

PART 3 - COMMUNITY MESH STUDY

ÉQUITÉ
NUMÉRIQUE
d'Ottawa



DIGITAL
EQUITY
OTTAWA



Boosting the Signal: A Community Broadband Solution in Ottawa

Produced by

SOCIAL PLANNING
COUNCIL
of Ottawa



National
Capital
FreeNet

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United Way
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Introduction

National Capital FreeNet (NCF) was founded in 1992 to connect people across the region to their neighbours and the wider world. As technology changed, so did NCF's services. Today, NCF sells affordable high-speed internet as a social enterprise, offers digital literacy workshops and online resources, and is committed to digital equity designed by and for the communities it serves.

The Social Planning Council of Ottawa (SPCO)S was founded in 1928 as a catalyst for sustainable social and economic development in the pursuit of social justice and the reduction of inequality, using modern research and communication methods. Some of SPCO's past work includes the development of the Neighbourhood Equity Index, using Statistics Canada data to compare unnecessary and unfair differences at the neighbourhood level on factors impacting well-being.

NCF and SPCO partnered, with support from United Way East Ontario, to establish Digital Equity Ottawa and address four pillars of digital equity: digital literacy, access to connected devices, the digital capacity of the voluntary and social service sector, and connectivity with other stakeholders across Ottawa and the surrounding regions.

This is the third report in a three part series produced in 2021 by National Capital FreeNet and the Social Planning Council of Ottawa, with support from United Way East Ontario. The reports have been prepared to advance digital equity across four pillars: connectivity, access to devices, digital literacy and digital capacity of the non-profit sector. Report 1, entitled "**Boosting the Signal Increasing Digital Equity in Ottawa Part 1 Urban Connectivity Report**", sets out a plan to address digital equity across the four pillars in Ottawa. Report 2, entitled "**Boosting the Signal Pathways to Improving Digital Equity in Eastern Ontario, Part 2 Rural Connectivity Report**", sets the foundation to address digital equity in the rural counties in Eastern Ontario. All three reports can be found at <https://neighbourhoodequity.ca/digital-equity-ottawa/>.

Building on its existing capacity as a not-for-profit Internet Service Provider (ISP) and its partnership with Ottawa Community Housing (OCH) to offer a lower-cost internet package for OCH tenants, NCF has been looking into different ways it could offer faster speeds at a lower price for those that need it most.

SPCO's Neighbourhood Equity Index is an important addition to this work, identifying which communities face the most inequities. This is particularly important as we have found that the digital divide mirrors existing social inequities.

Through this work, we have alighted on the idea of piloting a community mesh network in neighbourhoods facing high inequity as a meaningful way to improve connectivity for those living on low incomes. The community mesh network would increase community resilience by offering free public WiFi in OCH buildings and other nearby community spaces. Our proposed initiative would also incorporate a neighbourhood training program for under-employed youth, to participate in the provisioning and maintenance of the network, including HelpDesk support.

We conducted an initial study of:

- what broadband solutions have been used in urban contexts like Ottawa,
- the strategies that have been adopted that have made those solutions successful,
- the challenges alternate broadband solutions are facing.

Based on this, we developed an approach to implementing a new community-based broadband initiative in Ottawa.

We are also assessing if the alternate broadband solutions we studied can be sustainable in the high inequity neighbourhoods of interest and how to mitigate against failure that will have a detrimental impact on those communities.

The proposed community mesh network pilot would partner with Ottawa Community Housing, leveraging OCH tower blocks as antennae locations for the service. Our initial plans include a mix of home broadband solution and public WiFi areas in the indoor and outdoor common areas of the OCH buildings, that can be extended to parks and other communal facilities in the neighbourhood.

We also looked at existing community mesh networks around the world and ways that community and municipally owned networks are increasing as ways to address longstanding digital inequities.

Existing Broadband Solutions

Most households in urban centres with home internet connections receive broadband service over DSL, Cable or FTTH (Fibre to the Home), sometimes also known as FTTP (Fibre to the Premise).

NCF has offered wholesale DSL service on the Bell network since 2005 and recently started offering wholesale cable internet on the Rogers and Cogeco networks. Wholesale internet is regulated by the Canadian Radio-Television Telecommunications Commission (CRTC). CRTC sets wholesale prices for many costs of delivering home internet, including the line cost and some of the usage costs. Other components of these prices are not regulated and are offered at market rates.

Currently FTTH internet access is not available wholesale to independent ISPs like NCF. The final CRTC decision on this issue is expected soon.

Unfortunately, the high tariff line rates for wholesale DSL and cable service makes it unsustainable for NCF and other independent ISPs to offer the CRTC's basic service objective of a 50/10Mbps speed service with unlimited usage service at an affordable rate for low-income families.

Since 2017 NCF has instead offered a 6/0.8Mbps speed plan with unlimited use to OCH tenants for \$25.00 a month. There are other lower-cost plans now available to those on low incomes. Rogers offers its own Connected for Success, recently expanded. The Connected Families program offered to 220,000 low-income families across Canada, selected by lottery if they receive the maximum Canada Child Benefit. Both programs offer plans that start at \$10/month, which is far below the tariff line rate NCF must pay for comparable services. We discuss these plans in more detail in our Digital Equity Ottawa report.

if NCF wants to offer a lower-cost internet at a faster speed, it must do so outside the existing wholesale regulated market.

Two such alternative broadband solutions with the potential of being deployed at affordable rates are Multi-Dwelling Unit (MDU) Fibre and Community Mesh Network, solutions deployed and adopted successfully in the urban content.

	Multi-Dwelling Unit (MDU) Fibre	Community Mesh Network
Pros	<ul style="list-style-type: none"> ○ Faster than DSL and Coaxial Cable ○ Most future-proof medium ○ Light technology makes for a noise-free networking environment 	<ul style="list-style-type: none"> ○ Faster than DSL ○ Low deployment costs ○ Easily scalable and redundant architecture
Cons	<ul style="list-style-type: none"> ○ Very Intrusive to deploy ○ High Deployment Costs 	<ul style="list-style-type: none"> ○ Slower than most current Cable plans ○ Possible higher latency

Multi-Dwelling Unit (MDU) Fibre

Providing Fibre services to MDUs like apartments and condos has been a growing broadband solution in recent years. This is because service providers can spread the high cost of fibre deployment over multiple potential subscribers in a single building.

