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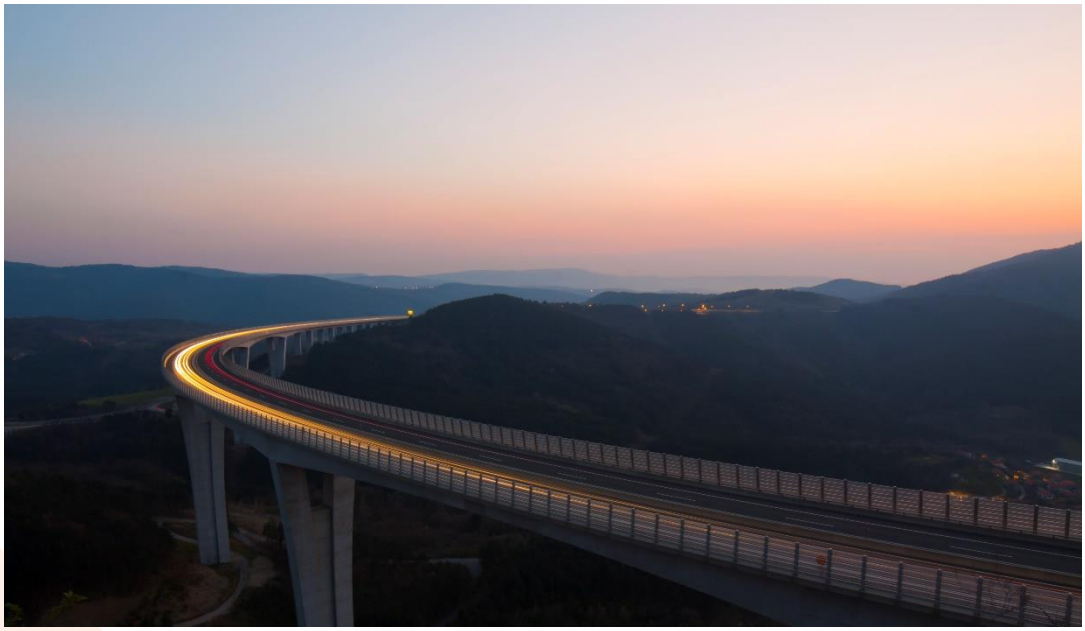
Executive Briefing

# HOW REGIONAL ISPS ARE BRIDGING THE DIGITAL DIVIDE THROUGH INNOVATION

The digital divide in North America is leaving millions without adequate broadband. Regional ISPs have a clear role to play in closing that gap – we highlight four key business model factors that they can consider to enable network build and services more quickly.



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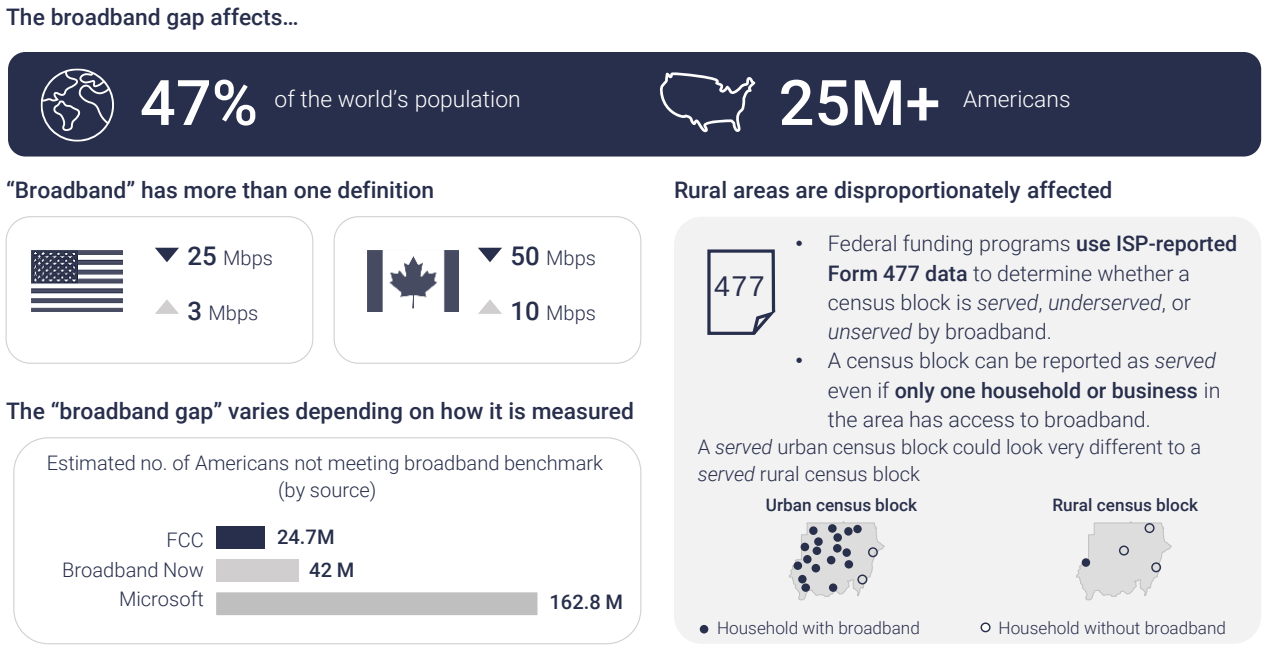
# Executive Summary

## Over 25 million Americans are unconnected by broadband today

North America covers a large and diverse geographical area, much of which is rural. Incumbent operators typically serve "islands" of connectivity in dense areas, perpetuating the digital divide in the gaps in between their service footprints. This has created a fragmented landscape of regional ISPs to close the gaps, while not necessarily increasing competition.

**Figure 1: Sizing the "digital divide"**




Source: STL Partners

Regional ISPs face specific challenges, which makes building their networks, upgrading core capabilities and infrastructure security, and rolling out services more difficult:

1. **Making the business case**: Increased cost per customer and low return on investment in sparse rural areas;
2. **Justifying the cost of technology**: Cost, regulatory and security requirements necessitating alternative networking technologies;
3. **Gaining access to skills and resources**: Limited access to technological and security expertise means that ISPs require support from specialist partners;
4. **Modernizing the core network:** ISPs should explore automation and cloudification for the core network, in order to be more flexible and scalable to future capacity requirements.
5. **Investing in security infrastructure:** Increased cyberattacks and Distributed Denial of Service (DDoS) weapons demand that regional ISPs put network security and core network expansion in the forefront of their network planning strategies.

# Regional ISPs should explore new business models to close the divide

Regional ISPs can accelerate network build and bridge the digital divide by adopting innovative business models outside of those established by the larger carriers. In this report, we focus on four key ways in which regional and rural ISPs are innovating their business models: technology, partnerships, financing models, and new services and customer segments.

Regional ISPs are experimenting with different technologies, such as TV white space, to substantially reduce the cost of extending broadband coverage. They have been collaborating with local municipalities and other ISPs adopting "hybrid" financing models to lower the cost of entry for broadband deployments, while injecting competition into underserved or monopolised markets. Regional ISPs are also exploring new monetisation opportunities for both consumers and businesses to grow revenues beyond pure Internet connectivity services. Finally, regional ISPs are growing partner ecosystems with other value chain players to accelerate their network deployments and optimise their assets towards nationwide coverage.

