APPLICATION NOTE

# Broadband for municipal governments

**Local governments in rural areas are building municipal broadband networks to address the lack of affordable high-speed internet access in their communities. While municipally owned broadband networks have several recognized benefits, local governments must overcome key challenges of infrastructure, affordability, and adoption. Ciena's broadband solution includes the flexibility, scalability, and sustainability required to deliver high-speed internet access to ensure digital equity for all citizens.**

Real-time access to digital applications, data, and video is critical for a community's success, whether for work, study, or play. High-speed internet access provides the real-time services that citizens and businesses require, significantly impacting where businesses locate and employees choose to live. It is a meaningful driver for community growth.

Reliable and affordable broadband access—currently defined as 25 Mb/s or faster—adds multiple benefits to a community: Employees can work where they live rather than live where they work; students can attend classes online; entrepreneurs can connect with far-flung markets; and patients can use telemedicine to access medical expertise without the need to travel. The FCC recently increased the minimum broadband speeds in the U.S. to 100 Mb/s for downloads and 20 Mb/s for uploads. The ongoing discussions about pushing the minimum limit to 1 Gb/s further emphasize the need for next-generation broadband networks. Broadband access is becoming as vital in the daily lives of community members as public utilities like water, sewer, gas, and electric power.

Access to high-quality broadband has been historically limited in rural areas, with an estimated 28% of rural residents lacking access to broadband.[1]

## Highlights

- Access to high-speed internet in rural areas provides economic development, remote work opportunities, online education, and better telehealth and emergency services
- Access to high-quality broadband has been historically limited in rural areas due to costly expense for traditional internet service providers (ISPs)
- Approximately one in five U.S. households, mostly in rural communities, does not have broadband service
- Hundreds of municipalities have invested in creative public networks, using various models to connect rural and underserved communities
- A flexible broadband solution combining routing and switching platforms, Ciena's virtual Broadband Network Gateway (vBNG) software, XGS-PON pluggable technology, leading optical technology, Navigator Network Control Suite™ (Navigator NCS), and Ciena Services address infrastructure, affordability, and adoption challenges