Providers can offer very competitive internet packages to those in condos fortunate to receive their service like a \$50/month gigabit service from Beanfield Communications or \$40/month 100Mbps download plan from Rally in Toronto.

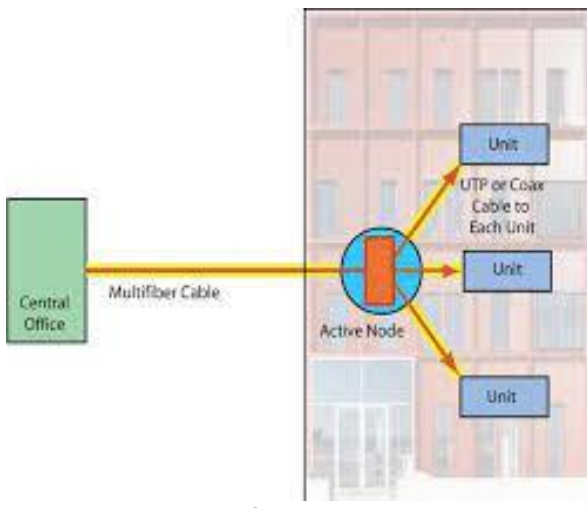


Figure 1 - Example of a Fibre Deployment in an MDU

Although those rates are still high for most lower income families, they are very competitive with what’s offered over Cable, DSL or FTTH at similar service levels.

These services tend to be provided in new condo or apartment buildings that are easier to cable or where cabling was completed for during the build phase, reducing the cost of deployment and ultimately, service provision.

This is a consideration for future new builds by social housing providers like Ottawa Community Housing.

NCF sought quotes on the costs of wiring an existing OCH tower block with dedicated fibre access, and they were too high to provide at affordable rates for lower income families. Also, some OCH tower blocks have already been wired with direct fibre access by the incumbent providers like Bell, but these FTTH services are only available at a premium price.

Community Mesh

The Canadian internet landscape has been characterized by decreasing choice and affordability for consumers. The industry has been growing in subscriptions, total revenues, and average revenues per user for years. Sadly, these successes have not translated into savings for the consumer. This has a disproportionate impact on those living on low incomes.

Instead, the growth in the industry has been concentrated in the largest incumbent ISPs who have long argued that reducing prices for consumers will result in lowering their capacity to continually invest in infrastructure¹. This perspective pits increasing access, particularly for under-served rural areas, against affordability.

Given the challenges of both the wholesale regulated market and cabling direct MDU fibre access in enabling affordable connectivity for those living on low incomes, we have focused on a community mesh network.

Our survey of OCH tenants, as well as aggregated data about connectivity challenges for those living on low incomes shows that many residents in these communities are either priced out of a high-quality internet service² or they must make significant budget sacrifices to stay connected.

¹ [Two years ago, Ottawa aimed to lower the high price of wireless and internet. Not anymore - The Globe and Mail Editorial](#)

² [Neighbourhood Equity Index developed by Social Planning Council of Ottawa](#)

As Suzanne Smythe, Associate Professor in Adult Literacy and Adult Education at Simon Fraser University has written: “decisions about who has internet and devices cannot be left to for-profit ISPs and ‘the market’ when the CRTC has already declared the internet an essential basic service.”³

Our Digital Equity Model

We are suggesting an approach that prioritizes closing digital equity gaps locally over other considerations as this would help bridge the digital divide as well as other related social and economic inequities.

Drawing on SPCO’s Neighbourhood Equity Index data, we are proposing that the community mesh start in the ten Ottawa neighbourhoods experiencing the most inequities⁴:

1. Sandy Hill – Strathcona Heights
2. Heron Gate
3. Vanier-McArthur Ave
4. Overbrook-the Four Corners-Queen Mary Court
5. Ledbury-Albion-Heatherington-Fairlea
6. Hawthorn Meadows- Confederation Court
7. Britannia Woods- Michele Heights
8. Carlington-Belleview-Lepage-Caldwell
9. Cummings-Cyrville
10. Bayshore

³ [Digital Equity and Community Solidarity during and after Covid-19](#) – Policy Note, Suzanne Smythe

