

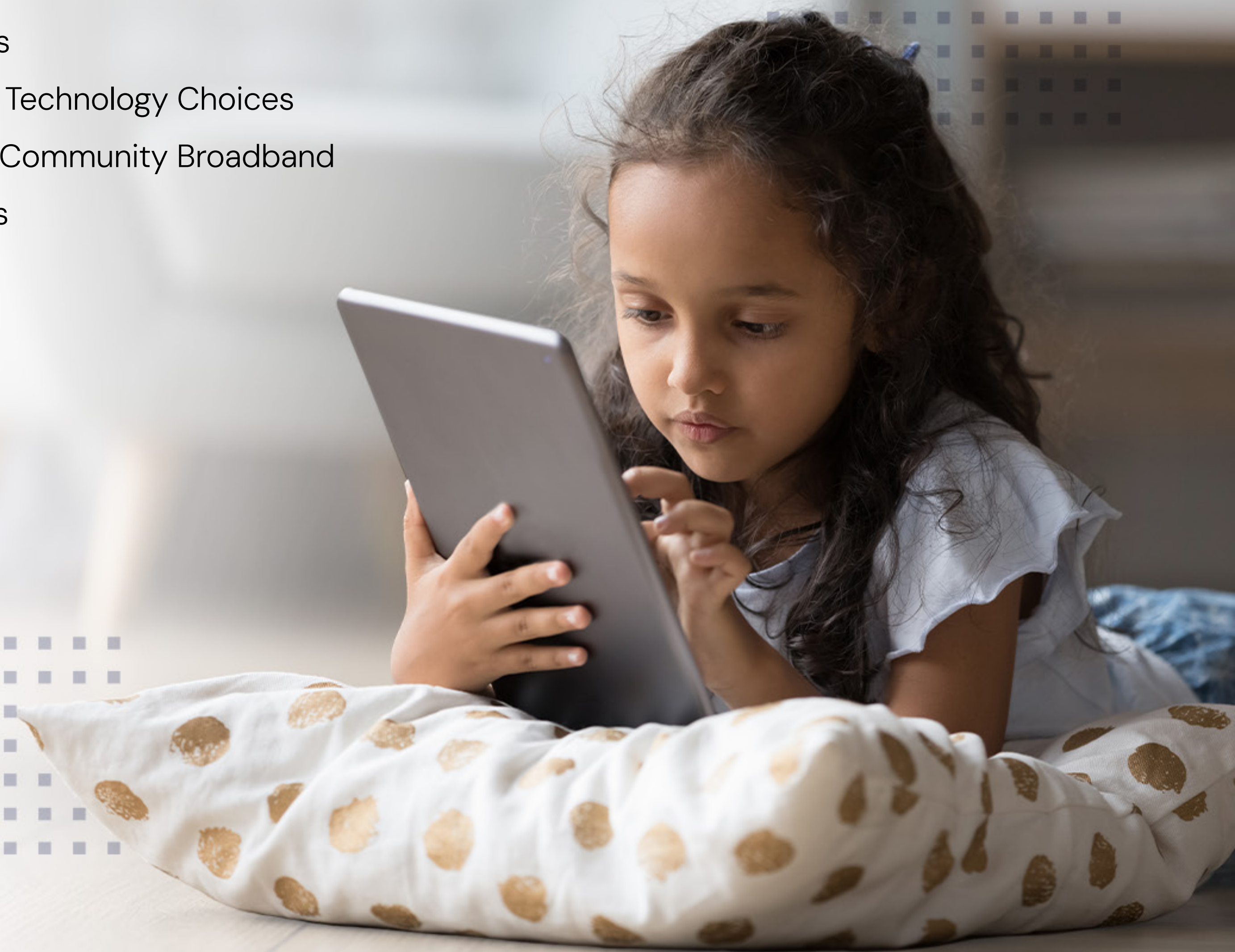


How Open Access Can Help Municipalities Deliver High-Speed Broadband and Competition to Communities



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Closing the Digital Divide Using Open Access

Multiple strategies are being considered to extend high-speed broadband to communities across the country. The main public policy objective, to close the “digital divide,” has developed between urban and rural areas. Deploying infrastructure in rural areas is often unviable or unattractive for traditional operators due to construction and implementation costs. As a result, broadband performance in such areas can be poor, while a lack of market competition means there are few alternatives.

One model designed to overcome this problem is the open access network (OAN). In this model, the underlying network could be owned by a variety of players from the municipality benefiting from the network to a network operator. The network then supports multiple service providers at the retail level. These providers can compete for subscribers without the financial commitments of building and supporting their own networks.

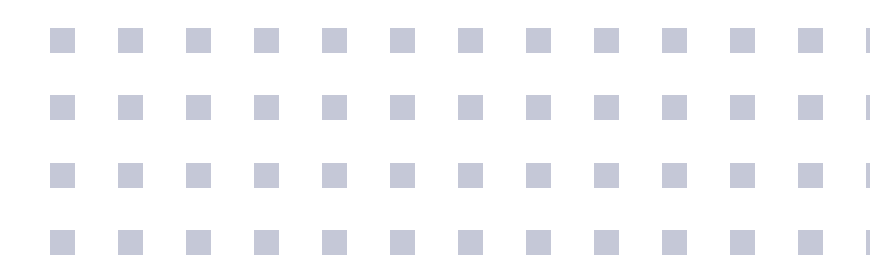
Many diverse types of companies build OANs: traditional telecoms companies, new entrants backed by private capital, publicly owned entities, or consortiums involving several stakeholders. In some cases, OANs are owned by municipalities. These partnerships between the public and private sectors share common goals: bringing fiber broadband to the municipality’s community and stimulating competition.