This report discusses findings from a research programme conducted by STL Partners between September and November 2021, consisting of in-depth interviews that culminated in deep-dive case studies on three ISPs that exemplify these approaches:

- Inland Cellular demonstrates the value of an **ecosystem** approach to provide services to rural industries;
- Alaska Communications highlights how **technology** can dramatically change the economics of the network and allow an ISP to scale more quickly;
- Bluewater Regional Networks showcases the value regional ISP services can bring to **new customer segments** – especially in B2B.

# How can regional and rural ISPs futureproof their networks as they scale to close the digital divide?

1. Develop partnerships beyond network deployments that can help establish new value chains and ecosystems to deliver new verticalized solutions, build internal expertise, and shape industry standards.
2. Consider using a combination of different wireless technologies and spectrum to reduce total cost of ownership and deploy at greater speeds.
3. Ensure that the core network, as well as access, can scale to meet additional capacity requirements, understanding the IP capabilities needed in the core network to meet increasing subscriber and device count. Explore cloud-native, converged network cores to help reduce total cost of ownership and time to market.
4. Prioritize security investments in core network planning to withstand the changes in the threat landscape, including basic cybersecurity hygiene and upgraded DDoS protection.

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# Preface

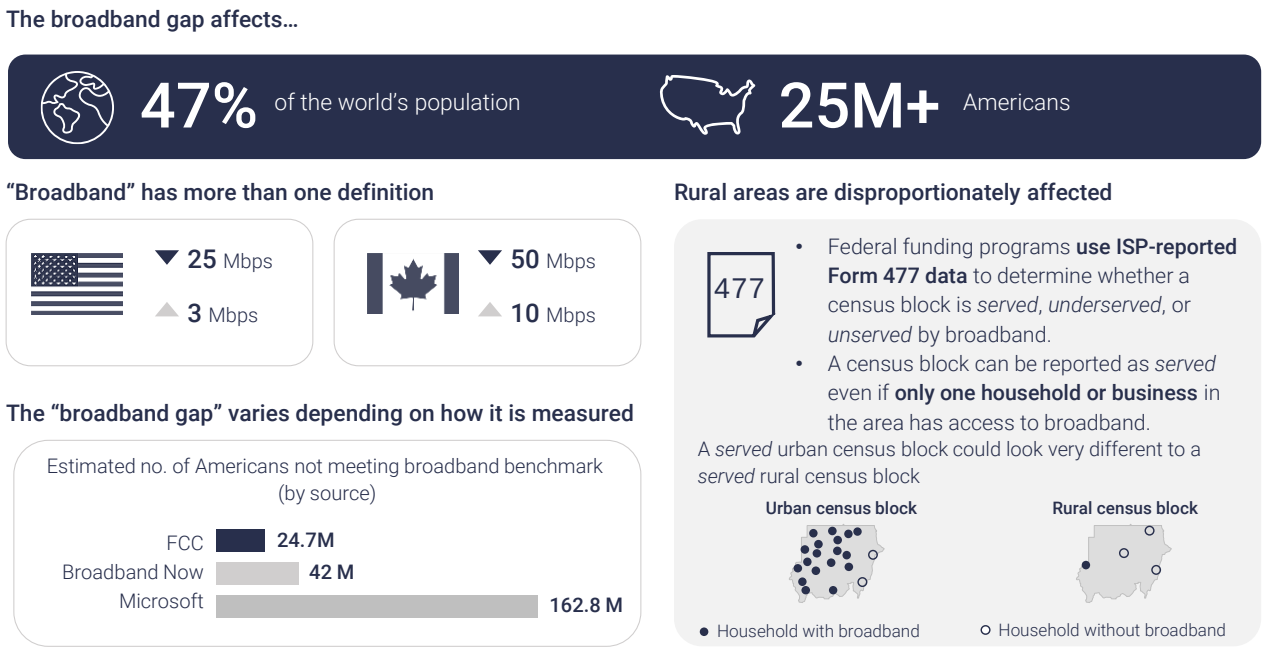
The document has been prepared by independent consulting and research firm STL Partners and commissioned by A10 Networks. STL Partners maintains strict editorial independence. Mentions or allusions to companies or products in this document are intended as illustrations of market evolution and are not included as endorsements or product/service recommendations.

# Introduction: The digital divide in North America is disproportionately affecting rural communities

Shutdowns around the world due to the COVID-19 pandemic have highlighted the need for robust digital communications infrastructure to continue our economic and social activities. Over 47% of the world's population is still offline today, with rural communities and developing regions bearing a disproportionate share of the burden.[1] Critical community resources that are located outside of urban areas, including hospitals, are ill-served by existing broadband connectivity.

Against this context, how can regional and rural ISPs consider innovative approaches to their business models to accelerate network build and bridge the digital divide? This report discusses findings from a research program conducted by STL Partners between September and November 2021, consisting of in-depth interviews that culminated in deep-dive case studies on three ISPs in North America that have demonstrated innovation in their business: Inland Cellular and the Rural Cloud Initiative, Bluewater Regional Networks, and Alaska Communications (& Cambium Networks and Meta Connectivity).

**Figure 2: Sizing the "digital divide"**




Source: STL Partners

In North America, FCC (Federal Communications Commission) Form 477 data indicates that, in 2019, 1.5% of Americans in urban areas were "unserved" by broadband, compared to 22.3% in rural areas and 27.7% in tribal lands.[2] In Canada, 87.4% of urban households have access to broadband that meets CRTC (Canadian

1 FCC benchmark of broadband speeds, United Nations (2021).
2 Federal Communications Commission (2020), "2020 Broadband Deployment Report".

Radio-television and Telecommunications Commission) benchmarks, compared to only 45.6% in rural communities.[3] However, the definition of what constitutes "broadband" varies across borders. In the U.S., "broadband" internet is defined by the FCC as having at least 25 Mbps downstream and 3 Mbps upstream speeds.[4] CRTC, on the other hand, defines minimum broadband speeds as 50 Mbps downstream, 10 Mbps upstream.

For the purpose of this report, the "digital divide" or "broadband gap" will refer to the disparity of broadband availability across North America using the FCC's benchmark of 25 Mbps downlink/3 Mbps uplink ("25/3"). This is due to regulatory, commercial, and technological barriers that impede service providers from expanding broadband connectivity to certain areas, as well as acceptance of the technology and affordability. However, technology acceptance is not the focus of this report.

The FCC's method of reporting (at block-level) is very different to reporting at an address-level and disproportionately affects rural areas,[5] where it is more likely that many addresses within a "served" block are in fact unserved by broadband. Its current methodology considers a census block as "served" even if only one household or business in that area has broadband access.[6] This contrasts other institutions, such as Broadband Now and Microsoft, which use a stricter measure for broadband access (see Figure 2). There is a sizable disparity in FCC's reporting between urban and rural areas. For instance, 90% of residents live in urban areas in Arizona, where unserved addresses are 11% higher than FCC estimates. In South Carolina, where only half of the population lives in urban areas, unserved addresses are 30% higher than estimated.

