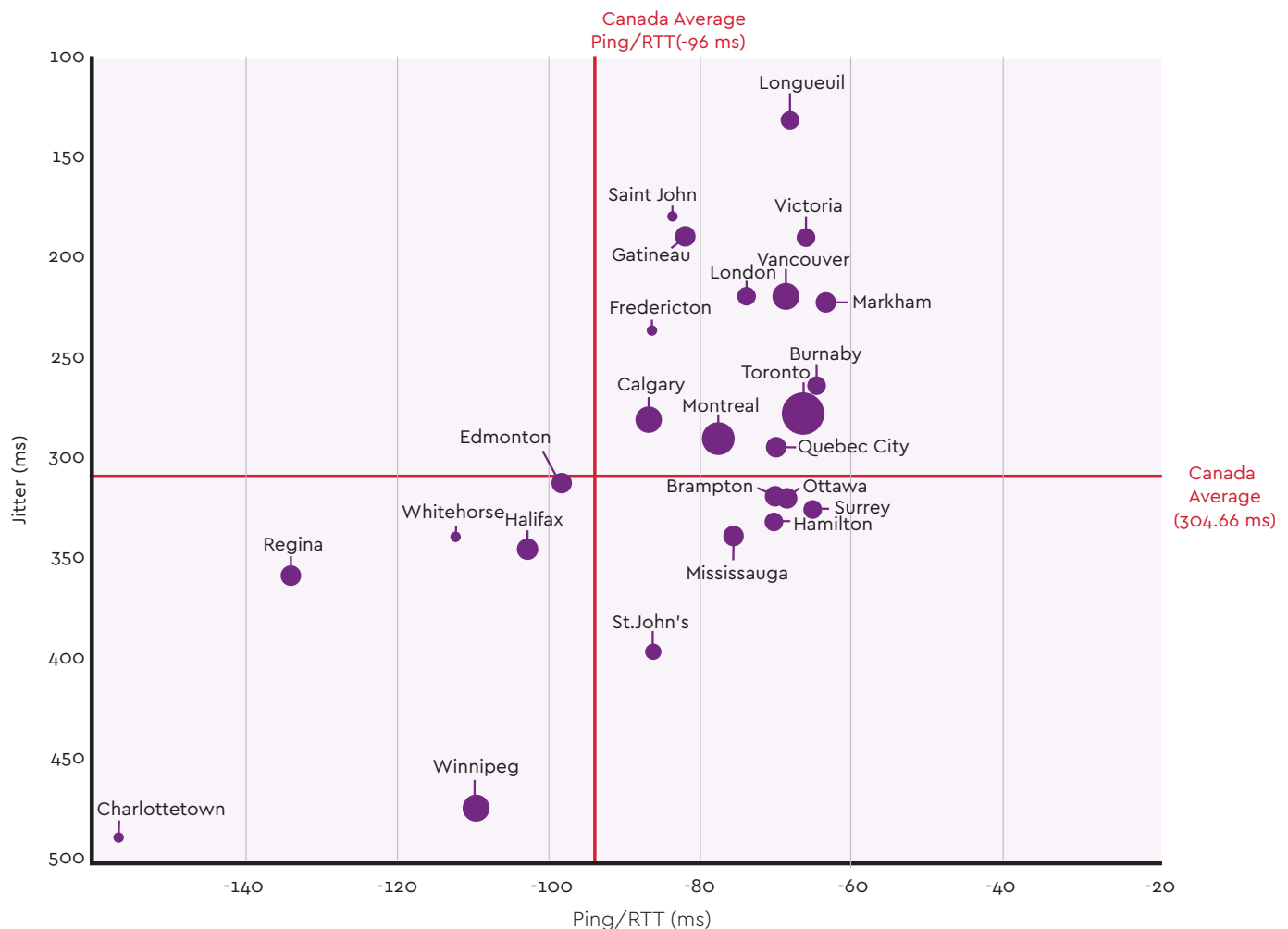


\*Relative city population size is indicated by the size of the icon.



# QUALITY – A COMPARISON OF PING (OR ROUND TRIP TIME) AND JITTER AGAINST THE NATIONAL AVERAGE

A positive Internet experience requires more than simply upload and download speed. CIRA has worked to create a quality metric defined by ping and jitter. When municipalities are mapped by ping and jitter next to national averages a large grouping of the largest cities land in the top right quadrant.