In this context, OANs are seen as a public utility, usually deployed by a municipality on a non-profit basis. A comparison can be made to transport infrastructure. Roads are built and maintained by the municipality and available to road users of all types. The municipality does not usually extract direct profit from the venture, but benefits from the wider economic advantages of deploying infrastructure.

The open access model is already well-established in Europe. Municipality-led OANs are a relatively new phenomenon in North America and more prevalent in Canada than the US. However, they are growing in popularity due to an influx of private capital and state funding in recent years.

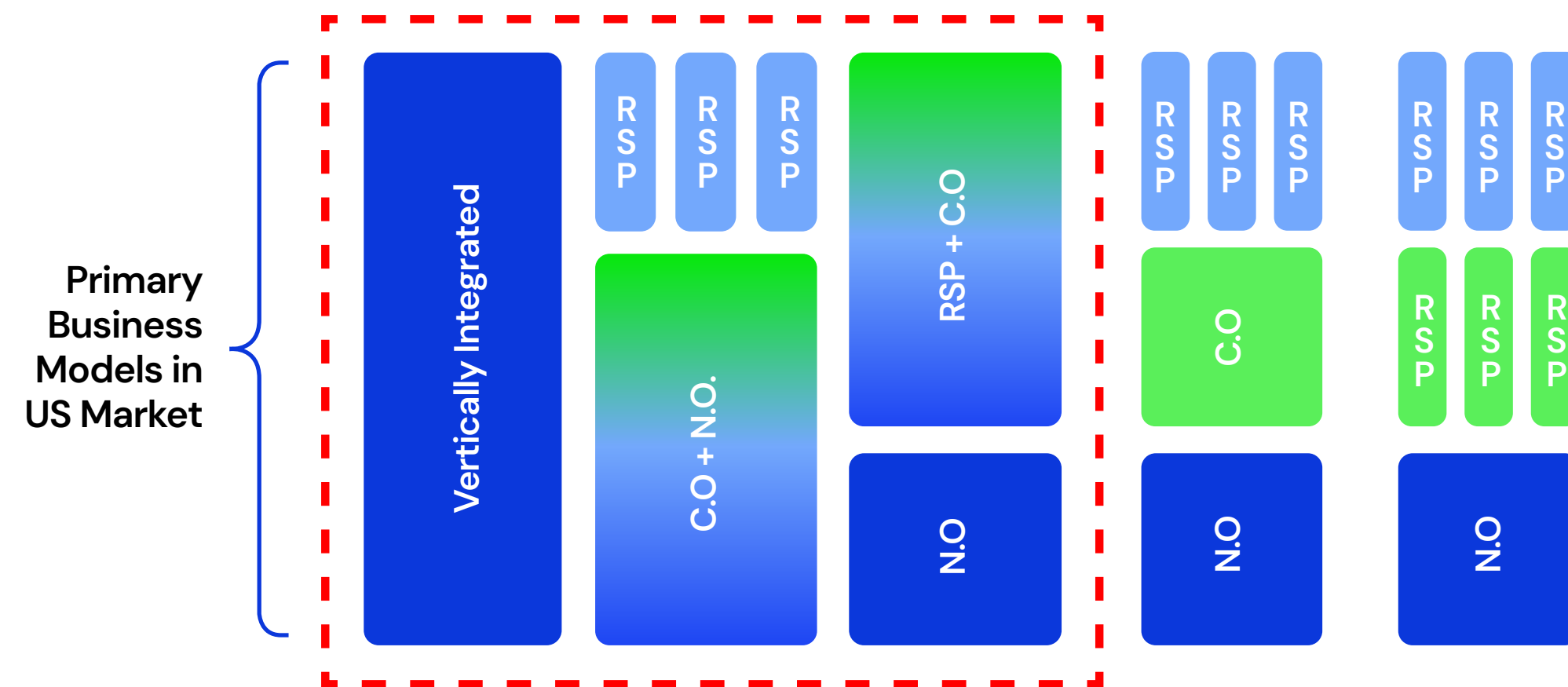
This eBook examines the model’s unique advantages and disadvantages for municipalities, plus examples of OANs from North America and beyond. It also explains how OAN owners, operators, and service providers are partnering with Calix to build modern, future-proof networks that are bringing high-speed broadband services to subscribers around the world.





Open Access Explained: Operating Models and Technology Choices

Open Access Models in US



3-Layer Model

- Layer 1 represents the passive infrastructure, typically managed by a **Network Operator (N.O.)**
- Layer 2 represents the active infrastructure, typically managed by a **Communications Operator (C.O.)**
- Layer 3 represents the retail services offered by 3rd party **Retail Service Providers (RSP)**

The defining feature of an open access network (OAN) is the structural separation of the underlying infrastructure from the layer that delivers the service to the end consumer. This means that one (or more) companies own and operate the network, supporting multiple retail service providers (RSPs) at the retail level.