1 Federal Communications Commission, "FCC increases broadband speed benchmark," March 2024

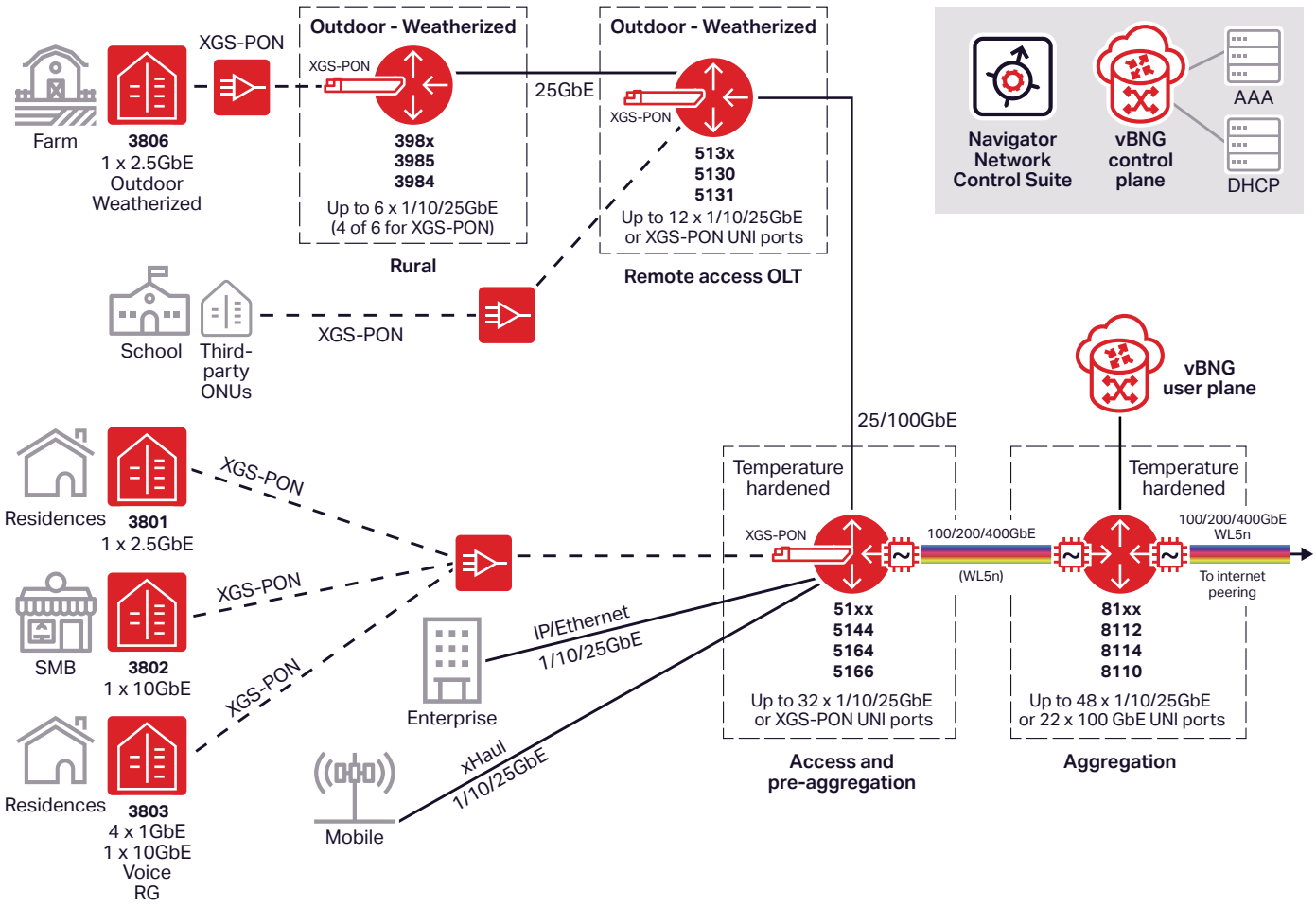


*Figure 1. Ciena's broadband solution for access networks*

Low population density and long distances to existing infrastructure make the upfront investment of broadband expansion too costly for private service providers. But unlike profit-driven private companies, municipal governments can take a long-term view and serve their communities while achieving a return on investment over a longer period.

Given the importance of internet access to modern businesses and quality of life, some local governments have invested in networks that have revitalized local economies and saved taxpayer dollars. But municipal governments, like their private company counterparts, face many challenges when building municipal broadband networks, including:

- **Access infrastructure:** The network technology that ensures high-speed internet access to all citizens, businesses, and institutions throughout the community
- **Affordability:** The network architecture and management that contains cost, along with federal and local programs that subsidize internet access
- **Adoption:** How to quickly build and maintain a subscriber base to ensure the financial sustainability of the municipal broadband network

## Ciena's broadband solution

Ciena's approach to broadband is designed to deliver the flexibility, scalability, and sustainability municipal broadband network operators require to create a lasting business while protecting their network investment, ensuring digital equity and serving the community well into the future.

Ciena's broadband solution uses the power of Ciena's portfolio, including routing and switching platforms with XGS-PON pluggable technology, market-leading optical networking technology, Navigator NCS, vBNG, and Ciena Services. This solution allows end-users access to applications for working from home, telemedicine, remote learning, cloud gaming, and ultra-high definition (UHD) video streaming now—and helps municipal operators upgrade their service portfolio when required by artificial intelligence (AI), immersive experience and augmented reality/virtual

reality (AR/VR) applications—without the need to rip and replace existing network infrastructure. Ciena goes beyond network infrastructure by offering municipal network operators a complete solution to accelerate their network modernization journey—from business planning to marketing execution to system integration, implementation, and managed services.

