How To Thrive in the Growing Residential Broadband Market

Ciena's Residential Broadband Solution is designed to deliver the openness, modularity, and scalability required by new and established network operators of all kinds to thrive in the lucrative broadband market while protecting their investments and maintaining a competitive edge well into the future.

We are in a defining moment—where a once-in-a-generation public and private investment in residential broadband will redefine how internet access is consumed for both personal and business applications. Ubiquitous, affordable, and reliable connectivity will not only ignite a new wave of cloud-based applications for existing residential broadband consumers, but will also directly address digital inclusion for underserved communities to enable broader socioeconomic growth by shrinking the digital divide. To ensure commercial success, network operators must not be limited by legacy architectures of incumbent vendors, as their mission to deliver sustainable residential broadband for all is too important to compromise.

This solution leverages the power of Ciena's Routing and Switching platforms, XGS-PON pluggables, virtual Broadband Network Gateway (vBNG), optical platforms, Manage, Control and Plan (MCP) domain controller, Blue Planet® Intelligent Automation software, and Ciena Services. By leveraging a rich ecosystem of technologies and vendors enabled by an open approach, network operators can offer differentiated broadband services—allowing end-users to work, learn, play, and socialize from home. Network operators will also be able to upgrade their service portfolio, when required, to support the next wave of applications, such as the metaverse (internet 3.0) and Augmented Reality/Virtual Reality (AR/VR),without the need to rip and replace existing network assets.

Ciena's residential broadband customers benefit from Ciena's expertise in planning, design, deployment, management, maintenance, and support for their networks. Ciena can also address skill gaps by training operator technical staff.

Ciena's solution goes beyond network infrastructure by offering network operators—such as service providers, utility co-ops, municipalities, and Multiple System Operators (MSOs)—a complete approach to accelerating their residential network deployment or modernization journey, from planning to marketing.

Innovative residential broadband architecture

Ciena's Routing and Switching platforms provide unmatchable scalability and flexibility by aggregating Fiber-to-the-Home (FTTH) or middle-mile traffic using multiple 100, 200, or 400GbE Network-to-Network Interfaces (NNI), powered by market-leading WaveLogic™ Nano coherent optical pluggables to support both existing and future bandwidth requirements.

This allows the convergence of last/middle-mile or FTTH/metro aggregation functionality by integrating XGS-PON micro–Optical Line Terminal (μOLT)
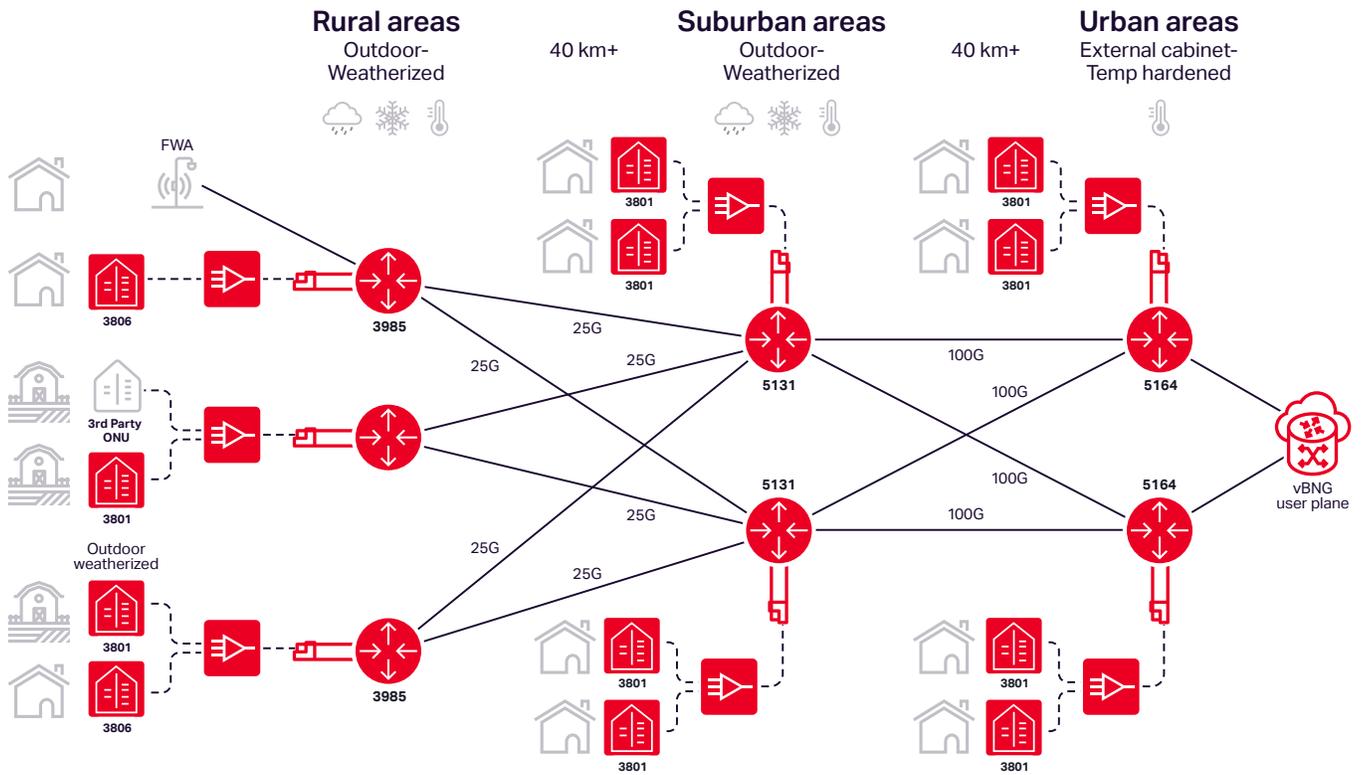
Figure 1. Ciena's solution supporting the requirements of multiple communities

