# POLICY BRIEF

# Benchmarking Internet Access Infrastructure Quality Gaps in Southwestern Ontario (2017)

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*Summary:* **Based on 51,923 crowdsourced Internet connection tests conducted by residents and businesses in Southwestern Ontario (SWO) in 2017, this report provides an empirical assessment of the quality of broadband infrastructure within the Region. We further benchmark broadband infrastructure quality in SWO municipalities relative to universal service speed targets established by the Canadian Radio-television and Telecommunications Commission (CRTC).**

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**Results**: According to CIRA/M-Lab NCT data, maximum connection speeds detected in the majority of SWO communities tend to exceed CRTC's basic service aspirational speed targets. However, average effective Internet connection speeds in most SWO communities tend to fall below these targets in both rural and urban parts of the Region. The magnitude of broadband infrastructure quality gaps within SWO is substantive, with users in leading communities experiencing effective connection speeds that are 3 to 5 times faster than in the lagging cluster. In a large number of communities across the Region, average effective bandwidth available for users to access content and applications from the open Internet remains below 10Mbps.

**Context:** Over the past decade, residents, businesses, and public sector stakeholders in Southwestern Ontario (SWO) have expressed increasing concern about the quality of Internet connectivity that is available to them[i].  Previous rural broadband subsidy programs have helped reduce coverage gaps in remote and some rural parts of the Region, but connection quality remains a problem. Furthermore, the development of ultra-high capacity fibre networks has been limited to a small subset of SWO communities. In response, municipal and regional public sector stakeholders developed the Southwestern Integrated Fibre Technology (SWIFT) initiative in 2016, with funding from all three levels of government and in partnerships with service providers.[ii]   Over the next few years, SWIFT plans to allocate around $200 million of public subsidies to reduce the costs of private sector network deployments and incentivize service providers to deploy advanced fibre and next generation mobile network in both rural and urban parts of the Region. Although SWIFT is just in its early implementation stage, it is important to note that in anticipation to this public sector initiative, some large incumbent providers have already announced their plans to accelerate investments in fixed fibre and 4G+ mobile broadband networks that serve residents and businesses in SWO[iii].  There are also decisions being made by federal government that that will influence the development of rural fibre and wireless networks[iv].

The extent to which these public and private capital expenditures will translate into actual network quality improvements residents and businesses experience represents an empirical question that can only be answered in the future. The primary objective of this report is to provide

a high-level empirical perspective on the current state of Internet connectivity that enables residents, businesses, and other stakeholders to benchmark and monitor the pace of progress in their communities.
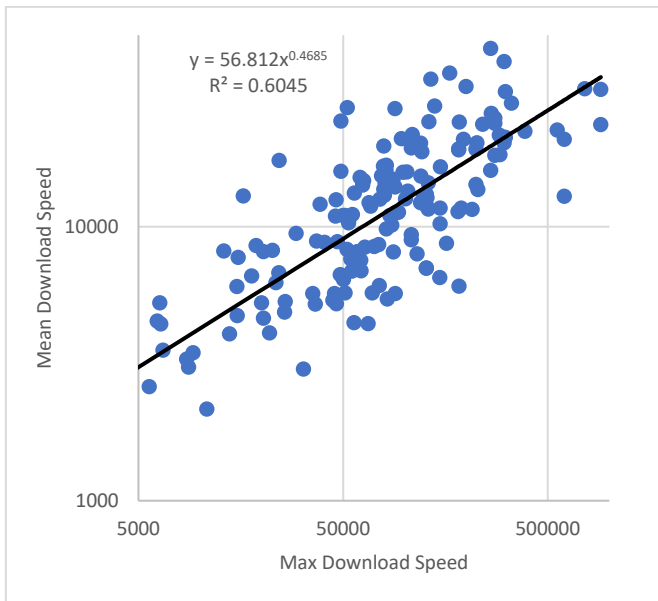


$$y = 56.812x^{0.4685}$$
$$R^2 = 0.6045$$

*Figure 1: Download Speed Indicator in SWO (2017) in kbps, logs; Source: CIRA/M-Lab NDT/R2B2*