## DEFINITIONS

**Ping:** round trip time for a packet of information, lower number is better, can affect applications like online gaming

**Jitter:** the variation in time that a series of packets arrive, a lower number is better, can impact services like video and VoIP

Larger cities are over-represented in the top right because when you run a test, the quality you get is impacted by the complexity of the route your data needs to travel to get to the M-Lab testing servers located in Internet Exchange Points. In the absence of great peering and transit across Canada, larger population centers have a closer path to travel and more robust networks.

Poor quality Internet connections affect the performance of common applications like voice over IP, streaming video, or media downloads.

# FUTURE READY – THE PERCENTAGE THAT HAVE ADOPTED THE LATEST INTERNET STANDARDS FOR DNSSEC AND IPV6

As Internet technologies evolve, there is a need to implement new standards. CIRA has long advocated for both IPv6 and DNSSEC adoption in Canada and the Internet performance test measures progress towards this goal.



\*Relative city population size is indicated by the size of the icon.

The Internet Performance Test will continue to track these standards and report on progress. It is important to note that Canada lags behind its global counterparts in terms of standards adoption. For instance, IPv6 recently celebrated its 20<sup>th</sup> birthday by reaching 10% deployment globally with Canada's average only reaching 2.4% (<http://arstechnica.com/business/2016/01/ipv6-celebrates-its-20th-birthday-by-reaching-10-percent-deployment/>).

The Internet is a perfect example of thinking globally and acting locally. We can all best participate by ensuring that our piece of it is at its best and understanding what happens to data after it enters "the cloud".

## COMPARING URBAN VS RURAL – RURAL COMMUNITIES ABOUT 25% BEHIND

There is little doubt that the power of population plays a role in what ISPs deliver across Canada. For the most part, in the large metropolitan areas, ISPs have built the networks and are competing aggressively for customers. This is not always true in rural markets.

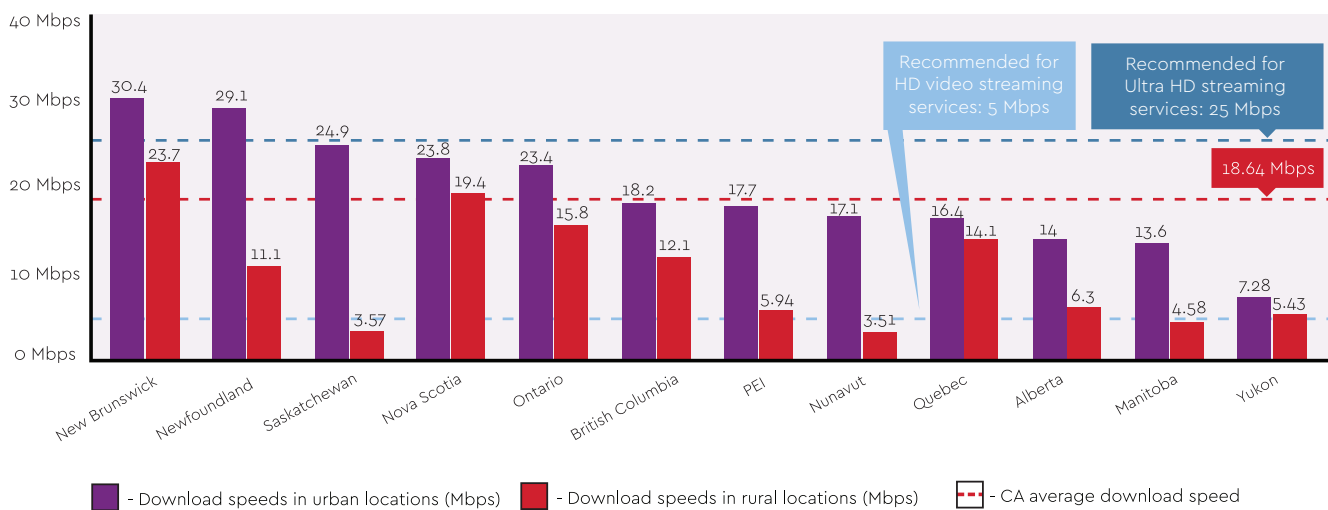
CIRA's test relies on a crowd-funded model. Rural homes that don't have Internet access obviously cannot run an online Internet performance test. As test-volumes increase and small regions are better represented in the data it will be possible to draw more detailed conclusions.