⁴ [Ottawa Neighbourhood Equity Index](#) - SPC

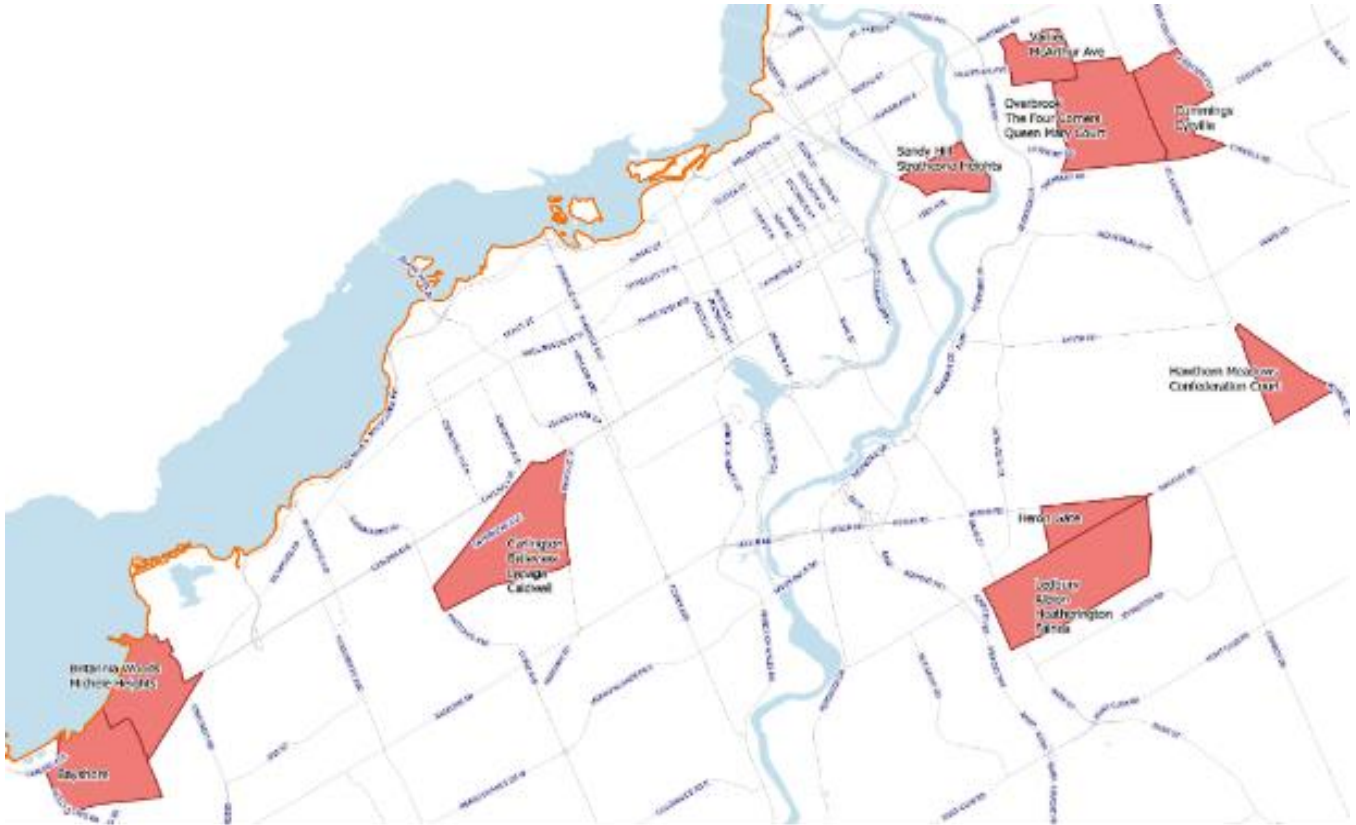


Figure 2 - 10 Highest inequity Neighbourhoods in Ottawa according to Neighbourhood Equity Index

The capabilities of most of the technologies we are looking at allows us to regroup those neighbourhoods into five communities for potential pilots.

Communities	Households on Low Income	Percentage of Households on Low Income	Persons living in Low Income Households
1. Overbrook / Vanier	5,915+	31%	11,265+
2. Lowertown / Sandy Hill	4,290+	32%	6,850+
3. Heatherington/ Heron Gate / Hawthorne Meadows	2,775+	42%	6,785+
4. Foster Farm / Bayshore / Britannia Woods / Michelle Heights	2,790+	25%	6,710+

5. Caldwell / Carlington	1,675+	32%	3,290+
All Target Communities	17,445	31%	34,900+
Ottawa	55,393	15%	115,160

Starting in neighbourhoods facing the highest inequities is the opposite of a market-first approach to digital equity. We’re proposing a digital equity model that prioritizes community needs, community partnerships and skills building in the targeted neighbourhoods.

Digital equity projects in a typical for-profit ISP are part of the “corporate social responsibility” efforts. The impact of such programs is significant to the community members who can join them. However, they address only a small portion of the need. In Ottawa, only roughly 10% of Ottawa Community Housing tenants are receiving subsidized internet and their eligibility criteria excludes most low income residents. These programs also often rely on structural advantages of the incumbents and, because they are offered by individual companies as incidental to their main lines of business, they can be ended at any time.

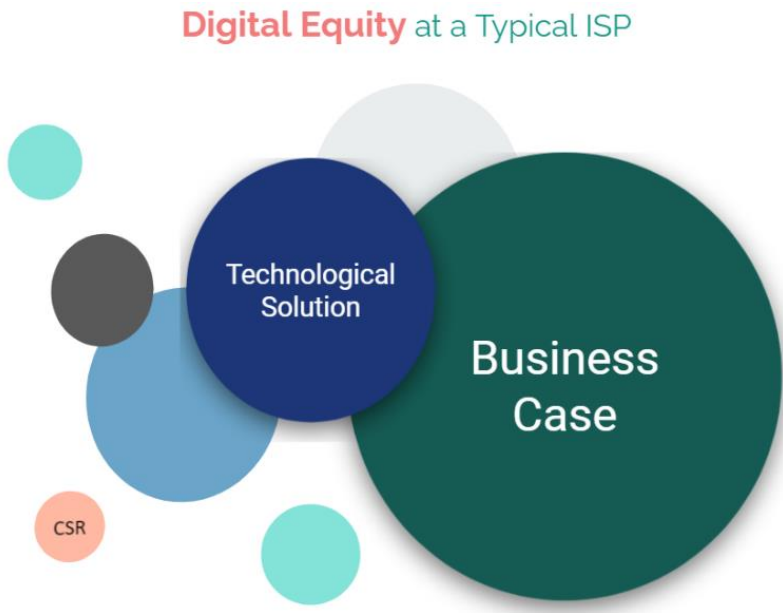


Figure 3 Digital Equity project are under CSR project of a typical ISP

With the community mesh network, we can design a network with digital equity in mind from the start. Business sustainability and technological resilience are important elements that can be balanced with the goal of providing a high-quality affordable network for both the unconnected and under-connected in high priority neighbourhoods.

Digital Equity perspective with a Community Network

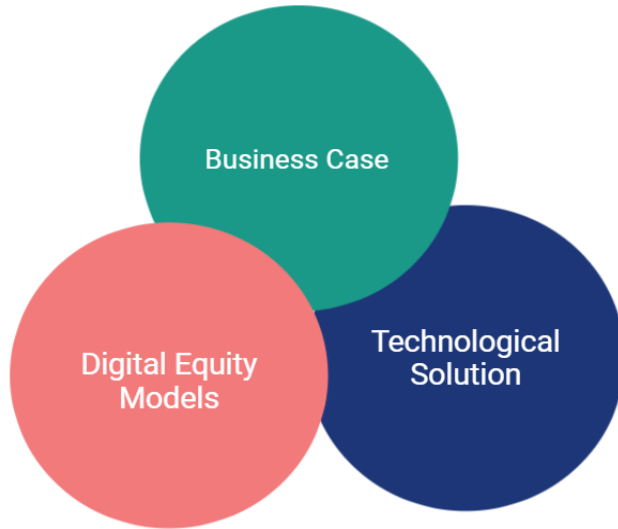


Figure 4 - Digital Equity Models balance out Business Case and Technological Solution in a Community Network

Service

We have set a service goal to deliver a 100Mbps speed unlimited usage plan, twice the home internet connection recommended by the CRTC. This will help OCH tenants improve their economic stability and increase their economic opportunities. The service aims for low latency and low network congestion to allow for a seamless connectivity experience for video conferencing, online schooling and working from home. The service will also offer built-in security measures that ensures members can use the internet as part of development of the network. As part of these services, NCF will plan to introduce a virtual private network (VPN) service for additional security for members on the network and at public WiFi hotspots. Every member of the community mesh network should be able to use the network with ease knowing their connection is secure with access to the key applications and service they need.