How data is reported and mapped perpetuates the digital divide because it directly impacts the efficacy of federal funding programs, which use self-reported Form 477 data to determine whether broadband is available at block-level. There are efforts to change this, but they will take time to implement. In March 2020, Congress allocated $98 million in funding through the Broadband Deployment Accuracy and Technology Availability (DATA) Act to update FCC's broadband maps with standardized up-to-date data that is checked against publicly crowdsourced information, ensuring that there is national consensus on which areas are unserved and where infrastructural investments should be directed.[7]

## Government funding initiatives are increasing, but are not the only answer to closing the broadband gap

In the U.S., several federal funding initiatives have recently been introduced or expanded: Connect America Fund Phase II Auction (CAF II), the Rural Digital Opportunity Fund (RDOF) and Infrastructure Investment and Jobs Act. Additionally, the U.S. Department of Agriculture has launched the Rural Development Broadband ReConnect Program, and the FCC has been issuing grants to connect low-income households through the Emergency Broadband Connectivity Fund during the pandemic. Each of these initiatives uses different mechanisms to expand broadband access. However, they each have their limitations and will take time to implement. We explore three of these in more detail below.

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[3] CRTC cites 50/10 Mbps as the target broadband speeds in Canada.
[4] The FCC has not changed this since 2015.
[5] "Rural" is defined here as an area with under 5,000 inhabitants. See 7 CFR § 1735.2.
[6] Congressional Research Service (2021), "Broadband data and mapping: Background and issues for the 117th Congress".
[7] CNN (2021), "Biden wants to close the digital divide in the U.S. Here's what that could look like".

## Figure 3: Federal funding initiatives in the U.S. do not completely solve the problem

| 1 | 2 | 3 |
|---|---|---|
| **Connect America Fund Phase II auction (CAF II)** | **Rural Digital Opportunity Fund (RDOF)** | **Infrastructure Investment and Jobs Act** |
| • Start year: 2018<br>• Total amount: USD 1.49 billion<br>• Dedicated, national initiative designed to stimulate infrastructure build | • Start year: 2020<br>• Total amount: USD 20.4 billion<br>• 10-year programme focused on rural, unserved communities | • Start year: 2021<br>• Total amount: USD 65 billion<br>• National middle and last-mile access programme for affordable connectivity |
| Shortcomings and challenges for regional ISPs | | |
| • Funding in Phase I not available to regional ISPs<br>• Reverse auction (lowest bidder wins) process benefits more cash rich ISPS<br>• Arrangement only incentivizes build through subsidy, does not fund entirely | • Definition of unserved or underserved based on flawed, self-reported coverage and speed stats from ISPs<br>• Criteria weighting favors fiber deployments over more affordable technologies | • Government intervention historically ineffectual<br>• US $54 bn programme, 2014-2019, increased access to adequate broadband by 1% |

Source: STL Partners

**The Connect America Fund (CAF) Phase II auction** will provide $1.49 billion in funding over a six-year period to subsidize the cost of building or upgrading network infrastructure for both voice and broadband services, reaching over 700,000 locations in 45 states. Whereas Phase I (2015) offered funding to larger "price cap carriers", such as AT&T, Frontier, and Windstream, Phase II seeks to broaden this to smaller carriers, but only in service territories where the price cap carriers opt not to upgrade.[8] By the end of 2020, CAF Phase II-funded rural broadband deployments have served 3.6 million homes and businesses in the U.S.[9]

**The Rural Digital Opportunity Fund (RDOF)** is an extension of the Connect America Fund (CAF). The $20.4 billion FCC program will be financing broadband projects for six million homes and businesses in unserved rural communities over ten years from 2020. As of July 2021, the FCC has announced that it is poised to approve over $311 million in broadband funding across 36 states.[10] Under RDOF, service providers are obligated to deploy to 40% of locations in their service delivery area within three years, and 100% of locations by the end of the sixth year. It is more accessible to smaller ISPs, as incumbent service providers no longer have the first right of refusal. However, the bidding process gives an advantage to service providers who meet the "Gigabit" speed and low-latency requirements, thus favoring fiber technologies over viable, affordable alternatives like fixed wireless.

[8] FCC (2020), "Connect America Fund Phase II FAQs".
[9] Universal Service Administrative Co. (2020), CAF Phase II Model.
[10] FCC (2021), "FCC announces over $311 million for broadband, acts to clean up RDOF".

**The $1.2 trillion Infrastructure Investment and Jobs Act** was signed into law by U.S. President Joe Biden in November 2021.[11] The bipartisan infrastructure bill will disperse $65 billion into state and local governments to improve last- and middle-mile broadband internet access, a reduction from the $100 billion originally proposed. It aims to reduce prices and promote price transparency, by requiring providers to display a broadband "nutrition label" for price comparison.

Unfortunately, government interventions to close the broadband gap have been inadequate in the past, both in scope and efficacy. Previous government programs only increased access to adequate broadband by 1%, despite having allocated more than $54 billion of network infrastructure investment between 2014 and 2019.[12]

## Regional ISPs play a key role in closing the digital divide

The North American region covers a large and diverse geographical area, much of which is rural. Providing ubiquitous broadband coverage for these various terrains is challenging because return on investment for provisioning sparse populations is low, and carriers must navigate local permitting laws (which may differ by state, or type of land, e.g., tribal lands) to get access to rights-of-way.

This is why infrastructure investors and network operators have prioritized broadband access for larger, wealthier cities with densely populated communities. The cost per customer served is higher in rural areas, as well as ongoing operating and maintenance costs. The lower density of residential homes and businesses means that more infrastructure (per capita) is necessary to provide broadband services. More land is crossed to connect between dispersed areas, increasing acquisition, permitting, and easement requirements. This leads to higher service charges, which make high-speed internet less affordable for rural customers.

Incumbents operate in "islands" of connectivity, serving densely populated areas at a national scale – perpetuating the digital divide in the gaps in between their service footprints. This has created a fragmented landscape of regional ISPs to close the gaps, while not necessarily increasing competition. There are over 2,000 service providers in the U.S.,[13] but a third of Americans live in areas where only one provider offers broadband speeds or 100/10 Mbps or above.[14]

There are specific challenges that regional ISPs face, which makes building their networks, upgrading core capabilities and infrastructure security, and rolling out services more difficult:

1. **Making the business case**: Regional ISPs tend to serve smaller, more sparsely populated communities, which drive up the cost per customer. Identifying additional value-added services that ISPs can provide to their customers can help drive higher returns on investment – so can targeting alternative customer segments (e.g., B2B), who may be more willing to pay a premium for high quality broadband.

[11] Infrastructure Investment and Jobs Act, H.R. 3684, 117th Cong. (2021).
[12] Partly because the FCC raised speed benchmark for "broadband" from 4/1 Mbps to 25/3 Mbps in 2015.
[13] FCC (2020), "Fixed Broadband Deployment Data: December 2020 Status V1".
[14] FCC (2020), "Compare Broadband Availability in Different Areas".

2. **Justifying the cost of technology**: Many vendors' products and solutions for telecoms operators are designed for the large carriers, which means both the technology and the commercial model or pricing may be inaccessible for a smaller ISP. Evaluating alternative technologies is key, particular as ISPs face pressure to roll out networks quickly, while complying with regulation and the need to keep networks secure. Another consideration is working with an ecosystem approach, which can help gain economies of scale.

3. **Gaining access to skills and resources**: Regional ISPs are smaller organizations; therefore, they do not always have the skills and headcount that larger carriers have. Also, being situated in rural areas limits the pool of skills available to recruit from for certain skills, for example, technology strategists or security specialists. As service providers, much of their workforce is focused on delivering the connectivity service, which means support is needed from partners to ensure the ISP has strong network technologies and back-end systems, plus a robust security fabric.