pluggables in Ciena's Routing and Switching platforms, offering shared fiber broadband services for residential as well as Small and Medium Enterprises (SMEs). Ciena offers one of the best XGS-PON port density per Rack Unit (RU) and the lowest energy consumption per port for typical deployments, while allowing customers to buy only the XGS-PON pluggables required, when required, in a pay-as-you-go business model. As the market evolves, Ciena's Routing and Switching platforms are ready to support 25G PON plugs when applications require it and when they are available in the future.

Ciena offers a highly scalable and modular solution that allows network operators to easily go from tens to hundreds of XGS-PON ports without losing sunk platform investments, replacing existing network equipment, or needing significant upfront costs.

Ciena's Residential Broadband Solution Leverages Universal Aggregation (UA) and access capabilities to support multiple service options, in addition to XGS-PON. With the solution's innovative modularity, network operators can offer enterprise business services over IP or dedicated Ethernet and mobile wholesale services with xHaul transport capabilities in a highly optimized footprint that reduces energy and space requirements to expand addressable market and revenue opportunities. Hardened and

weatherproof platforms provide network operators with maximum flexibility and ability to move their OLTs closer to end-users for improved performance in urban, suburban, or rural environments.
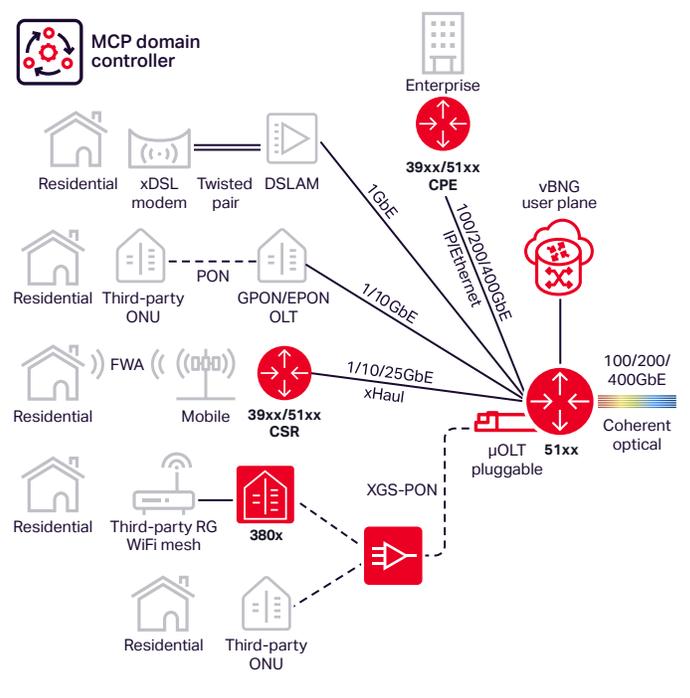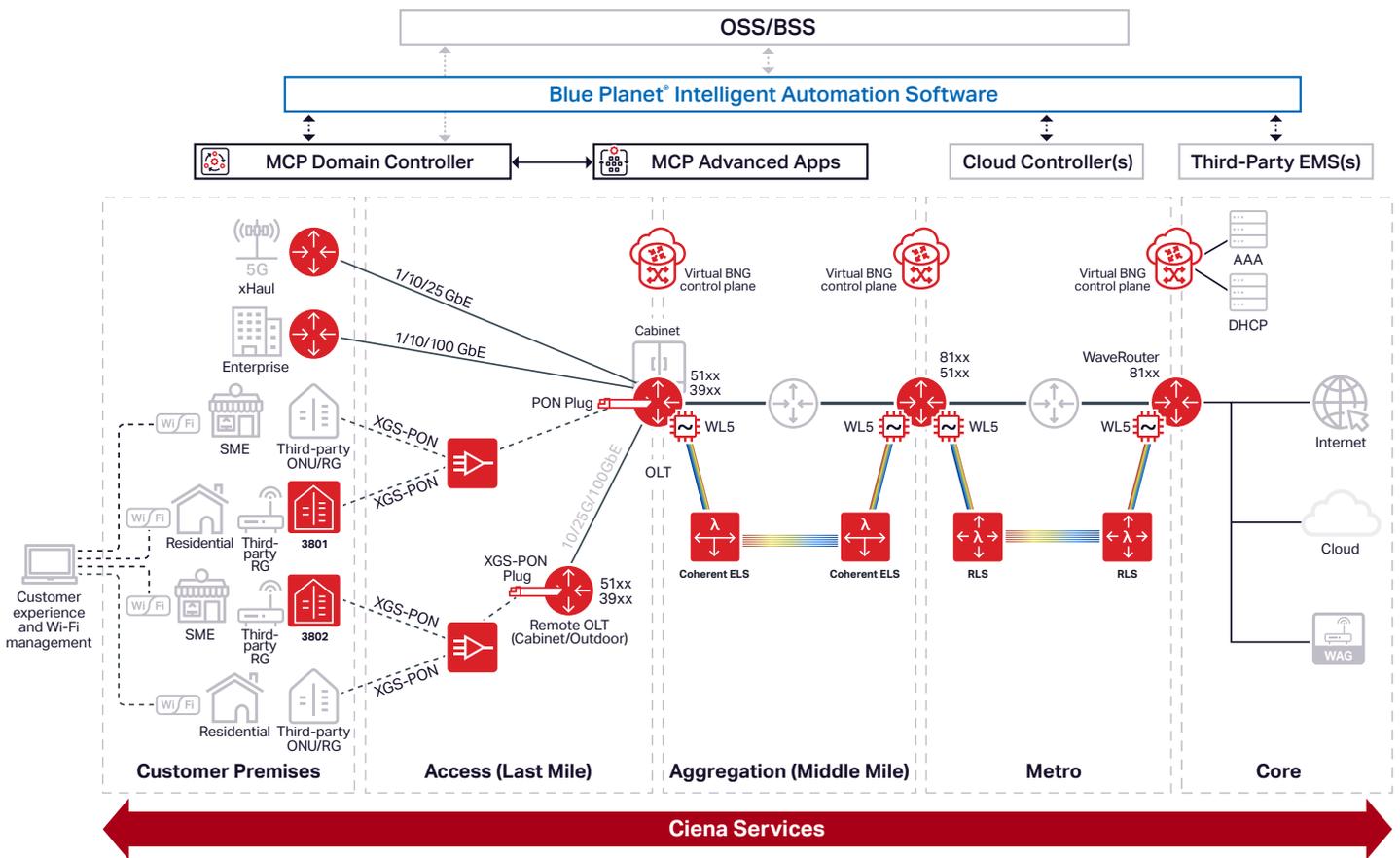

Figure 2. Ciena's Universal Aggregation and Access

Figure 3. Ciena's Residential Broadband Solution ecosystem

For end-users, Ciena's Residential Broadband Solution offers a family of Optical Network Units (ONUs), allowing end-users to benefit from multi-Gb/s connectivity while providing increased choice by being open to support other vendors' ONUs using Open ONU Management and Control Interface (OMCI).

Ciena's solution is open by design—enabling network operators to create the best possible network infrastructure by choosing preferred vendors that complement the network elements. By not limiting network operators to one vendor's innovation cycle, operators are able to protect their competitive edge. This also allows operators to maintain better control over their procurement processes to minimize—and outright eliminate—vendor lock-in for a broader and more secure supply chain.

Deploying broadband is much more than just deploying network elements. Network operators are looking to deliver the best Quality of Experience (QoE) to their customers while increasing operational efficiencies.

The fixed broadband network has several critical components, but the cornerstone 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 (AAA), IP address assignment, Quality of Service (QoS), and policy enforcement. All traffic outbound to the internet passes through the BNG and all traffic inbound from the internet passes through the BNG on its way to the customer.

Ciena's vBNG was architected as a software-defined, fully containerized, virtualized, cloud-native BNG from its inception. It brings the flexibility and agility operators need to quickly address opportunities in today's ever-changing broadband market.