The system will provide added benefit to the community, through free public Wi-Fi in indoor and outdoor OCH common areas, including on-site community gardens.

We are currently examining pricing options. Partnering with existing municipal infrastructure and other community organizations could significantly reduce costs for building and running the service, which would make it even more affordable.

Technology

A Community Mesh Network is built with inter-connected routers called “nodes” that route internet connectivity across a community. In Ottawa, NFC would extend our existing partnership with Ottawa Community Housing to use OCH tower blocks and the surrounding townhouses, duplexes and quadplexes as its backbone.

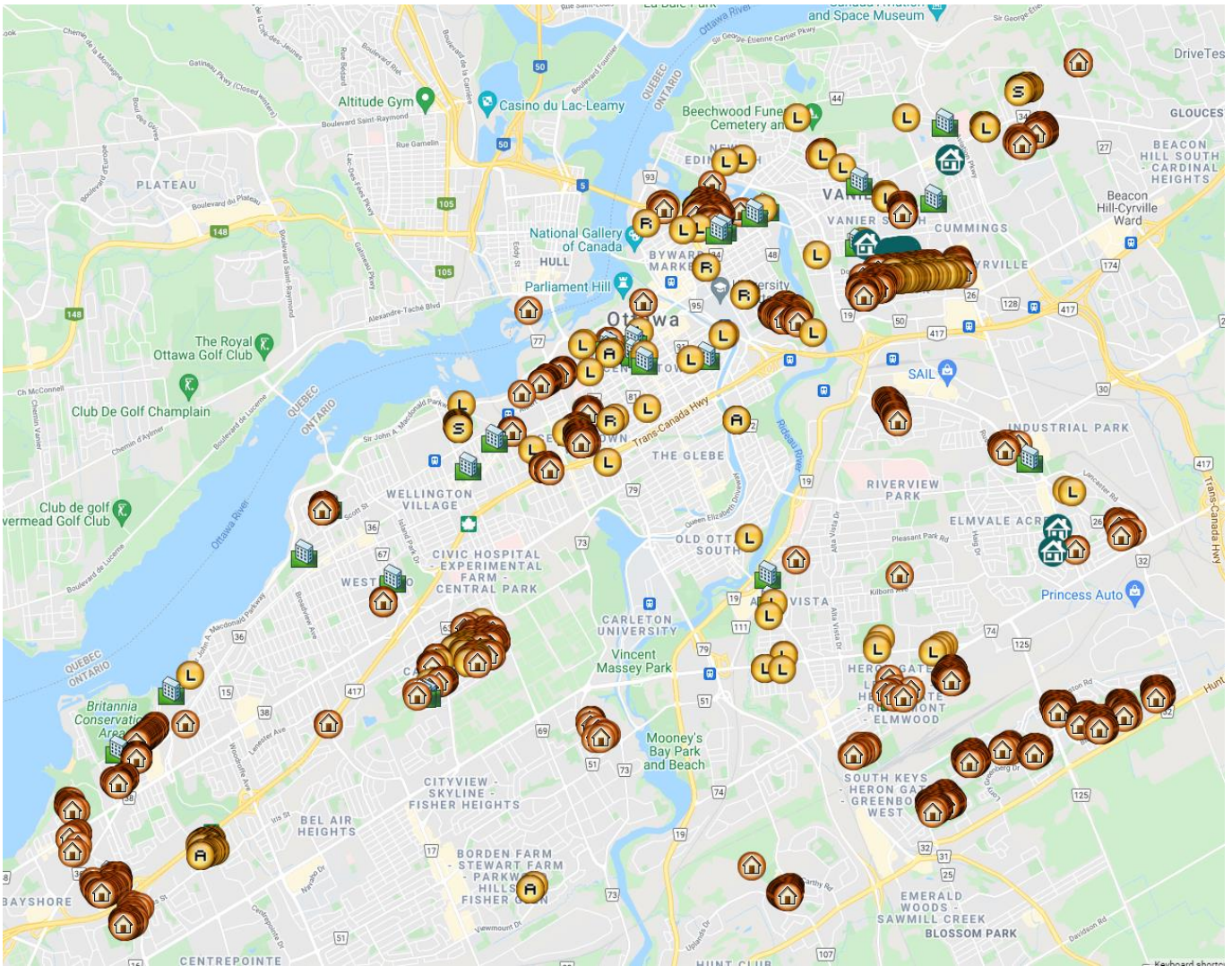


Figure 5 Map of OCH Housing Units

Our proposed initial pilot is 800 St. Laurent Boulevard (shown in green), an OCH building serving seniors, located in the Vanier/Overbrook area. It is surrounded by more than 100 OCH-owned townhouses, duplexes and quadplexes (shown in yellow) as well as many social service agencies, municipally-owned parks and community centres. This neighbourhood experiences high inequity on SPCO's Neighbourhood Equity Index.

In its first stage the pilot would offer free public WiFi inside the building's common spaces and outdoor lounge area and community garden, as well as home WiFi mesh connectivity to the surrounding homes. Future developments could also provide in-building home WiFi to the apartment and free public WiFi to a range of local community spaces.