4. **Modernizing the core network:** Network buildout and funding efforts have largely focused on access technologies, but regional ISPs cannot afford to consider core network expansion and network security measures as an afterthought. ISPs should explore virtualization and containerization for the core network, as a cloudified core will be more flexible and scalable to future capacity requirements. Automation of remote core network locations will also be key to reducing the cost to operate and maintain.

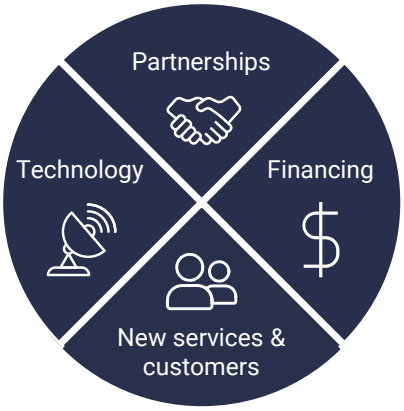
5. **Investing in security infrastructure:** Regional ISP networks are vulnerable to a wide variety of cyberattacks and Distributed Denial of Service (DDoS) weapons that pose a threat to their internal network and IT, as well as enterprise and consumers' services. COVID-19 lockdowns have resulted in more people accessing the internet from decentralized locations. Having remote workforces expands the attack surface from closed, enterprise networks to employees' residential networks. The number of tracked DDoS weapons globally have tripled since H2 2019, from 5.9 million to 15 million in the first half of 2021.[15] ISPs must invest proactively to reduce the risk of such security threats.

[15] A10 Networks (2021), "DDoS Attack Mitigation: A Threat Intelligence Report".

# Regional ISPs should explore new business models to close the divide

Regional ISPs can overcome their unique challenges by developing business models that are not accessible by the larger carriers. Many smaller ISPs are formed by public entities, such as electric cooperatives and tribal governments, meaning that they operate locally and are more attuned to their community's needs. In this report, we will highlight innovative business models that regional and rural ISPs are pursuing to bridge the digital divide, focusing on four key factors: technology, partnerships, financing models, and new services and customer segments.

**Figure 4: Business models are evaluated against four factors**




**Technology**
- Use of new, innovative technology to accelerate access network build and optimize the network core for scale

**Partnerships**
- Working with unique companies and organizations to share skills, technology and increase value provided to customers

**Financing models**
- Accessing capital for investment through different models and partners – public or private

**New services and customer segments**
- Improving the business case by developing new services and taking these to (new) market(s)

Source: STL Partners

## Technology

Regional ISPs can drive faster, more economical expansion of coverage by looking at new technologies, which include wireless access (e.g., TV White Space and Low Earth Orbit satellites), flexible core network systems that meet security and scalability needs, and forging ecosystem partnerships to enable technology innovation.

Fiber can deliver speed, bandwidth, and reliability, but its installation can be impractically expensive for rural deployments, where population density is much lower. Fiber infrastructure rollout can cost $30,000 per mile, which significantly stifles return on investment for ISPs in sparse rural areas.[16] To alleviate the pressure on their bottom lines, ISPs have been experimenting with combinations of wireless access technologies across

[16] Jennifer Levitz and Valerie Bauerlein (2017), "Rural America is Stranded in the Dial-up Age".

licensed, unlicensed, and shared spectrum. In a 2017 study, Microsoft found that using a combination of technologies (i.e., TV white space, fixed wireless, and satellites) can substantially reduce the cost of extending broadband coverage – 80% lower than using fiber-to the-home. [17]

> **"When policymakers talk about broadband, they focus on fixed wireless and long-haul, but mobility is a critical piece for places like mines and ranchland that are at least seven years away from getting fiber. Getting connectivity there is like 'baking a pie' – we have to bring together all these different ingredients: LoRaWAN, Wi-Fi 6, mmWave, even microwave."**
>
> (Chip Damato, Executive Vice President, Inland Cellular)

Aerial deployments for rural and remote communities are also gathering pace. New satellite technologies, namely high-throughput satellites (HTS), non-geostationary Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) satellites have attracted investment from a range of players, including Boeing, Qualcomm, and SpaceX. LEO has much lower latency and higher capacity than high-orbit, geostationary satellites, and offers a low-cost, scalable alternative to fiber.

Beyond access network innovation, changes in the core network are required to generate secure ISP scale. ISPs must build a flexible core, capable of accommodating these many access technologies at scale. In upgrading their core stacks, ISPs are now exploring cloud-based options to reduce the upfront and overall cost, effort, and time to market. This growing interest in cloud-native, converged, "access-agnostic" cores is driven the ability to efficiently manage service performance with a unified view of the entire network across multiple use cases. Another key consideration will be ensuring that the network security is maintained as the core scales and new technologies are added. As cyberthreats and DDoS threats increase, ISPs must prioritize security investments and stay informed of the changes in the threat landscape for network infrastructure, doubling down on basic cybersecurity hygiene and upgrading their DDoS protection.

Bringing together network operators and players from outside the traditional telecoms vendor ecosystem is pivotal to developing new technology models and expanding coverage to those who need it most. Open-source communities (e.g., Open Core Network (OCN) Project Group) and Big Tech R&D initiatives (e.g., Microsoft Airband Initiative and Meta Connectivity's Terragraph) have proven non-traditional players as credible partners to lay the foundations for regional and rural ISP access and core technology innovation.

### Example: Microsoft Airband provides TV white space as an alternative wireless access technology

The mission of Microsoft's Airband Initiative is to connect 3 million people in rural unserved areas in the U.S. by July 2022, using cost-effective solutions like TV white space (TVWS). [18] More affordable than fiber deployments, TVWS is ideal for long distance rural deployments (up to 10 miles) and penetrates buildings and foliage better than other wireless communication technologies (e.g., Wi-Fi). [19]

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[17] Microsoft (2017), "A Rural Broadband Strategy"

[18] TV white space (TVWS) leverages unused spectrum in the traditional UHF and VHF television broadcast band (between 470 MHz and 698 MHz). Traditionally, unused "white spaces" are placed between active TV channels as a buffer to prevent broadcasting interference. White space radios are designed for dynamic spectrum access (DSA), referencing a database to identify unused frequencies across this spectrum and adapting bandwidth and power levels based on available frequencies.

[19] Microsoft (2017), "A Rural Broadband Strategy".

Central to the Airband Initiative are knowledge sharing and collaborative partnerships with governments, communities, and ISPs. The Airband ISP Program offers preferential pricing on telecoms hardware for ISPs to reach rural customers faster and more cost-effectively, and even trains ISPs to improve their digital skills. In a typical partnership, an ISP secures upfront capital from Microsoft to expand middle- and last-mile broadband coverage with a combination of technologies (including TVWS), then Microsoft recoups its investment through a revenue share model.

### Example: Magma core makes LTE more accessible to rural ISPs

Magma is an access-agnostic packet core developed by Meta Connectivity (and now supported under the community of the Linux Foundation) to help service providers deploy and upgrade mobile networks at speed and scale, without vendor lock-in.1 This has been particularly useful for ISPs to use cellular technology in hard-to-reach areas in a more cost-effective way, because traditional mobile core solutions were not designed for smaller ISPs.