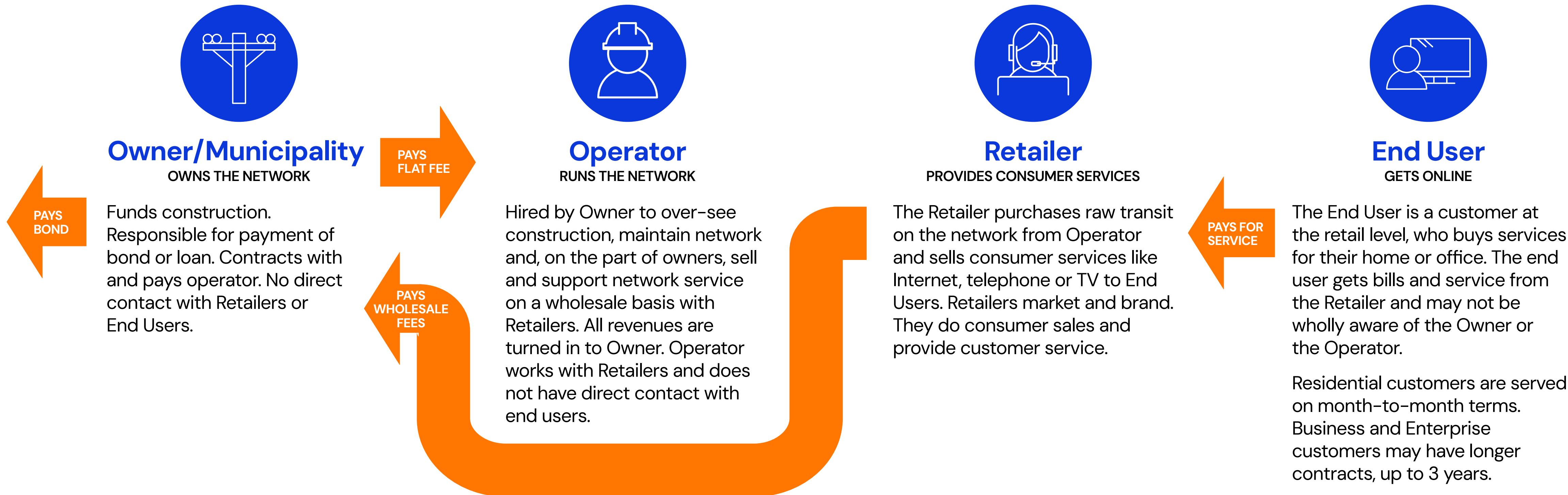
There are variations in how this model is arranged. A “two-layer” model features a single network owner/operator, plus the RSPs. In a “three-layer” model, the network is owned by one company—typically a municipality—while a second company operates and maintains the network, the third is multiple RSPs.

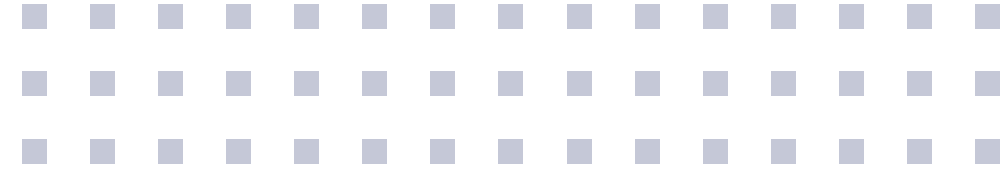
- The **first layer** is passive infrastructure and consists of the conduit and physical cables that create the network. This is typically the municipality, but can be anyone from a private telco, a utility, a co-op, an investor, or a community.
- The **second layer** is the active or operations layer, lighting up the physical network with electronics. It is managed (and often owned) by the Communications Operator.
- The **third layer** is the service layer and consists of all the services delivered and sold over the network. Core services include internet, telephone, and TV services—but specialized services such as telehealth and home security are increasingly offered too.

Regardless of the arrangement, the OAN operator allows RSPs onto the network, offering standard terms and pricing to all providers. The OAN operator would not act as an RSP itself. This allows the RSPs on the OAN to compete to sign up subscribers. Subscribers should be able to switch between RSPs seamlessly and even select different services from different providers on the same OAN.

Open access models can be deployed at the various parts of the network. A network deployed by a municipality hosting multiple RSPs concerns the

“last mile” of the network—the connection between the network and the subscriber premises. The other part of the network where open access can occur is the “middle mile,” which connects the core network to the access (last mile) network. In most cases, an open access service spans from the Access Demarcation device at the subscriber side (e.g., ONT for FTTH) to a hand-off POP (the peering between the OAN and the RSP).