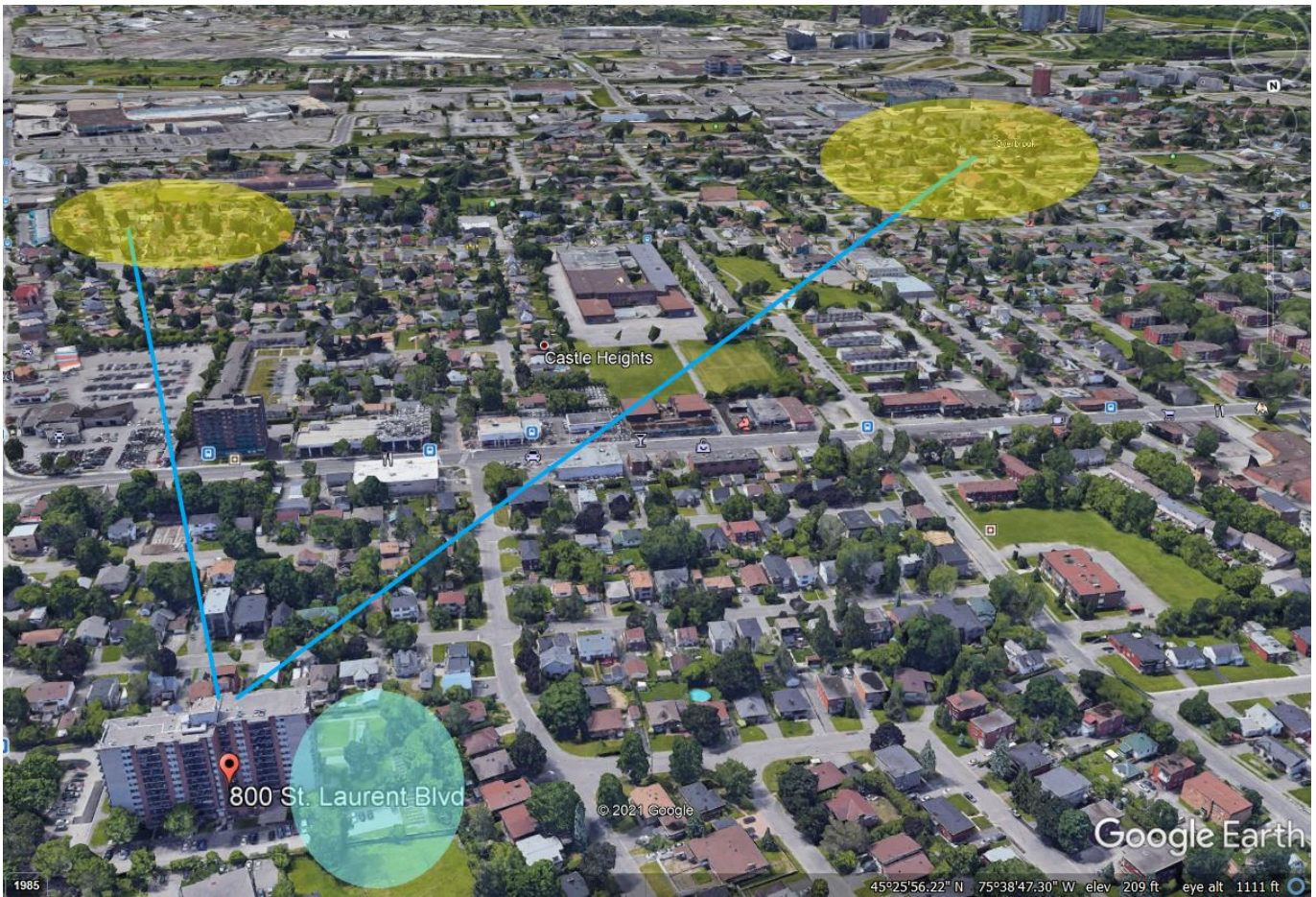


Figure 6 - Google Earth Aerial Image of 800 St Laurent and surrounding neighbourhood

As part of the network design, NCF would install Point-to-Multipoint radios with antennae on OCH towers that send a wireless internet signal out to the surrounding community, depending on line of sight and distance from the antennae.

Interested members of the community network would have devices installed on the outside and inside of their units that act as nodes to connect to each other and back to the antennae on top of the OCH towers for a resilient connection. As illustrated in Diagram (b) of Figure 2, the community mesh is a shared connection in the community, with resilience built through the fact that connection is established from multiple nodes.

Most wireless Point-to-Multipoint technologies can now operate at ranges beyond 30 km assuming favourable topography and line of sight. In this feasibility study, we look at communities within 5km of the OCH tower block to increase the potential for higher speeds and our confidence in plans about how to build up the network.