One such ISP is WiConnect Wireless, which connects seven counties in Wisconsin using fiber, cable, and wireless networks. Its service delivery area spans a rural "driftless" terrain, where line of sight is low due to bluffs, hills, and valleys. This means that many more wireless sites are needed to ensure coverage, even if some sites have only 5-30 subscribers. WiConnect partnered with FreedomFi to migrate their Wi-Fi networks to LTE by integrating Magma Access Gateways with existing sites. LTE improves coverage, has a large ecosystem of user equipment (compared to Wi-Fi), and would allow for mobility, which could open up new revenue streams.[20] The Magma core was important for migrating to LTE in a cost-effective manner, while not completely changing the operating model by integrating into WiConnect's existing equipment monitoring solution .The cloud-native, distributed Magma EPC (LTE core) increases network availability by packaging a complete, albeit small, MME (Mobility Management Entity) into the Access Gateway which is deployed close to each tower site. Other non-real time functions required by the core are run in the cloud. This architecture keeps costs down while making it much easier to scale.

## Partnerships models

Regional ISPs are engaging in different types of partnerships, outside of pure financing models, to share technology and create services that deliver more value to end-customers (

Figure 5).

- **Enabling network build:** Regional ISPs are working with public and commercial partners to pool their resources for broadband deployments.
- **Building new value chains for emerging use cases:** Through participating in cross-industry partner ecosystems, such as the Rural Cloud Initiative, regional ISPs are collaborating with different industry players to deliver new use cases and applications.

[20] While full 3GPP mobility is not supported today, Magma currently supports mobility of UEs attached to eNBs behind a single access gateway.

- **Establishing standards to future-proof their network:** Regional ISPs are contributing to standardized frameworks and open architectures through initiatives like the Open Core Network (OCN) initiative, where they can incubate experimental network use cases.

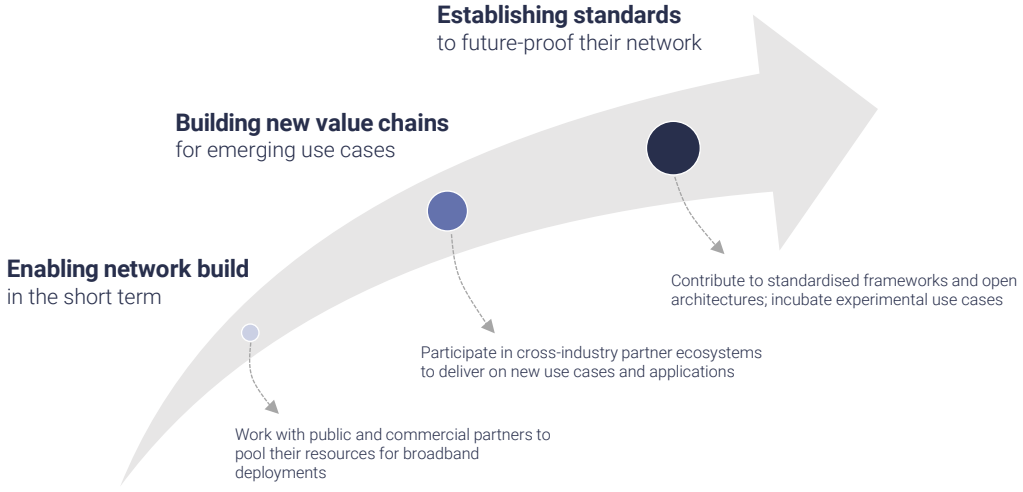
### Example: Makah Tribe & Cape Flattery School District co-fund their network build

Regional ISPs work with public and commercial partners to pool their resources for broadband deployments, where it is not feasible to do so alone. Tribal communities, like Makah, worked with both government entities and commercial providers to finance their buildout. Out of the 574 tribes in the U.S., only 18 hold spectrum licenses and very few have their own broadband infrastructure.[21] Because of this, Makah Tribe faced a 13-mile fiber gap when the local operator refused to build, which left some schools without any broadband connectivity. Makah established a partnership with the Cape Flattery School District and CenturyLink in 2014 and was able to build out a combination of microwave and fiber to connect the schools within four months.[22]

### Example: Declaration Networks partners with public and private bodies to broaden fixed wireless access

Declaration Networks Group (DNG) works with municipal and commercial partners not only to fund broadband deployments in Virginia, but also to explore alternative wireless technologies, like TVWS. As well as participating in the Microsoft Airband Initiative, Declaration Networks is also a co-founder of the Air.U Initiative, a consortium of educational institutions, public groups and technology companies that seeks to bring fixed wireless broadband to underserved campus communities. DNG also has a public-private partnership with Garrett County, MD, in which the ISP used county funds and a public grant to build fixed wireless network assets (including use of TVWS frequencies) that are owned by the county and leased back to DNG to deliver internet services to customers.

**Figure 5: Regional ISPs using partners to fund networks, access new technology and develop new services**




Source: STL Partners

[21] Native Nations Communications Task Force (2019), "Improving and Increasing Broadband Deployment on Tribal Lands", p.24.
[22] Native Nations Communications Task Force (2019), "Improving and Increasing Broadband Deployment on Tribal Lands", p.33.

# Financing models

The third way that rural and regional ISPs are innovating is through their funding models, which overcomes a key barrier to entry. The three primary ways that innovative ISPs are making it easier to fund their projects is through hybrid ownership models, consortia (particularly in utilities) and risk sharing models.

**Traditionally, broadband network and service models can be categorized as either by "private" – built and serviced by a commercial provider – or "municipal" – fully owned and operated by a local utility or other public entities. A viable third option involves both public and private parties to varying degrees, depending on a community's demographics, existing infrastructure, and access to capital (Figure 6: Hybrid public-private financing models enable regional ISPs to share risk and revenue with local municipalities**

| | 1 | 2 | 3 |
|---|---|---|---|
| | Municipally-enabled, privately-serviced | Public-private ownership | Open-access revenue share |
| Owns rights of way | Public | Public | Public |
| Owns middle mile | Public | Public | Wholesale |
| Owns last mile | Public | ISP | Wholesale |
| Operates network | ISP | ISP | Wholesale |
| Services customers | ISP | ISP | ISP(s) |
| | Public entity funds, builds, and owns the infrastructure, while the ISP provides services over that infrastructure and oversees network operations. | ISP builds and owns a subset of the network infrastructure, such as the last-mile network, in addition to providing services for end-customers. | Multiple ISPs to offer retail services over a service provider-agnostic wholesale network, then shares revenues and fees with the municipality. |

Source: STL Partners

As well as public-private broadband financing models, there has been growing interest in forming bidding consortia between electric cooperatives that function as member-owned ISPs to jointly secure federal funding. CAF II is the first time that the FCC has opened its auction of funds to non-traditional telecoms providers, including utilities. Electric co-ops won around 15% of the awarded funds – notably, the Rural Electric Cooperative Consortium (RECC) formed by a joint venture of 22 co-ops across eight states and secured a total of $186 million in funding to provide gigabit fiber-to-the-home service.

Electric cooperatives are well positioned to bring affordable and reliable broadband services to rural communities by leasing additional fiber capacity from their own critical communications network to help lower broadband deployment costs (known as the "utility lease" model). They can provide "middle-mile" infrastructure from which ISPs (which may be a subsidiary of the co-op) can then build out last-mile broadband services. This is exactly what Firefly Fiber Broadband is doing. Through the $300 million Regional Internet Service Expansion (RISE) project, Firefly has partnered with four utility companies to bring gigabit fiber internet to more than 25,000 Central Virginians in 13 counties by the end of 2025.