More specifically, Ciena's vBNG is open architected and built to the Broadband Forum's TR-459 Standard: Control Plane, User Plane Separation (CUPS) for a disaggregated BNG. There is no specialized hardware required, functionality is delivered in software, and it runs on x86-based, Commercial Off-The-Shelf (COTS)

servers. This architecture delivers tremendous value in its openness, flexibility, and scalability.

Ciena's Residential Broadband Solution leverages the MCP domain controller, which allows operators to scale the network—simplifying operations, reducing cost, and delivering the agility and resiliency their customers expect. It provides operators with the ability to manage and orchestrate their multi-layer network from end to end, including middle mile, last mile, and Customer Premises Equipment (CPE) when delivering broadband, enterprise, or mobile wholesale services using a common and integrated platform.

Supporting multi-vendor interop or third-party ONU integration, Ciena's Residential Broadband Solution avoids vendor lock-in by supporting both OMCI and Ethernet Operations, Administration, and Maintenance (OAM) in-band management. With rich, carrier-class OAM and Provisioning (OAM&P) software, operators can persistently store configurations, provide Performance Monitoring (PM) data collection, employ fault monitoring, and manage firmware images.

Full support to new and existing network operators

To reach the goal of igniting a digital future for all, operators must leverage the benefits of an open solution through proper planning, deployment, management, and support. While some network operators may have the requisite capabilities, others may not. To help address the needs of all customers, Ciena has developed a pre-validated reference architecture that anchors an end-to-end suite of professional, support, learning, and marketing services to assure commercial success. These services are designed to be flexible rather than an all-or-nothing proposition, and are available individually as well as in a packaged solution.

Ciena Services for residential broadband include:

- Customizable reference architecture-anchored solution with planning, design, and integration that pre-validate Ciena and third-party components and allow for customer-preference substitutions

- Operations Support System/Business Support System (OSS/BSS) integration
- Enhanced deployment capabilities
    - Integrated staging, including passive and active cabinets
    - Deployment/turn-up and test
- Rollout assurance for initial service rollout and/or self-deployment
- Go-to-market support, including the Ciena Partner Network's Marketing-as-a-Service (MaaS) program[1] and learning services
- 'Day 2' support, including managed services and technical support

For those who may be new to providing residential broadband or whose marketing teams could benefit from an extra hand, the award-winning Ciena Partner Network's MaaS program—included at no additional charge in most cases—takes network operators to market faster with collaborative engagement, execution, and dedicated marketing experts to accelerate time to revenue. Ciena not only supports the development of go-to-market strategies, but also executes to win business together.

Sustainability must not be an afterthought

Investing in infrastructure to close the digital divide without considering all relevant environmental and economic sustainability aspects can negatively impact any service provider's long-term financial viability.

Ciena continues to invest in the sustainability of all critical network elements by converging the access infrastructure with best-of-breed routers, WaveLogic coherent optics, and innovative uOLTs and corresponding ONUs.

Sustainability models show Ciena has already helped customers avoid more than 550,000 metric tons of CO_2e over an eight-year period (from 2014 to 2021) with Ciena's Routing and Switching platforms. This helped customers' production networks achieve

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1 The Ciena Partner Network's Marketing-as-a-Service (MaaS) is currently only available in the Americas Region. The products and services described here are available only to participants in the Ciena Partner Network (CPN). For more information about CPN, visit www.ciena.com/partners.

23 percent savings in power consumption, equaling 96,000,000 kWh saved which resulted in $12 million per year OPEX savings.[2]

Through WaveLogic coherent optic investments, Ciena introduced the industry's first 400 Gb/s transceiver in 2017 and is delivering the pluggable version five years later at one-fifth the power, one-tenth the space, and with improved industry-leading systems performance.

Combining Ciena's routing, optical, and PON innovations together offers significant improvements in footprint and power savings to enable more efficient and sustainable networks for customers—and the planet at large. For example, evolving from a traditional pure PON chassis-based, multi-boxed solution to Ciena's converged access with XGS-PON and routing in a single platform results in a 67 percent reduction in footprint and 63 percent reduction in power consumption. This is just one example and, when applied to 100,000 homes passed at 50 percent market share (12 sites) using a 64 OLT split, can avoid 84,400 kWh annually and result in 59.8 metric tons of CO_2e avoided. A higher market share rate or homes passed would yield much larger sustainability results.

Summary

Network operators are moving away from legacy chassis-based approaches to residential broadband because the former simply does not offer the capacity, efficiency, adaptability, or sustainability required to succeed in a highly competitive market with constantly evolving application requirements. Ciena leverages innovative broadband technologies and proven expertise in deploying ultra-high-capacity networks to enable customers to thrive in the growing residential broadband market.

2 Ciena's Routing and Switching Sustainability Model to Quantify Equivalent CO2 Emissions Avoided: 2014-2021

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