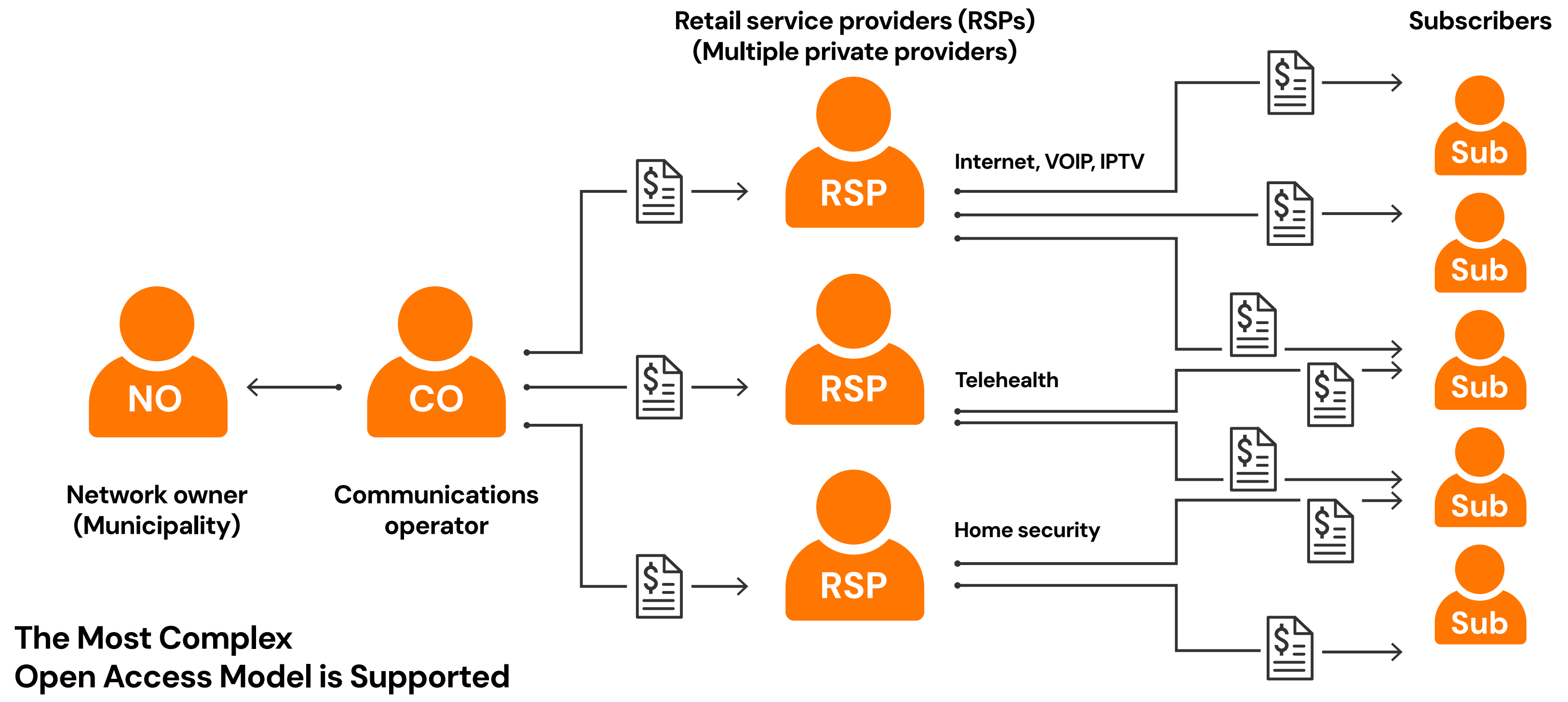


As most large telecoms firms also operate at the retail level, they rarely adopt the open access model in the last mile section of the network that serves subscribers. However, in some cases, they can participate in open access agreements in the network's backbone and middle mile of the network.

Demand for high-bandwidth services—a trend accelerated during the pandemic—has underlined the need for fiber-to-the-home (FTTH). Because the underlying network needs to have sufficient capacity and capability to support

multiple RSPs, fiber is the most popular choice for OANs today. The latest XGS-PON standard can deliver upstream and downstream (symmetrical) speeds of up to 10 Gbit/s (gigabits per second).

Another form of fiber-based open access concerns dark fiber leasing. In this model, the dark fiber is deployed in the ground but stays dormant until it is leased and “lit up” by a third party, usually a large enterprise or RSP.



Municipalities Look to Open Access to Deliver Community Broadband

In most markets, high-speed broadband is provided by only a small number of incumbent players. In the US, for example, the residential market is dominated by cable operators (such as Comcast and Charter) and large telecom operators (such as AT&T and Verizon) deploying FTTx, DSL, or fixed wireless access.

These companies are known as vertically integrated operators (VIOs). Unlike in the open access model—the same company owns, operates, and provides services over the network. Rival operators need to build their own network infrastructure to compete. Incumbent operators using this model may deem it economically unviable to deploy infrastructure in rural areas, which means many communities across North America are underserved or unserved.

Fiber penetration in the United States is estimated at around 51.5% today, significantly below comparable global regions. Supporters of OANs in the US cite research that estimates the model could cover close to 80 percent of the US population with FTTx without the need for government subsidy. By comparison, the research calculates that the incumbent VIO model could only reach 50 percent of the population while remaining economically viable.

As a result, OANs operated by municipalities have gained popularity in North America in recent years to deliver connectivity and competition. Most OANs are deployed by municipalities serving their own communities, usually as part of public-private partnerships.