). Collaborative public-private financing models incentivize service providers to deploy broadband in rural areas where the return on investment for private capital is low, enabling ISPs (service provider) to share risk and revenue with local municipalities (infrastructure provider).

**Figure 6: Hybrid public-private financing models enable regional ISPs to share risk and revenue with local municipalities**

| | 1 | 2 | 3 |
|---|---|---|---|
| | Municipally-enabled, privately-serviced | Public-private ownership | Open-access revenue share |
| Owns rights of way | Public | Public | Public |
| Owns middle mile | Public | Public | Wholesale |
| Owns last mile | Public | ISP | Wholesale |
| Operates network | ISP | ISP | Wholesale |
| Services customers | ISP | ISP | ISP(s) |
| | Public entity funds, builds, and owns the infrastructure, while the ISP provides services over that infrastructure and oversees network operations. | ISP builds and owns a subset of the network infrastructure, such as the last-mile network, in addition to providing services for end-customers. | Multiple ISPs to offer retail services over a service provider-agnostic wholesale network, then shares revenues and fees with the municipality. |

Source: STL Partners

As well as public-private broadband financing models, there has been growing interest in forming bidding consortia between electric cooperatives that function as member-owned ISPs to jointly secure federal funding.[23] CAF II is the first time that the FCC has opened its auction of funds to non-traditional telecoms providers, including utilities. Electric co-ops won around 15% of the awarded funds – notably, the Rural Electric Cooperative Consortium (RECC) formed by a joint venture of 22 co-ops across eight states and secured a total of $186 million in funding to provide gigabit fiber-to-the-home service. [24]

Electric cooperatives are well positioned to bring affordable and reliable broadband services to rural communities by leasing additional fiber capacity from their own critical communications network to help lower broadband deployment costs (known as the "utility lease" model). They can provide "middle-mile" infrastructure from which ISPs (which may be a subsidiary of the co-op) can then build out last-mile broadband services. This is exactly what Firefly Fiber Broadband is doing. Through the $300 million Regional Internet Service Expansion (RISE) project, Firefly has partnered with four utility companies to bring gigabit fiber internet to more than 25,000 Central Virginians in 13 counties by the end of 2025.

[23] Electric cooperatives in the U.S. were formed under the 1937 Electric Cooperative Corporation Act, which saw rural residents coming together to bring electricity services to unserved areas through not-for-profit, community-owned electric utilities. Today, they are facing a new challenge with the lack of access to high-speed Internet service in rural America. The 1996 Telecommunications Act gave utilities new rights to provide capacity to multiple public telecommunications service providers.

[24] NRECA (2018), "Electric co-ops get a big boost for rural broadband efforts in FCC auction".

### Example: Ting Internet and Westminster shares risk through innovative payback model

The case of Ting Internet illustrates an innovative revenue and risk sharing model between a local municipality and an ISP. The city of Westminster, Maryland, built and financed the dark fiber infrastructure through a bond offering. Ting leases fiber from Westminster through a two-part payment. First, Ting pays a monthly fee based on how much fiber has been built ($6 fee per premises passed, regardless of subscriber count), which incentivizes Ting to sell services to cover this cost. Additionally, Westminster also receives a second monthly fee of $17 per subscriber, which allows it to share some of Ting's revenue as well as market risk. On the other hand, to share Westminster's construction risk, Ting agreed to cover some of the city's debt service obligations in the event where Ting's payments were insufficient and be reimbursed in subsequent periods.

## New services and customer segments

Targeting new customer segments or expanding the service portfolio can help regional ISPs create a better business case for building out the network. This could entail targeting B2B customers, as well as B2C, or taking services to market that will leverage the network.

To increase average revenue per user (ARPU) for residential customers, ISPs can expand their portfolio into IoT services and offer device connectivity bundles to support use cases like smart home, on-demand video streaming, cloud gaming, video conferencing. Inland Cellular offers a Smart Home solution through its Emerge Technologies brand. Their service involves customization and installation of smart products, including surveillance cameras, smart thermostats, and smart lighting. Customers can control all their connected products on a central hub or app on their phone or tablet. Regional ISPs should also develop offerings that cater to mobile-only internet users, for example uncapped data plans for mobile hotspots. This is because in areas that are not well-served by terrestrial broadband, consumers may rely solely on mobile devices to access the internet. Almost one-fifth of Americans are "smartphone-only" internet users who do not subscribe to broadband internet service at home.[25]

As the number of connected devices soars with the maturing of IoT use cases – each device requiring an IP address – ISPs will have to be prepared to mitigate IPv4 port exhaustion and to migrate to IPv6 connectivity using one of many available translation or encapsulation technologies, while minimizing service disruption. Managed services providers (MSPs) can support ISPs to manage this transition. For example, Richweb provides managed core network services for electric co-ops and other regional ISPs to deliver broadband internet to rural communities in Virginia. As part of its infrastructure-as-a-service offering, the MSP offers routing and peering, as well as carrier-grade network address translation (CGNAT) to help ISPs allocate IPv4 addresses more efficiently as the number of subscribers and IoT devices increase.

For B2B customers, regional ISPs can offer commercial services like cybersecurity, cloud, managed IT services, and unified communications. Saddleback Communications is a success story of a tribe-owned and -operated ISP that offers up to 500 Mbps to over 80% of the tribal community, after leapfrogging from an aging copper network to all-fiber with USF funding. As well as serving residential customers, Saddleback has

[25] Pew Research Center (2019), "Mobile Technology and Home Broadband 2019" survey.

launched a subsidiary, Reinvent Telecom, providing Unified Communications as a Service (UCaaS) for over 400 business customers in Arizona.

Besides "residential" and "business" portfolios, ISPs can also target industry verticals that require reliable connectivity and are located outside of well-connected urban nodes, such as Agriculture, Healthcare, Energy and Education. A key driver is to be able to digitally transform these industries and allow them access to connectivity-based technology that can improve productivity, increase efficiencies, and ensure a higher quality service. Some of these industry solutions have security at the heart of the proposition. For example, telehealth services need to be HIPAA compliant, energy solutions have a zero tolerance for failure or security breaches, while schools require cybersecurity measures in place to comply with the Children's Internet Protection Act (CIPA).

# ISP case study deep-dives

In this section, we will focus on case studies of three ISPs that have innovated in their business model and exemplify our four key factors:

- Inland Cellular demonstrates the value of an **ecosystem** approach to provide services to rural industries;
- Alaska Communications highlights how **technology** can dramatically change the economics of the network and allow an ISP to scale more quickly;
- Bluewater Regional Networks showcases the value regional ISP services can bring to **new customer segments** – especially in B2B.

## Bluewater Regional Networks

Founded in 2016, Bluewater Regional Networks (BRN) was launched in direct response to a lack of fast, reliable, and well-serviced connectivity options in Sarnia - a city with a rich history in the oil and gas industry, located in southwestern Ontario, Canada. The Bluewater Power Group of Companies, BRN's parent company, had contemplated building a network in 2015 to solve its own problem: the power company lacked access to adequate connectivity infrastructure to run its mission critical services. However, it soon realized that this problem was shared with a sizeable market of enterprises and that the Group could leverage the expertise gained in developing its own network to build and scale a networking business. To help grow the network at speed and supplement existing skills, BRN engaged specialist partners in areas such as network design and core network security. In the latter BRN have been engaging with a group of companies on a fiber security framework, developing technologies in collaboration with other local ISPs and companies to create a dynamic design which can adapt to new threats as they emerge.