**Motivation and data:** Internet service providers typically advertise connection speeds in terms of maximum theoretical speeds their customer may expect (i.e. "up to" xMbps). Actual service quality levels service providers deliver/users experience tends to vary from "best effort" advertised rates, often substantially. This is particularly the case with providers that rely on legacy/slower technologies and in rural communities where a relative lack of competition limits providers' incentives to increase effective capacity in response to demand growth. While they collect detailed data on service quality levels they deliver to their customers, Internet service providers consider this data competitively sensitive and are generally unwilling to share it with their users or public policymakers.

To help address this information asymmetry in SWO, the Rural and Regional Broadband (R2B2) initiative at the University of Guelph and SWIFT stakeholders have been working together to collect crowdsourced Internet measurements from residents and businesses throughout the Region since 2014. R2B2 and SWIFT use additional datasets obtained under Requests for Information from providers and user surveys[v]. As well, data from the Canadian Internet Registration Authority (CIRA) is cross-referenced. The M-Lab Network Diagnostic Tool (NDT) underlies the CIRA testing platform and SWIFT user surveys. It represents a standard-based open source/open data initiative that allows individual users to assess the quality of their connection to the open Internet (i.e. third party servers outside of their service provider network; "off-net" test)[vi]. In this context, it is therefore important to note that effective service quality levels/speeds users experience when accessing prioritized/sponsored Internet content and application services or those cached "on net" might be higher than those reflected in our measurements. Having encouraged users in SWO to test their connections using a series of surveys, our sample for 2017 consists of around 52,000 CIRA/M-Lab NDT tests from 167 municipal entities and reserves across SWO. We recognize that potential biases in the data may exist because users are motivated to fill out the SWIFT survey and run the embedded speed-test because they wish to improve their internet service and benefit from

SWIFT. CIRA speed tests in rural SWO increased 60% between 2016 and 2017 due to promotion of the SWIFT user surveys.

Figure 1 illustrates the relationship between average and maximum speeds detected across SWO communities in 2017 (in log scale). Figure 2 documents the association between average effective download and upload capacity available to users in absolute terms for ease of interpretation in the context of CRTC basic service targets.
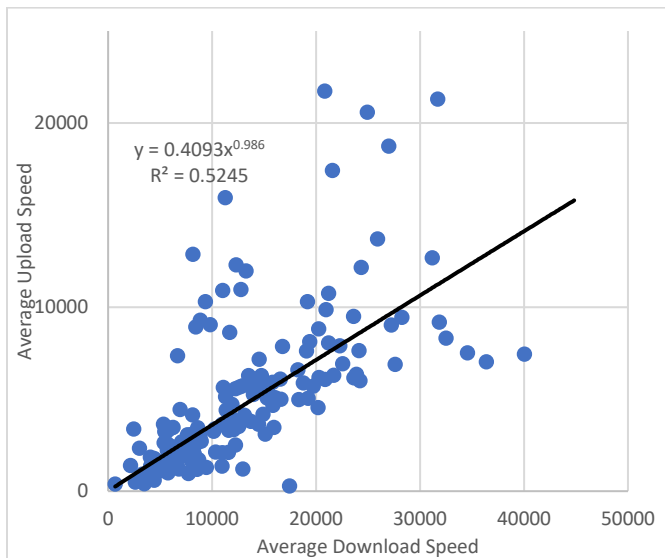


*Figure 2: Download v. upload speed in SWO (2017) in kbps, logs; Source: CIRA/M-Lab NDT/R2B2*

**Benchmarking SWO vs. CRTC universal service targets:** In 2016, the federal telecom regulator CRTC reclassified high-speed access as a basic telecommunications service and established aspirational connection speed targets of "at least 50 Mbps download and 10 Mbps upload."