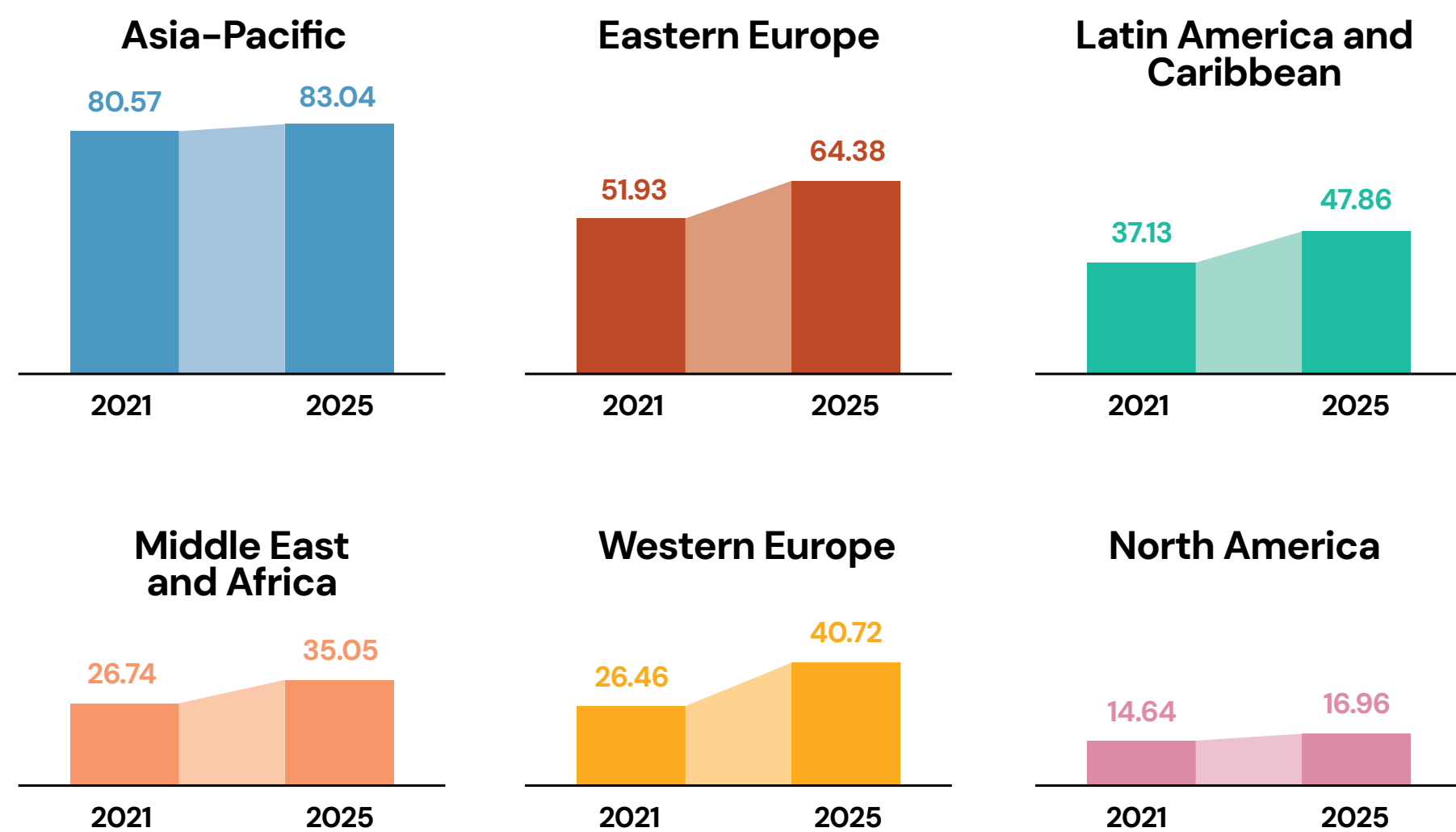
Regulatory conditions in the US are generally less favorable to municipally owned networks than elsewhere in the world. In some states, OANs are required for municipally owned networks to operate. However, OANs are benefiting from increased funding opportunities from both private and government sources. The government supports these ventures via initiatives such as the US Broadband Equity, Access, and Development (BEAD) program. Advocates of open access are campaigning for OANs to become recipients of the current US administration’s \$100 billion digital infrastructure plan.

Meanwhile, Canada’s vast landscape, with its varying geography and climate, presents unique challenges to the provision of high-quality broadband internet.

Only 62% of rural communities in Canada have access to broadband at 50/10 Mbps. To tackle this digital divide, the Canadian government launched a C\$3.225 billion Universal Broadband Fund in 2020 with the goal of connecting every Canadian citizen to high-speed internet by 2030. The Fund said it will look “favorably” on applications that provide open access to last mile infrastructure. As of 2023, 62% of rural Canadian households now have access to 50Mbps.