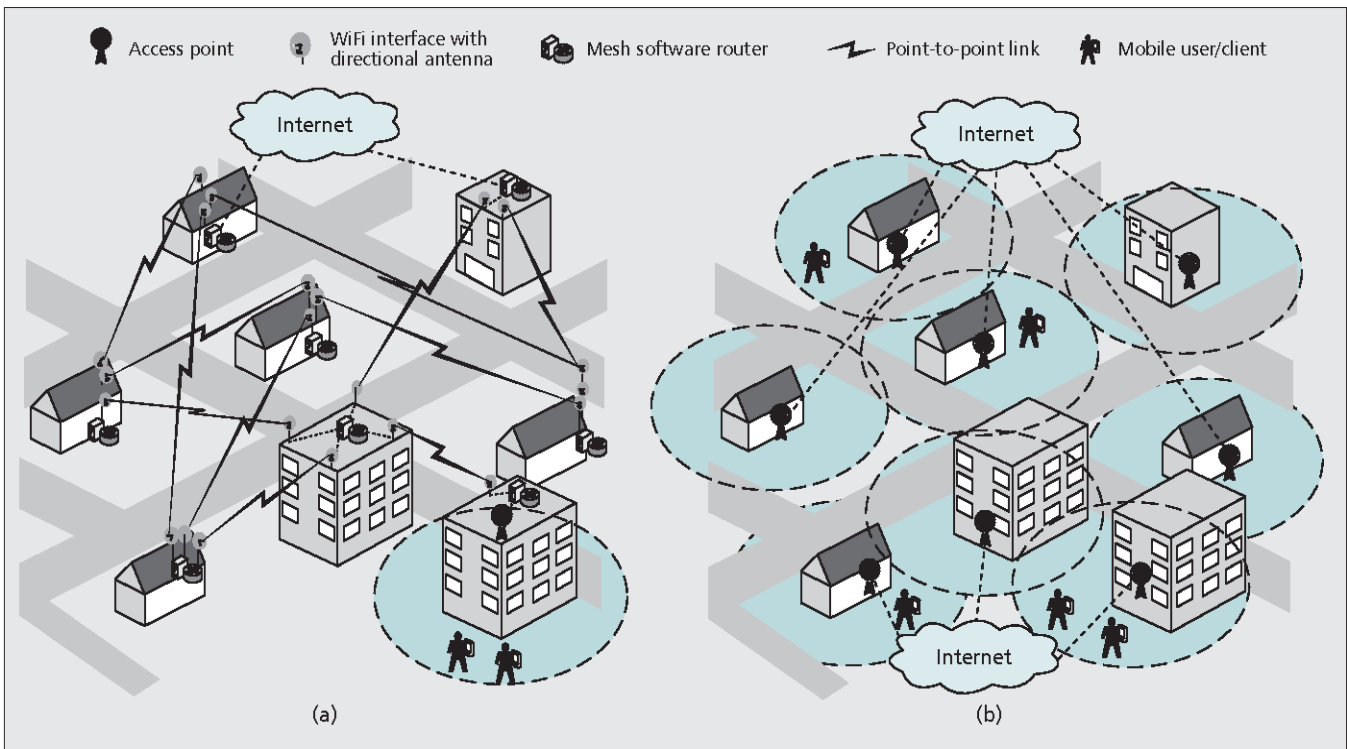


Figure 7 - Architectural alternatives for Wireless Community Networks. A wireless mesh architecture is shown in (a), while the hotspot-based alternative is shown in (b).⁵

⁵ [Wireless Community Networks: An Alternative Approach for Nomadic Broadband Network Access](#)

Community Needs Before Market Needs

Community needs are prioritized in the design of the network, the pricing of the product and the service excellence targets for its operations. This is reflected in the plan to go into the neighbourhoods with the highest needs first and to find a model that can be sustainable for those communities. Also, emphasizing affordability and including public access for common spaces allows for communal benefits where the network is deployed.

Our Proposed Digital Equity Model

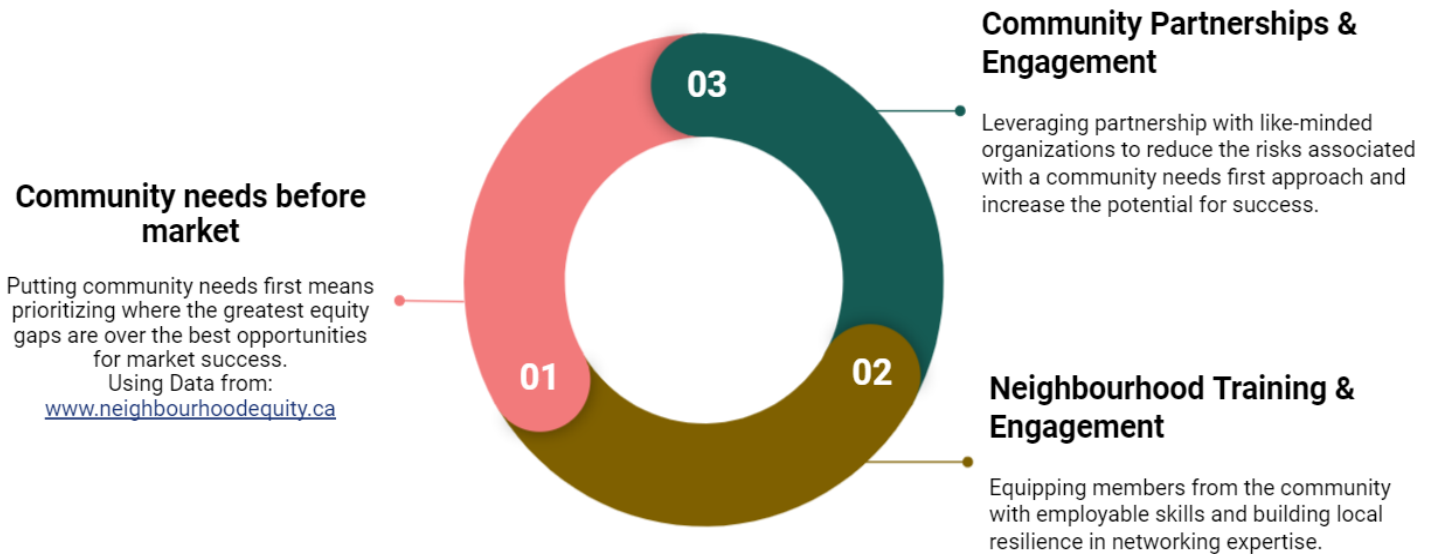


Figure 8 Our Proposed Digital Equity Model

Neighbourhood Training & Engagement

We aim to a community development program and a skills training program with members from the target communities.

Our **youth skills training program** will provide opportunities for up to five community members to start learning about community mesh networks and build employable technical skills. The paid training program will include 4 weeks of IT Support Training, preparation for CompTIA certification and a 12-week internship with NCF at \$18 per hour. The youth could continue as mesh installers, maintenance workers and HelpDesk support.

Community Partnerships & Engagement

Our **community development work** will increase awareness and digital literacy through webinars, community forums and other feedback sessions. It will also give NCF the opportunity to learn more about the communities' specific needs and how a network can support other local improvement projects.

As part of the efforts by Digital Equity Ottawa, we are hoping to build partnerships with the City, other municipal organizations, social service organizations and other charities and non-profits to address other digital equity issues of families in need.

For example, how can we ensure that the families connected on the community mesh network also have access to affordable connected devices. The Seattle Digital Equity Initiative has a similar program that pairs free or discounted devices with an internet essentials package for qualifying households⁶.

Community and Municipal Networks

The proposed project is based on lessons learned from other existing community networks using mesh network technology as well as fibre build-outs.

Rhizome Networks is run by the city of Stratford, Ontario. It provides city-wide WiFi through its municipally-owned network since 2010. Built off existing hydro-electric infrastructure, the project was initially intended to support smart metering for the city of Stratford but expanded to help address the digital divide, spur economic development and solidify its standing as a Smart City. It has 300 wireless mesh access points. Rhizome has since partnered with local telecom companies to expand service to include FTTH for residences.