It further emphasized that "these speeds are to be the actual speeds delivered, not merely those advertised."[vii]  As documented in Figure 1, maximum speeds detected in the majority of communities in SWO tend to exceed CRTC's 50 Mbps benchmark. In a small number of communities, maximum speeds detected approach 500 Mbps, suggesting that a subgroup of users in them have access to ultra-high capacity fibre links (e.g. large businesses or municipalities with educational institutions connected to the Ontario Research and Innovation Network (ORION)). On the other hand, there are some communities within SWO where no users are able to achieve maximum speeds approaching 50 Mbps, suggesting limited access to fibre transport/middle mile facilities. However, much like maximum advertised speeds maximum measured speeds that may be theoretically feasible do not represent a realistic picture of the network quality suppliers make available to average users under normal use conditions. CIRA data suggests that average measured download speeds only in a small number of SWO communities are starting to approach the 50 Mbps benchmark. Average speeds in the majority of the Region remain substantially below CRTC's 50/10 Mbps benchmarks rates (~2-10 times lower). This raises an issue: effective bandwidth/network capacity will have to be scaled significantly for reaching CRTC targets in terms of average actual speeds users experience when accessing content and applications from "off-net" servers/the open Internet.

**Regional disparities:** The magnitude of connectivity gaps within SWO also appears substantive, according to CIRA data. At one extreme, there are a number of communities where average speeds remain below the 5/1 Mbps target the CRTC adopted back in 2011 (i.e. those in lower left hand side of Figure 2). At the other extreme in a small group of leading SWO communities, average effective speeds exceeded those in Canada's relatively low-cost/high-revenue urban centres such as Toronto and Vancouver.[viii]  Effective bandwidth service providers have provisioned for users in these communities tends to be 3 to 5 times higher than in the lagging cluster. Understanding the success of these communities and

apparent market failures in the lagging cluster may offer valuable insights for service providers and policy makers in SWO and beyond. In addition to assisting policymakers identify and prioritize addressing capacity gaps within the Region, independent testing by users is critical for enhancing the accountability of suppliers for delivering "high-speed" data services their customers expect (per "up to" xMbps advertised speeds), enhancing competitive discipline and incentives to deploy new technologies, and enabling ex post monitoring of minimum service quality standards private network providers are expected to deliver in return for scarce public broadband development subsidies.[ix]

**Data limitations and future analysis:** Further research will examine the grouping of speed-tests at premise to the aggregate of "communities", and subsequently to the regional level. The CIRA data suggests substantial variability of service among premises or within communities as well as across communities to indicate regional disparities. Speed test data, advertised or from user-run tests, is acknowledged as an imperfect indicator. Cable and wireless discrepancies arise from fluctuation and speeds are affected by load. R2B2 uses and recommends the use of multiple datasets and longitudinal analysis in policymaking to assess broadband access.

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## REFERENCES/NOTES:

[i] http://swiftnetwork.ca/wp-content/uploads/2018/03/2018-Broadband-Position-Paper-1.pdf

[ii] http://swiftnetwork.ca/

[iii] See e.g. re fixed: http://swiftnetwork.ca/2017/12/12/case study-bell-and-swift/ ; re mobile: https://mobilesyrup.com/2018/02/27/huawei-and-bell-trial-fixed-wireless-alternative-to-broadband-in-rural-ontario/

[iv] See R2B2 Policy Brief #2018-2 "Rural Fibre and 5th Generation Wireless: Substitutes or Complements?"

[v] SWIFT user surveys are available here: http://swiftnetwork.ca/surveys

[vi] https://www.measurementlab.net/tests/ndt/

[vii] Telecom Regulatory Policy CRTC 2016-496. https://crtc.gc.ca/eng/archive/2016/2016-496.htm

[viii] https://cira.ca/reports-and-analysis-canadas-internet-internet-performance-test

[ix] Rajabiun, R. & Middleton, C. (2015). Lemons on the Edge of the Internet: The Importance of Transparency for Broadband Network Quality. *Communications & Strategies*, *1*(98), 119-136.

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