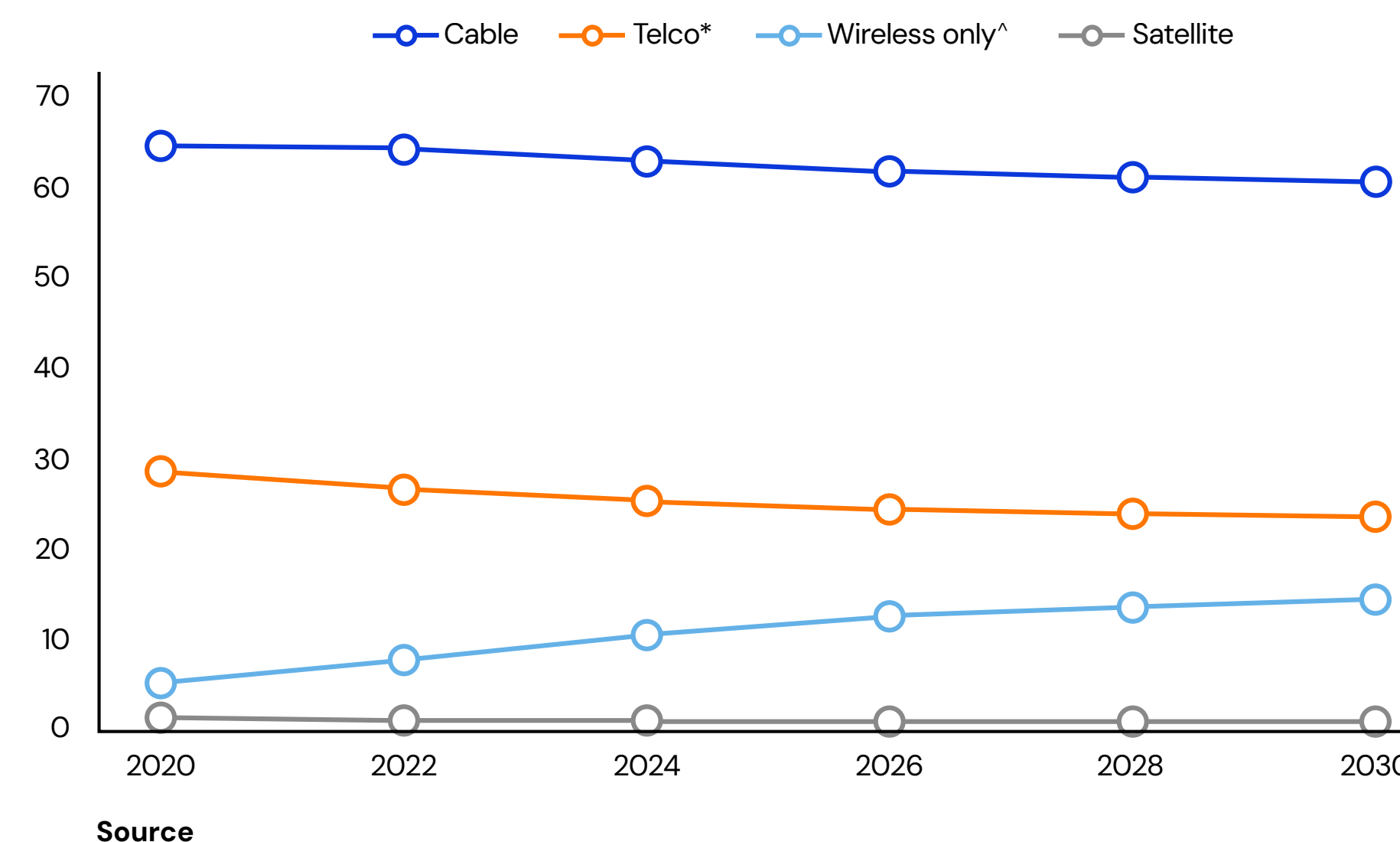
Political support for municipal OANs is by no means universal. Some lawmakers argue against municipal networks in general, claiming that the costs involved are ultimately paid for by residents. Opponents of the model also maintain that issues such as poor rural coverage are best addressed by market-led solutions.

Fiber share of total broadband homes (%)



As of November 2021.
Sources: Industry data, Kagan estimates.
Kagan, a media research group within the TMT offering of S&P Global Market Intelligence.
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Projected US residential broadband market share, 2020–2030 (%)



Data as of April 2022.
*Includes DSL and fiber-to-the-home broadband access.
^Includes fixed and mobile wireless broadband connections used for primary internet access.
Sources: Industry data; Kagan estimates
Kagan, a media research group within the TMT offering of S&P Global Market Intelligence.
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The “Pros and Cons” of Municipal Open Access

Municipalities considering whether to invest in an open access network for their communities should be aware of the model’s unique advantages and disadvantages. These include:

Advantages

Lower barriers to entry. By opting to run services on an OAN host, RSPs can get to market without the upfront costs of building and maintaining their own network.

Increased competition. The lower barriers to entry can stimulate competition between multiple RSPs, providing more choice and price competition for the end consumers served by the OAN.

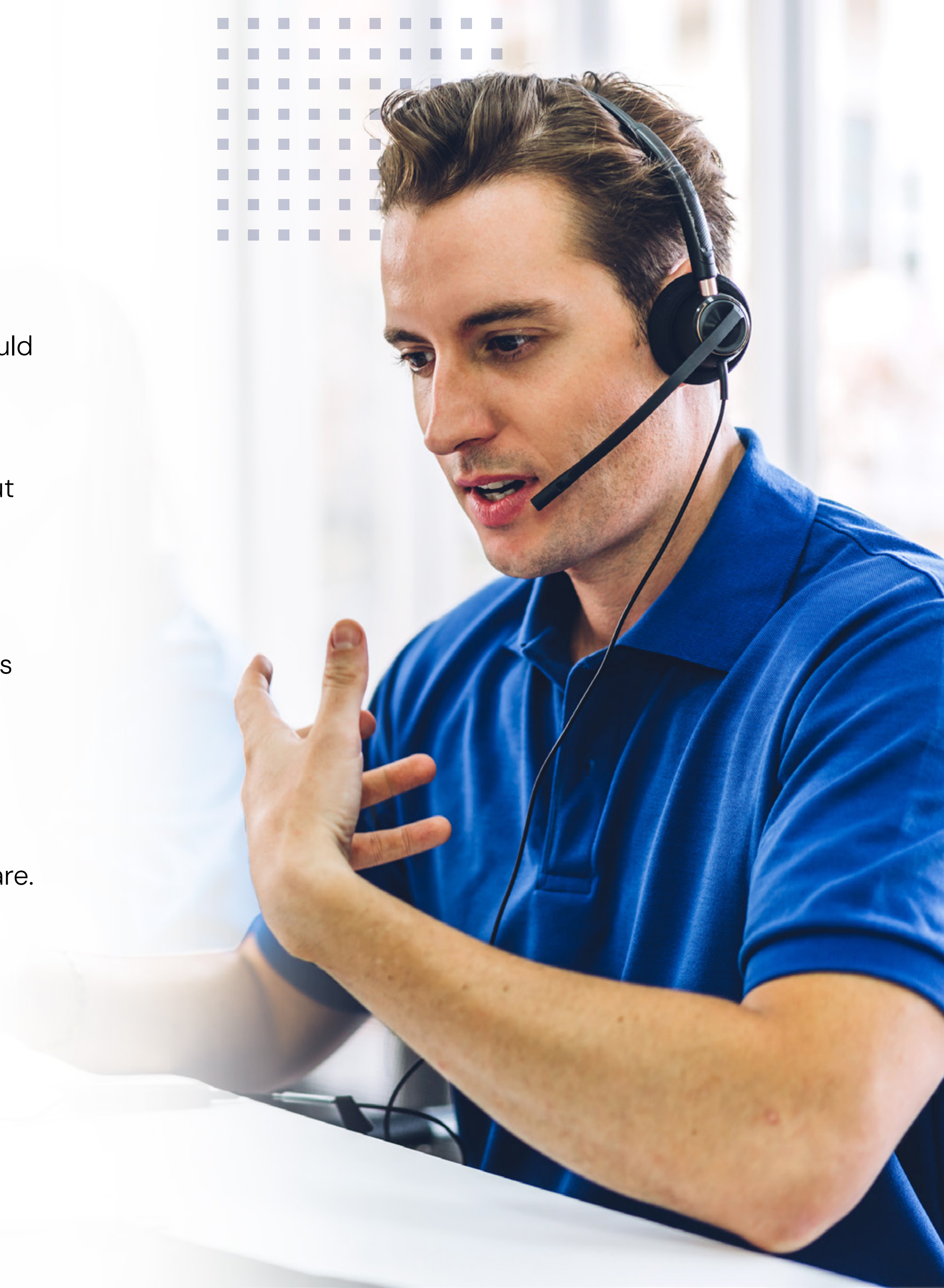
Extending coverage to hard-to-reach areas. An OAN can be deployed by a municipality in areas where privately-owned networks are not economically viable.