### Urban vs Rural

	Download	Upload	Ping/RTT	Jitter	DNSSEC	IPv6
	Mbps	Mbps	ms	ms	%	%
Urban	19.80	7.66	87.90	287.08	15.10	2.43
Rural	14.81	5.96	124.36	358.6	14.39	2.30

In what is sure to be one of the most hotly debated points in this report, the data *among those who have run tests*, suggests that rural access is relatively good at 14.81 Mbps download speed. When comparing this to the national average and urban average, rural communities are about 25% slower than urban ones and have significantly lower quality connections for RTT and Jitter.

CIRA has adopted the Statistics Canada definition for urban (population of at least 1,000 and a density of 400 or more people per square kilometer). This report includes CIRA 29,451 tests from rural areas and 96,511 from urban centres.



### Spotlight on Ottawa

Even within a large metropolitan area you can see that there is an urban/suburban/rural difference in download vs upload speeds that Canadians are getting.

\*Sample size for Manotick and Greely is very small (between 100-200)

	Download (Mbps)	Upload (Mbps)
Ottawa	22.53	10.19
Orleans	17.95	3.66
Nepean	17.17	5.95
Kanata	18.31	6.02
Stittsville	12.87	4.27
Gloucester	20.07	10.08
Manotick	7.1	1.83
Greely	6.08	1.3

## APPENDIX 1: FULL DATA BY CITY

Listed by population size

	Population	Speed		Quality		Future Ready	
		Download	Upload	Ping/RTT	Jitter	DNSSEC	IPv6
		Mbps	Mbps	ms	ms	%	%
<b>Toronto</b>	2615060	22.33	10.63	72.62	262.44	33.82	1.76
<b>Montreal</b>	1620693	16.98	11.26	84.59	275.52	15.97	4.38
<b>Calgary</b>	1096833	14.72	3.73	94.61	265.32	6.91	2.50
<b>Ottawa</b>	883391	22.53	10.19	69.44	309.81	25.29	1.44
<b>Edmonton</b>	812201	12.32	5.65	99.44	299.19	4.68	1.76
<b>Mississauga</b>	713443	19.32	5.68	75.03	339.16	23.77	0.64
<b>Winnipeg</b>	663617	13.09	3.58	111.26	471.96	6.48	1.87
<b>Vancouver</b>	603502	16.36	6.83	68.78	210.03	7.36	1.41
<b>Brampton</b>	523911	22.50	6.56	72.68	306.67	18.24	0.75
<b>Hamilton</b>	519949	17.84	6.63	69.73	322.25	29.38	3.05
<b>Quebec City</b>	516622	17.67	15.78	72.11	291.07	8.70	3.85
<b>Surrey</b>	468251	16.86	3.87	66.10	330.28	5.20	1.73
<b>Halifax</b>	390096	22.91	12.92	106.12	344.27	3.69	2.24
<b>London</b>	366151	20.24	6.05	75.96	214.90	19.14	0.94

	Population	Speed		Quality		Future Ready	
		Download	Upload	Ping/RTT	Jitter	DNSSEC	IPv6
		Mbps	Mbps	ms	ms	%	%
<b>Markham</b>	<b>301709</b>	<b>18.99</b>	<b>5.49</b>	<b>63.49</b>	<b>217.10</b>	<b>33.82</b>	<b>0.29</b>
<b>Gatineau</b>	<b>265349</b>	<b>13.77</b>	<b>6.49</b>	<b>80.87</b>	<b>184.65</b>	<b>12.13</b>	<b>5.95</b>
<b>Longueuil</b>	<b>231409</b>	<b>16.15</b>	<b>5.78</b>	<b>65.68</b>	<b>139.61</b>	<b>6.89</b>	<b>7.49</b>
<b>Burnaby</b>	<b>223218</b>	<b>17.36</b>	<b>8.59</b>	<b>64.23</b>	<b>255.01</b>	<b>8.33</b>	<b>1.39</b>
<b>Regina</b>	<b>193100</b>	<b>8.73</b>	<b>4.25</b>	<b>135.32</b>	<b>357.47</b>	<b>2.79</b>	<b>0.15</b>
<b>St John's</b>	<b>106172</b>	<b>24.37</b>	<b>11.76</b>	<b>93.83</b>	<b>395.3</b>	<b>2.56</b>	<b>0.18</b>
<b>Victoria</b>	<b>80017</b>	<b>16.33</b>	<b>3.32</b>	<b>66.84</b>	<b>177.61</b>	<b>6.23</b>	<b>1.18</b>
<b>Saint John</b>	<b>70063</b>	<b>24.56</b>	<b>12.69</b>	<b>83.70</b>	<b>169.09</b>	<b>3.70</b>	<b>0.22</b>
<b>Fredericton</b>	<b>56224</b>	<b>21.87</b>	<b>14.33</b>	<b>88.8</b>	<b>236.82</b>	<b>3.86</b>	<b>0.13</b>
<b>Charlottetown</b>	<b>34562</b>	<b>17.12</b>	<b>6.01</b>	<b>171.17</b>	<b>486.89</b>	<b>3.47</b>	<b>4.22</b>
<b>Whitehorse</b>	<b>23276</b>	<b>6.06</b>	<b>1.88</b>	<b>122.51</b>	<b>327.9</b>	<b>3.14</b>	<b>5.49</b>