## Innovative broadband access architecture for municipal government

Ciena offers unparalleled flexibility in access network deployment. It begins with Ciena's micro–optical line terminal (uOLT), the industry's first fully functional OLT in a small form factor pluggable (with embedded Ethernet-to-PON OLT MAC bridge). The uOLT turns Ethernet ports in a host switch or router into a fully functional OLT on a port-by-port basis (no dedicated chassis required), while other ports can be used for other services (Ethernet, IP, TDM, OLT, and so on).

This capability brings unmatched flexibility to PON deployment with the ability to deploy out of a central office, street cabinet, or an outdoor site such as on a pole or strand. Operators can cost-effectively deploy 10G PON surgically or at scale in all types of networks.

Ciena's broadband solution is complemented by a full family of host routers and switches. This includes outdoor weatherized options, enabling PON deployment anywhere in the access network, including remote rural locations. Freed from the constraints of OLT sizing determined by chassis-based or pizza-box form factors, PON can be deployed where needed, when needed, and in the increment needed to maximize revenue and broadband penetration. Scaling can occur in increments as small as one port/one uOLT and scale up based on traffic demand. This enables a pay-as-you-grow economic model.

Additionally, the fixed broadband network has several critical components, but the linchpin is the broadband network gateway (BNG). The BNG establishes and manages subscriber sessions by acting as the authentication point through which subscribers connect to a carrier's broadband network. It aggregates subscriber traffic from the access network and handles several important subscriber management functions, including authentication, authorization and accounting, IP address assignment, quality of service (QoS), and policy management.

Legacy (chassis-based) BNGs, with their historically closed architectures, make it difficult to address the rapidly changing demands for scalability and flexibility. Ciena's vBNG is an open architecture built to the Broadband Forum's TR-459 standard: "Control and User Plane Separation for a disaggregated BNG." User planes can be sized and placed in the network where needed with a vBNG and then scaled gracefully to meet traffic demand.

Operators can accelerate their sustainability goals and reduce environmental impacts with Ciena's broadband solution, which was designed with sustainability in mind. For example, since no fixed chassis is required, pluggable uOLTs can be deployed in a qualified router (a port at a time) and only use power, cooling, and space when needed. Since converged router/switch ports can be used for all services (Ethernet, IP, TDM, OLT, and so on), there is an efficient use of power, cooling, and space spread across multiple services. Fewer boxes, smaller footprint, less power and cooling—better sustainability.

Management and control are critical. Service providers want to operate and scale their broadband networks in a cost-effective and sustainable way. However, they are often encumbered with multiple legacy element management systems (EMSs) or controllers that require manual coordination of IP and optical operational workflows, resulting in long lead times and suboptimal network designs. With Navigator NCS, providers gain a single point of control to visualize the performance of their multi-layer, multi-vendor infrastructure. They can then simplify, optimize, and automate network operations, reducing costs and improving customer experience quality.

Ciena's broadband solution gives municipalities the flexibility they may have never had to build and evolve their access networks, protecting their network investment and guaranteeing they will serve their communities by enabling digital inclusion.

## Full support for new and existing municipal government networks

Many governmental agencies may not be set up to execute complex IT deployments. That's where Ciena Services' extensive experience, processes, and economies of scale can help with a successful rollout. Depending on needs, Ciena Services is ready to assist—from initial planning and design, systems integration, and implementation to 'Day 2' services to optimize, support, and manage this powerful solution. Ciena Services also offers an extensive library of learning courses and labs to grow IT teams' residential broadband knowledge. These services are designed

to be flexible—they are available individually or can be packaged together—and consist of consulting, implementation, systems integration, maintenance, managed services, optimization, and learning.

Marketing as a Service (MaaS) is available as part of Ciena's broadband solution. MaaS features customized marketing strategies and tactics designed to enable participants to get the most from their network investments. MaaS is available to participants in the CPNe program and/or select customers.

Municipal broadband network operators should avoid legacy approaches because they do not offer the flexibility, scalability, or adaptability required to succeed in a rural community while sustainably supporting new and emerging application requirements. Ciena uses an innovative broadband architecture combined with proven expertise in deploying ultra–high-capacity networks to help providers serve their communities and thrive in the broadband market.