Maximizing offerings. By utilizing OANs, a municipality can offer a variety of options from various providers, thus maximizing the utility of the network and increasing the overall take rate.

Differentiation. OANs can be an advantage to RSPs that want to stand out in a crowded field. Offering services that excite subscribers can be a benefit to RSPs in their effort to gain market share.

Long-term financial planning. Unlike private networks that require a short-term return on investment, OANs owned by municipalities can form part of longer-term investment strategies stretching over a decade or more.

Increased economic development. Municipalities can drive economic growth within their communities by deploying modern, digital infrastructure. Projects may also be eligible for state or federal funding.





Disadvantages

A “race to the bottom” on price. RSPs on open access cannot differentiate on network quality. Therefore, they lean in on pricing as a distinguishing factor, opting for price-based marketing and sales. There is risk of an unsustainable “race to the bottom” based on pricing, as price alone is not enough to keep continued interest and long-term end consumer loyalty.

Lack of expertise. Municipalities may be ill-suited to the telecoms sector, lacking the required expertise to build and maintain broadband networks.

Inability to attract RSPs to the network. Several OANs have failed due to a “build it and they will come” approach. Will the OAN be able to attract enough RSPs to its network to be sustainable?

Risk of reputational damage. The reputation of the OAN depends on the quality of the RSPs on the network. A poor subscriber experience at the retail level could lead to the municipality suffering reputational damage.

Operational complexity. Operating an OAN with multiple RSPs is more complex than the vertically integrated model. For example, it requires advanced OSS/BSS to support subscriber activity across a various range of providers and services.

Choosing the Right Partner for Open Access

By investing in digital infrastructure, municipalities can provide a broadband service for residents and businesses superior to that offered by incumbent operators. In many municipalities across the country, those communities have been left behind by larger operators from a lack of service due to outdated infrastructure. If successful, these OANs lead to more choices and better value for subscribers. However, building a sustainable OAN can be complex and challenging, particularly for municipalities lacking experience in this area. Many fail due to funding problems or a lack of interest from RSPs or subscriber take-up.

Calix has deep expertise in partnering with OAN operators to build modern, future proof FTTx networks. These software-defined networks provide flexibility, reducing the complexity of the OAN model—allowing operators to seamlessly provision and support RSPs on their network.

For example, in Lehi, Utah, a municipality is currently building an OAN network that will compete directly with the incumbent provider, Comcast. Comcast has been unwilling to upgrade their network to FTTx—leaving the community of 80K behind. To solve this problem and serve their community, the municipality has taken the lead. They are contracting with a network operator who will build and run the OAN, along with a handful of RSPs providing a variety of services to their subscribers.



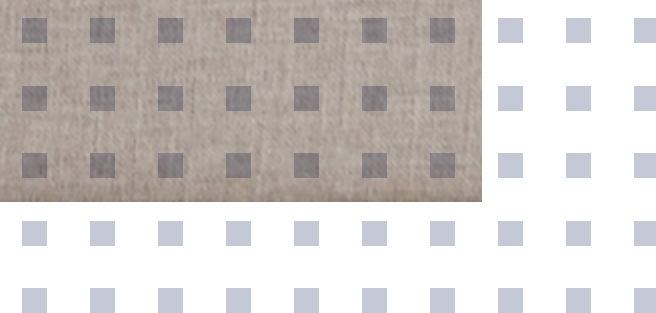


Calix also partners with open access specialists with complementary technologies such as [COS Systems](#). COS provides an end-to-end BSS/OSS platform that allows OAN owners to enable service delivery on behalf of different providers, and the network operator to successfully manage the active layer. It works by virtually slicing the single fiber to the subscriber's home in parallel "streams." On these streams, services can be delivered independently of each other.