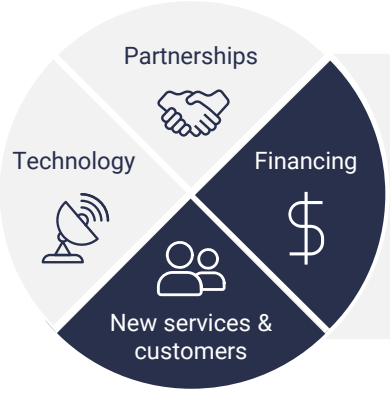
bluewater
REGIONAL NETWORKS

**Headquarters**
- Sarnia-Lambton, ON

**Subscribers**
- 60,000 end users

**Ownership model**
- Public sector (local municipalities)

**Providing utility-grade Internet to B2B customers**
- Business customers, i.e., enterprises and SMBs, in unserved or underserved areas possess significant appetite to pay for reliable broadband connectivity (even if expensive) as data streaming becomes increasingly critical to their core business operations. This could be a strong initial route-to-market for ISPs.




**New services and customer segments:**
- B2B offering that includes premium gigabit fibre connectivity and cloud services

**Financing models:**
- Community-owned and funded by six municipal corporations

In just five years since its launch, Bluewater Regional Networks now:

- Owns, operates, and maintains a 60km fiber backbone in Sarnia-Lambton;
- Owns and operates a cross-border network, running from Toronto to Chicago;
- Serves business customers, large enterprises and SMBs, across verticals (including manufacturing and energy), with 60% penetration of large enterprise customers;
- Offers open network access for local ISPs (fixed and wireless);
- Plans to expand direct services to consumers within the next three years. To ensure that its high market growth and longer-term continuity of service continues, BRN has proactively overbuilt and designed its network to avoid port and IP address exhaustion.

Bluewater Regional Network's main drive to close the digital divide is through stimulating competition in underserved areas. Most of its coverage areas have had access to the broadband but often the provided speeds were too low for many consumers and businesses who were wanting to use increasingly data consumptive services. Moreover, sizable pockets of that same customer base suffer from sub-par service levels and inflated prices from complacent incumbents. BRN has aimed to shift the paradigm, offering high speeds (up to 90x faster) and enterprise-grade support (24/7 NOC monitoring and guaranteed 99.99% availability) at competitive pricing.

> **"We operate our fiber network like we do our electrical grid, mission-critical service with white-glove care and control."**
>
> (Chris Gould, Chief Operations Officer, Bluewater Regional Networks)

Many enterprises, even small and medium businesses (SMBs), are willing to pay more for faster and more reliable connectivity, as it allows them focus on their business. Despite considerable investment in the network, BRN spreads build out cost across all customers even in less densely populated areas, where quick payback is not guaranteed. This approach, avoiding charging first customers more demonstrates BRN's appetite for commercial risk, and is how it can offer competitive pricing. The operator has seen initial success in its first 18 months, with its COO estimating 22% SMB market penetration. It has also started offering cloud services to a limited set of customers.

**Other ISPs can learn from BRN, in thriving commercially while connecting those who need it the most:**

- Understand market appetite to calculate appropriate commercial risk when scaling up;
- Leverage existing resources to drive scale, e.g., empower network staff with transferrable skills;
- Be open to partner with other ecosystem players where expertise is lacking internally, or there is limited scope to provide direct services.

# Inland Cellular & Rural Cloud Initiative (RCI)

The Rural Cloud Initiative (RCI) was founded in 2020 by Trilogy Networks as an attempt to create an ecosystem capable of bridging the digital divide for rural broadband customers. The initiative aims to provide ubiquitous, end-to-end coverage with distributed cloud capability to accelerate the digital transformation of rural America, particularly in agriculture and energy industries. Trilogy's ConEx service delivery platform and LinX virtual overlay network provide a mechanism to aggregate networks across different ISPs and enable industrial applications to be processed at the edge. This initiative allows the over 2,000 individual ISPs across rural America to play a key role in this ecosystem.


**Headquarters**

- Lewiston, ID

**Subscribers**

- 36,000+

**Ownership model**

- Private

**Connecting rural America to the cloud through coalition**

- Engaging in connectivity coalitions allows ISPs to leverage technologies with economies of scale not usually accessible to smaller players. Rural communities, and businesses located in them, can take advantage of technological advancement available to urban enterprises (e.g. smart agriculture) and thrive


**Partnerships:**

- Inland Cellular joined the RCI to leverage the FarmGrid application ecosystem and edge computing capabilities

**New services and customers:**

- The RCI membership opens opportunities for higher value services in vertical-specific solutions (e.g. in precision agriculture)

Inland Cellular is just one of the 30 operators already working with RCI, leveraging the network fabric to provide new services to the agriculture sector. The ISP operates in both Washington and Idaho and provides connectivity services for consumers and enterprises. In addition, it offers a Smart Home solution for EPX Home Phone, Surveillance and Climate Control capabilities. For businesses, it offers internet services, phone systems and end-to-end solutions, such as business surveillance, fleet management, website design and mobile marketing.

In the last year, the RCI has been able to:

- Expand their ecosystem to 70 different organizations, including 30 regional carriers;
- Cover 300,000 square miles of the 1.5 million of rural America, around 20%;
- Encourage the digital transformation of farms throughout rural America through their FarmGrid initiative, aiming to reach 18,000 farms in the Pacific Northwest;

Through this and other internal initiatives, Inland Cellular has been able to:

- Provide consumers and enterprises a "fiber-like" experience by combining alternative access technologies with edge computing – processing data more locally reduces latency and optimizes bandwidth;
- Generate more value from its network to sectors such as agriculture which are still yet to unlock huge benefits from digital transformation;
- Scale solutions across farms more quickly with a complete, out-of-the-box package, which aggregates applications from multiple software vendors;
- Actively participate in a digital ecosystem and play higher up the value chain by incorporating private cloud and edge computing into an offering and moving into data services;
- Position itself as an industry leading ISP for digital solutions.

The RCI ecosystem includes carriers and application developers working together to provide integrated solutions on the Trilogy platform, with a particular focus on digital health, automated security, and agriculture. The mission within agriculture is to enable the world's farmers to meet the target of doubling agricultural production by 2030 through the integration of digital data capture and processing. The challenge to date is that connectivity is either inaccessible in the remote areas that farms are located in or have insufficient bandwidth to enable truly automated, internet of things-based technology.

RCI and Inland Cellular are working together on FarmGrid, "an end-to-end Farm-to-Cloud, Cloud-to-Farm enterprise grade solution". FarmGrid comprises of network connectivity through local ISPs like Inland Cellular, coupled with edge data centers operated by Trilogy networks where cloud is deployed and operated to reduce latency. The final piece of the puzzle is an expansive application ecosystem spearheaded by the Rural Cloud Initiative, allowing the farm owner to purchase the applications they see as providing the greatest value to their operation. In the example of FarmGrid, these applications will revolve around precision agriculture, allowing farmers to receive valuable insights to their mobile, Wi-Fi, or any other connected device. One popular application for farmers is for soil maintenance – using data to know when the soil is too wet to sow, when their crop is ready to harvest, or which siloes of grain are reaching maturity, etc. They are working with large enterprises such as John Deere, McGregor, and Ford as they develop their solutions and take these to market. To sell their combined offering, Inland is approaching large scale enterprise providers like McGregor or CHS and leveraging the providers' existing relationships with U.S. farmers. The ecosystem not only supports the development of the solution but the scaling of this more quickly across the U.S.