Population from the 2011 Canadian census

*In order to put the priority on household connections and to remove high speed outliers that could include individuals testing from work locations, universities, etc, a test with a download speed greater than the mean plus twice the standard deviation from the mean was excluded for this comparison. Only cities with 100 or more tests were included in the analysis. A full review of all the data is available to qualified individuals and organizations.*



## DATA BY PROVINCE

	Upload	Download	Ping/RTT	Jitter	DNSSEC	IPv6	Number of tests
	Mbps	Mbps	ms	ms	%	%	n
Alberta	4.95	13.46	115.72	288.65	8.37	2.06	12 404
British Columbia	5.19	16.65	85.98	274.96	7.89	1.91	19 010
Manitoba	5.22	12.62	144.77	436.45	11.56	1.93	4 151
New Brunswick	12.39	26.98	103.17	235.95	5.48	0.48	3 560
Newfoundland	8.29	19.72	148.68	379.86	11.39	0.13	1 589
Nova Scotia	9.10	21.73	150.7	496.14	9.41	1.94	7 170
Nunavut + NWT	6.02	15.44	108.14	127.82	5.93	9.20	641
Ontario	7.90	21.76	86.29	298.91	25.09	1.54	47 215
PEI	5.80	14.60	205.52	858.75	3.48	2.43	948
Quebec	8.05	15.87	79.57	263.19	10.25	5.00	26 280
Saskatchewan	6.28	22.22	117.98	238.53	4.35	0.50	2 599
Yukon	1.80	6.68	139.75	242.47	4.05	6.08	395

## APPENDIX 2: HOW THE TEST WORKS

It is important to understand how the CIRA Internet Performance Test works in order to fully interpret the numbers. There are two basic ways that the Internet is tested. The first is by driving as much traffic possible through the highest-capacity route available and seeing how quickly the packets arrive – generally via multiple TCP connections. This is the Internet that Canadian consumers are paying for because an ISP can only guarantee the performance on their backbone.

The second way to measure Internet performance is to measure how quickly the data travels from your PC or device to a server in the wild and back. This is a more accurate measurement of your real world experience when visiting web properties. The CIRA Internet Performance Test uses test nodes located in Internet Exchange Points (IXPs) in Canada to measure your performance on Canada's piece of the Internet.

What makes this test so important is that the anonymous data we gather measures the entire path your data travels to provide research into how to improve the network in Canada.

## A CANADIAN APPLICATION BUILT ON A GLOBAL STANDARD

The CIRA Internet Performance Test uses a global open-source platform called M-Lab in each of its testing nodes. M-Lab is behind important global testing initiatives for performance, transparency, and state.

The front-end of the test is an HTML5 interface built by CIRA. This type of application allows for the maximum throughput for everyone but the fastest of connections, where the results can be limited by the ability/speed of the browser to execute the test code.

We have deployed nodes in Calgary, Toronto, and Montreal and have given enough network capacity to meet the load 99% of the time. In peak periods following significant media coverage on important data announcements the nodes can become busy from time to time.

## A CROWD-SOURCED TEST, CREATED IN THE PUBLIC INTEREST

Crowd sourcing data has its advantages and disadvantages. One advantage is that you can quickly get a cross-Canada view and get testing from big cities down to tiny hamlets. Secondly, it doesn't exclude those aren't able to participate in scientific white-box types of tests like the CRTC ran in 2015-2016. The disadvantage is that there is a large segment of Canadians who have little to no awareness of the Internet and how it works, can't describe with accuracy what packages they are paying for from their ISPs and have probably never run a test of their connection. This type of data sourcing would, by definition exclude these test subjects.

The average Canadian wants to know whether they are able to watch streaming video. This was underscored by a recent CRTC report that showed that 50% of Canadians polled had no idea what Internet speed they expected to get.

### How can you help?

Run as many tests as you can. Tell others about it. Get them to run tests. The more data we have the more we can help to effect policy change on the Internet in Canada.