Open access owners and operators around the world are taking advantage of Calix expertise in this area. For example, Germany's Vattenfall Eurofiber has [partnered with Calix](#) to deploy a fiber-based OAN to more than 500,000 households in the city of Berlin, delivering enhanced bandwidth at up to 10G speeds. By using the [Calix IntelligentAccess™](#) and [AXOS Network Innovation Platform](#), Vattenfall has significantly increased efficiency and simplified its operations—lowering its OPEX and CAPEX by up to 80 percent.

Calix is working with other OAN operators around the world, including [BrooksNET](#) in Canada and [CityFibre](#) in the UK.

Calix also works with RSPs on OANs to help them differentiate their offering by providing powerful value-added managed services. Based on the [Calix Broadband Platform™](#), this ecosystem of market-leading managed services includes [Calix SmartHome™](#), [SmartBiz™](#), and [SmartTown™](#). Network security ([ProtectIQ®](#)), parental controls ([ExperienceIQ®](#)), connected cameras ([Arlo Secure](#)), social media monitoring ([Bark](#)), and device protection ([Servify Care™](#)) can be leveraged by RSPs of all sizes to unlock new revenue streams and deliver real value to their communities.



Case Studies: Open Access Around the World

The prevalence of OANs around the world rests on several factors—particularly, favorable regulatory conditions and strong political support for the principles of open access.

One market where these conditions have been met is Sweden. Political support for OANs emerged following dissatisfaction with the traditional operators to provide broadband access at affordable prices across swathes of rural Sweden. In Sweden today, an estimated 95 percent of the 173 municipal networks and 42 percent of the housing companies with FTTx currently operate according to an open access model.

The open access model has been adopted elsewhere in Europe on a smaller scale, notably in France and Ireland. In North America, the model has gained traction in Canada in recent years. Both Canada's Connect to Innovate program and Universal Broadband Fund have looked favorably on open access, in both backbone and last-mile infrastructure.

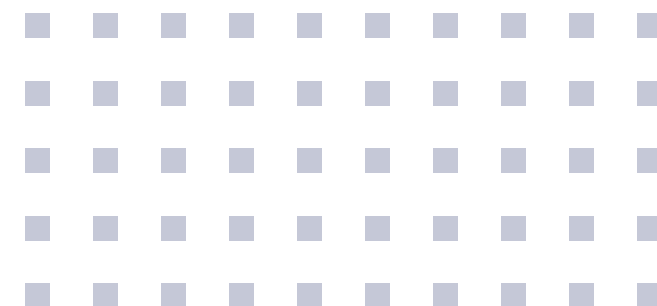
Below are examples of organizations around the world that have partnered with Calix to successfully deploy OANs.



Lit Communities (United States)

Lit Communities was established in April 2019 with the mission of helping municipalities across the United States provide high-speed broadband to unserved and underserved communities. In February 2021, it secured the initial capital investment to build its first community network in Medina County, Ohio. The Media Country Fiber Network (MCFN) will span 400 miles of fiber and bring FTTH to 45,000 homes and businesses.

Lit Communities selected Calix Intelligent Access EDGE and the E7-2 Intelligent Access System as the foundation of the Medina County network. It also implemented the comprehensive Calix Revenue EDGE platform to offer subscribers a range of managed services and worked Calix Professional Services to design and deploy the network.





CityFibre (UK)

CityFibre is one of the largest “alt-nets” (alternative networks) in the UK, taking on incumbent carriers by building an OAN that will allow a range of different wholesale partners to provide connectivity services. CityFibre expects to build out its “Full Fibre” network to a third of the UK by 2025. This includes connecting 8 million homes across more than 285 towns and cities, alongside 800,000 businesses, 400,000 public sector locations, and 250,000 5G mobile access sites.

CityFibre’s wholesale customers span several verticals, including residential broadband, smart city applications, the public sector, and advanced business services. It provides tailored solutions for each segment. CityFibre is currently working with Calix to upgrade its network to XGS-PON, enabling speeds of up to 10G—around ten times the capability of its current G-PON network.



Vattenfall Eurofiber

Vattenfall Eurofiber is aiming connect more than 500,000 households and businesses in Berlin to high-speed 10G fibre via an open access model. It uses state-of-the-art technology to lay the fiber over existing district heating duct capacity, resulting in significantly less civil engineering work.

The software-defined network will provide a digital infrastructure for 5G and IoT connectivity, paving the way for the capital’s rapid development into a smart city. The network is powered by the Calix Intelligent Access EDGE platform, which is enabling Vattenfall to lower OPEX and CAPEX by up to 80 percent.

Why Open Access, and Why Now?

For municipalities, open access networks are a viable model to help close the digital divide. By leveraging one network with multiple service providers at the retail level, broadband performance and end consumer service can increase. Especially for areas that are often left behind in network builds by larger incumbents, this model gives municipalities an edge in their mission to provide high-speed, reliable broadband and exciting services alongside the network.

While Europe takes the lead in this strategy, North American municipalities can follow their examples and partner with Calix for an award-winning, future-proof platform designed to serve communities of all sizes—for generations to come.

To learn more about OANs and how to leverage one to bring broadband to your community, sign up for a [Network Design Consult](#).



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