In September 2020, Rhizome leverage their existing network to boost WiFi network near two local high schools for a better outdoor socially-distanced learning experience.⁷

⁶ [Free and Discounted Devices](#) – Seattle Digital Equity Initiative

⁷ [Stratford's city-owned ISP giving a WiFi boost to teachers and students](#) – The Beacon Herald

O-NET is Canada's first community-owned and operated Fibre-to-the-Home network and it was constructed in Olds, Alberta starting in 2011. The network provides up to Gigabit services for residents and has developed a free public WiFi network⁸.

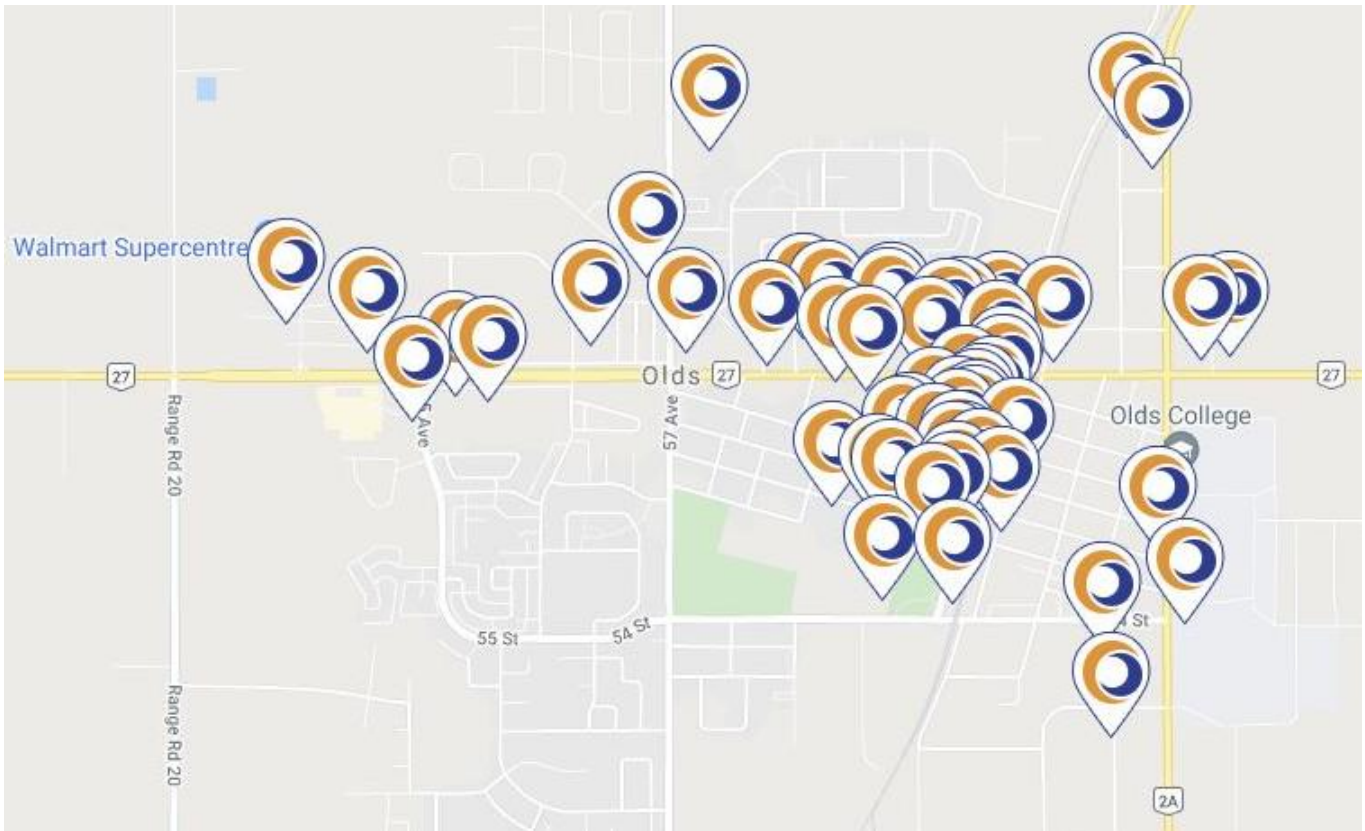


Figure 9 O-Net Public WiFi Map

The Mamawapowin Technology Society operates a free public WiFi network that services the four Indigenous nations in the Maskwacis Region of Alberta. Founded by Bruce Buffalo to combat the lack of internet access in his community, Mamawapowin is funded through donations and community sponsorships.⁹¹⁰

NYC Mesh is a community mesh network in New York City with over 830 nodes run with about 30 volunteers. NCF Mesh has been steadily growing since 2015 and was recently one of five providers to

⁸ [WiFi Map](#) - O-Net

⁹ [An Interview with Bruce Buffalo, Founder of Mamawapowin in Maskwacis, Alberta](#) – Northern Public Affairs Magazine

¹⁰ [Broadband Bruce: Fighting Canada's Digital Divide](#) - Aljazeera

receive approval from the city of New York to expand WiFi access to 13 buildings for no more than \$20 a month.¹¹

Red Hook WiFi - a resilient free WiFi network in Brooklyn, NY. The network which launched in 2012 has kept residents connected after multiple natural disasters including hurricane sandy.¹² They use a neighbourhood training model with a focus on marginalized youth to support the design, maintenance and growth of the network.