**Key recommendations for other ISPs:**

- Look to partner with larger ecosystems to develop more valuable customer propositions and access opportunities that would have been difficult to for a single regional ISP;
- Explore the value connectivity-based solutions can bring to remote industries and take an active role in enabling digital transformation of these sectors.

# Alaska Communications, Cambium Networks & Meta Connectivity

The size, weather and terrain of Alaska represent the biggest barriers to broadband access. Alaska is a huge state with a population density of only 1.28 residents per square mile, disproportionately smaller than the average of 93 across the rest of the U.S, and frequent snow adds to the difficulty and cost of laying and maintaining traditional fiber cables. Some of the communities served in Alaska are so remote that they are off the road system and only accessible by boat or plane.

Alaska Communications is one of 16 ISPs that operators in Alaska, serving both residential and business customers with voice, data, TV, and cloud services. It is in the process of expanding its more than 150,000 fiber miles in Alaska to reach more underserved homes and businesses. Alaska's environmental conditions mean that Alaska Communications cannot rely only on fiber to provide connectivity and is instead using a combination of microwave, satellite, and fixed wireless solutions. A key enabler for this expansion is Terragraph, a gigabit wireless mesh technology developed Meta Connectivity and licensed for free to partners, such as Cambium Networks (a wireless equipment provider).

alaska COMMUNICATIONS

**Headquarters**

- Anchorage, AK

**Subscribers**

- 110,000 (wireless)
  55,000 (internet)

**Ownership model**

- Private

**Exploring new technology options to reduce cost of network build**

- ISPs need to improve the affordability of broadband access for the least-served communities. An immediate opportunity is to explore new technology and work with partners who are offering cost-effective last-mile alternatives to fibre, e.g. Terragraph


**Partnerships:**

- Meta and Cambium Networks helping Alaska Communications connect the unconnected

**Technology:**

- Terragraph (fixed wireless access) and lightweight equipment delivers cost-effective services and rapid deployments

> **"From rainforest-like weather in the southeast to frozen tundras and permafrost in the north, we can't rely on a one-size-fits all technology or deployment strategy…Alaska Communications uses the best technology suited for the environment and needs of the customer."**
>
> (Heather Marron, Corporate Communications Manager, Alaska Communications)

The Terragraph technology used in Cambium's cnWave is a multi-node fixed wireless access (FWA) platform that uses unlicensed 60GHz spectrum, designed to bridge the last-mile gap between the subscriber and the ISP's closest fiber node. It has allowed Alaska Communications to augment its existing fiber infrastructure by placing cnWave transmitters at 200- to 250- meter intervals on existing infrastructure, e.g., street cabinets, utility infrastructure and buildings.

The benefits of using wireless technology and Terragraph include:

- The weather conditions in Alaska means that their fiber build season is only about five to six months in a year. With wireless, they can build access all year round.
- It improves speeds to ensure the ISP has a strong quality of service. Alaska Communications differentiates itself with competitively priced products and unlimited services: AKXinternet, its residential product, offers unlimited internet service up to 1 Gbps. Before Terragraph was deployed, only 10Mbps services were available in Anchorage.
- 60GHz cnWave can be deployed at a fraction of the cost and time of last-mile fiber networks as there are no licensing costs. Cambium cnWave nodes that leverage Terragraph technology and Qualcomm Technology's latest 802.11ay-compliant technology can deliver reliable, fiber-like speeds at a significantly lower cost of ownership and faster time to market. On top of this, 60 GHz cnWave nodes can also be used as wireless backhaul to Wi-Fi or other access networks at a fraction of the cost of wired networks.
- It is easy to scale as demand grows, compared to fiber, which means the ISP can reduce its upfront cost to deploy the network.

The close partnership between Meta Connectivity and Cambium Networks has ensured a quality solution and given the Alaska Communications access to future developments. Cambium Networks collaborates directly with Meta Connectivity engineers to optimize the planning and performance of the distributed meshing functions. Its development engineers meet on a weekly basis to understand end customer requirements, assess opportunities, develop functionality, and verify performance. These engineering teams continue to work together to design integrated solutions for rural customers, operating experimental labs and proof-of-concepts with an eye to move into more suburban and urban geographies.

**Other ISPs can learn from Alaska Communications:**

- Alaska Communications has effectively leveraged the unique technology from the Meta-Cambium Networks partnership, providing connectivity, which is cheaper than physical fiber, faster to deploy, and just as reliable. Though many regional ISPs believe they must rely on fiber infrastructure to properly provide for their customers, this deployment shows the power of wireless last-mile infrastructure to extend the reach of fiber without having to invest heavily in laying it in the ground. Other ISPs can learn from Alaska Communications in the following ways:
  - Leverage unique technologies which navigate the unique challenges of a region/population;
  - Create ongoing relationships with innovative technology players who can create value at scale.

# Recommendations for the industry

Regional and rural ISPs are well-positioned to tackle the broadband gap through innovative business models. As well as experimenting with new technologies and hybrid financing models to lower the cost of deploying and operating broadband networks, regional ISPs are also exploring partnerships and new customer propositions to increase their return on investment. In order to futureproof their networks, scale rapidly and anticipate unprecedented growth, ISPs must consider the following:

- Develop partnerships beyond network deployments. ISPs will need to establish new value chains and ecosystems around new customer propositions and participate in shaping industry standards, in order to futureproof their networks. Be open to partnering with other ecosystem players where expertise is lacking internally, or there is limited scope to provide direct services.

- There is no one-size-fits-all alternative to fiber for last-mile access. Consider using a combination of different wireless technologies and spectrum to reduce total cost of ownership and deploy at greater speeds. This could include LoRaWAN, Wi-Fi 6, mmWave, microwave, CBRS. To do so, ISPs should work collaboratively with hardware and software vendors to test and customize their solutions for their particular deployment context.

- There is an untapped opportunity for regional ISPs to provide verticalized solutions for industries like Agriculture, Healthcare, and Energy, which require mission-critical broadband connectivity at remote, un(der)served locations. At the same time, look not only at rural areas for future deployments – there remains gaps in broadband connectivity in urban and suburban areas that can be addressed.

- As an ISP scales, their core network will need to be agile and scalable to spin up additional capacity with ease. Regional and rural ISPs need to understand the IP connectivity options available and consider the IP capabilities needed in the core network to meet increasing subscriber and device count. Exploring cloud-native, converged core options can also help reduce total cost of ownership and time to market. Cloud-native options will provide the flexibility and modularity required to manage multiple mobility-based access technologies with an “access-agnostic” core infrastructure. Centralized cloud management will allow ISPs to efficiently manage service performance with a unified view of the entire network.

- Make security investments a higher priority in core network planning and be proactive. Regional ISPs must stay informed of the changes in the threat landscape for network infrastructure, doubling down on basic cybersecurity hygiene and upgrading their Distributed Denial of Service (DDoS) protection. Delivering specialized industry solutions would also require ISPs to advance their network security strategy to comply with industry requirements and develop the necessary capabilities to withstand ever-changing cybersecurity threats.

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