B4RN a gigabit rural broadband project in Melling, England. B4RN is registered as a Community Benefit Society has over 7000 connected properties. As part of their commitment to expanding connectivity, they offer services to places of worship, school, and village halls for free. B4RN averages about 65% of all the properties in the communities they've connected and has more than 2,300 shareholders (mostly subscribers).¹³

Guifi.net - is a free, open and neutral community network with more than 38,000 active nodes across Catalonia and Valencia in Spain. It began in 2004 to solve access issues in rural areas and combines wireless and fibre technology to connect more than 50,000 users.¹⁴

¹¹ [‘Welcome to the Mesh, Brother’: Guerrilla Wi-Fi Comes to New York](#) – The New York Times

¹² [Red Hook Public Wi-Fi To Nearly Triple Service With \\$1M Expansion](#) – Patch.com

¹³ [About Us](#) - B4RN

¹⁴ [What is Guifi.net?](#) – Guifi.net

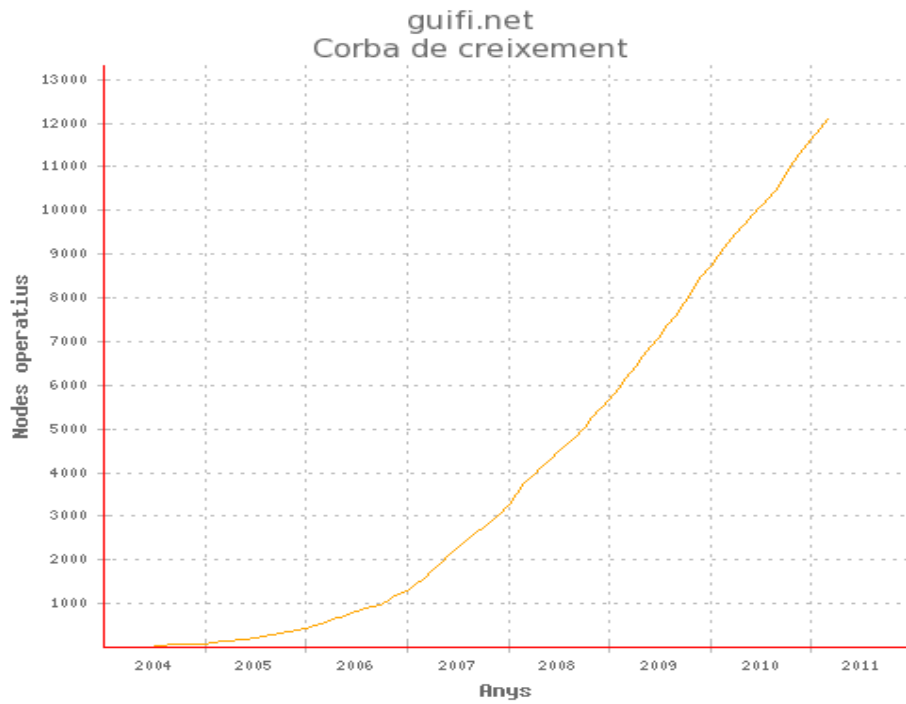


Figure 10 Growth of Guifi.net active nodes

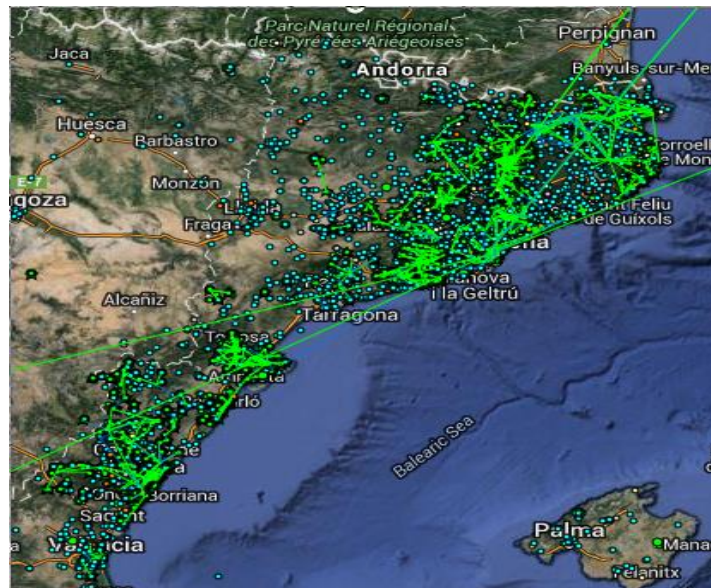


Figure 11 Map showing distribution of Guifi.net nodes

Freifunk is the largest community mesh network, operated in the Germany with over 49,000 nodes.¹⁵

¹⁵ [What is Freifunk About?](#) - Freifunk

What we learn from these examples?

1. All these projects were community-led and developed organically over time.
2. Different revenue models are possible. Some are sustained on donations and exclusively by volunteers. Others offer free and paid services and have paid staff.
3. Free WiFi is an essential element of providing internet service for communities even with an affordable paid service
4. Recruiting, training, and managing volunteers and/or staff is a critical part of providing reliable internet service over a community network.
5. When run efficiently community networks can scale to have a sizable impact on the digital divide in the communities they serve.

Growing Momentum for Community Broadband Initiatives

While there have been community networks for many years, the growing cost of connectivity combined with the centrality of internet connectivity during the lockdowns of COVID-19 seems to have led to growing awareness of the need for community networks, both for expanding free public WiFi as a tool of community resilience beyond libraries and coffee shops, and for home access.

In February 2021 the City of Toronto approved ConnectTO to “leverage municipal resources and assets to increase digital equity and expand access to affordable, high-speed internet to underserved Toronto residents”.¹⁶ The Toronto Community Housing Corporation voted in December 2020 to study what it would cost to provide all its subsidized tenants with internet services.¹⁷

City of Ottawa staff are currently in the initial stages of investigating how municipal assets could be similarly leveraged. In the meantime, the city added 13 initial free public WiFi hotspots during the pandemic.

¹⁶ [City Council approves program to increase access to affordable high-speed internet in Toronto](#) – City of Toronto

¹⁷ [Should public housing have public internet? TCHC mulls covering costs for subsidized tenants](#) – The Toronto Star

In the US, the Institute for Local Self-Reliance aims to promote “locally rooted, democratically accountable broadband networks that provide fast, affordable and reliable Internet access to all Americans”.¹⁸ Their newsletter and podcast are full of stories about community networks starting in rural and urban areas and the ways that leveraging municipal assets frequently means these community networks out-perform private monopoly providers.¹⁹

Conclusion

Given NCF’s history of internet service and award-winning support for connectivity and digital literacy, combined with SPCO’s history of identifying inequities and then working across the community to build coalitions that can tackle them, we believe we are well-placed to pilot a community network in Ottawa, leveraging a partnership with Ottawa Community Housing.

¹⁸ [Community Broadband Networks](#) – Institute for Local Self-Reliance

¹⁹ [PCMag’s Fastest ISPs in America List Once Again Proves the Value of Cities Investing in Internet Infrastructure](#) – Institute for Local Self-Reliance