

# Enabling Next-Generation Metro and Edge Networks for Communications Service Providers

Edge networks—including access, aggregation, and cloud—along with metro networks are the new frontier for storage, compute, and connectivity. Consumers and businesses are insatiable in their demand for new services, applications, and content—a trend that shows no sign of slowing down. The global COVID-19 pandemic, which forced the world's population to shift to working, learning, and playing from home, has only accelerated the importance of investments in the edge. But there is a problem.

Metro and edge networks are not designed or managed to enable Communications Service Providers (CSPs) to quickly monetize new applications and opportunities. This paper explores Ciena's perspective on the limitations of these current network architectures and presents a vision for the next generation of metro and edge networks that are designed for growth and opportunity—while delivering an incredible customer experience.

## Change brings opportunity

Consuming content at the network edge is nothing new—it has been a topic of discussion for the past few years. Adoption of IoT devices and demand for online entertainment, including gaming and high-definition video streaming, had already been driving steady growth in the Fiber-to-the-Home (FTTH) market. But the pandemic has changed everything.

As remote learning, commerce, entertainment, and teleworking have become more mainstream due to the pandemic, growth in the FTTH market is surging—and this is likely to be the new normal even after the pandemic subsides.

At the same time, enterprises are fundamentally changing the way they work, which is impacting the services they need. In fact, there is a shift in the enterprise services mix from network-based and private line to fixed broadband, such as xDSL, DOCSIS, PON, FWA, and DIA; public IP/DIA; and cloud-based services, such as SD-WAN, SASE, VNF, and 5G private networks. Layer on top of this the fact that 5G can enable an almost unlimited number of new services and applications, and the net result is a market primed for new revenue opportunities—but also heightened competition.

Capitalizing on these opportunities requires CSPs to improve their competitive advantage—now. And that boils down to creating an incredible customer experience that drives loyalty and deeper engagement with content and connectivity services. CSPs can no longer take months to bring new services to market when cloud service providers can do so in a few hours or less. At the same time, CSPs must be able to effectively monetize new services and applications that delight customers, and of course, do all of this with greater levels of automation and efficiency.

As CSPs begin to tackle the new market opportunities and challenges in front of them, all attention is turning to the network edge, where consumers, businesses, and machines create and consume content.

## No more status quo

Historically, metro and edge networks were built with upfront excess capacity in hopes that growing demand for bandwidth would eventually consume over-provisioned networks. However, this has proven to be a highly inefficient, costly,

## Next-generation metro and edge networking requirements

<p><b>Common infrastructure</b></p> <p>Enterprise, mobility, and residential over the same underlying network</p>	<p><b>Multi-layer convergence</b></p> <p>IP, Ethernet, and optical integration over an optimized photonic layer</p>	<p><b>Disaggregated principles</b></p> <p>Solution built from disaggregated components which can be used together or independently</p>	<p><b>Optimized routing</b></p> <p>Specific focus on the future state of services and transport including Segment Routing (SR) and Ethernet VPNs (EVPNs)</p>
<p><b>End-to-end automation</b></p> <p>Closed-loop end-to-end (E2E) automation leveraging advanced analytics and intelligence</p>	<p><b>Open APIs</b></p> <p>Open and standardized models with an emphasis on NETCONF/YANG and gRPC/gNMI</p>	<p><b>Advanced visualization</b></p> <p>Best-of-breed web-based network visualization over the multi-layer infrastructure</p>	<p><b>Virtualization</b></p> <p>Support for network virtualization capabilities natively within the solution</p>

and risky approach as CSPs lack visibility into the real-time utilization of their network assets, and thus do not have the ability to dynamically reassign and optimize resources when and where required. This strategy is proving financially challenging for the industry.

The other key challenge of current metro and edge networks is how they provide IP-based services. They use ever-larger hardware-based routers with complex IP stacks full of protocols that are no longer relevant in today's network environments, making IP service delivery slow, complex, and expensive from a CAPEX and OPEX perspective. As a result, CSPs are asking vendors to rethink IP. They want it to be simple, lean, automated, and open so they can rapidly and cost-effectively scale to meet the requirements of the next-generation edge, and its massive number of new IP endpoints related to 5G, IoT, and Edge Cloud.

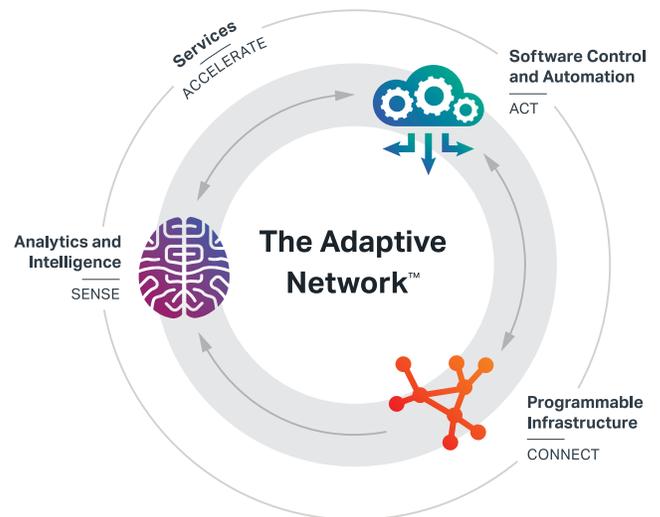
The legacy approach of building edge and metro networks is further complicated by the traditional approach of building separate access and aggregation networks for different service types, like enterprise, residential, and mobile. This is also not sustainable, as this approach is complex and leads to higher OPEX and CAPEX as the number of new services a provider is expected to launch grows exponentially.

### The next generation of metro and edge networks

It is clear the status quo for metro and edge architectures will not work in driving toward a more efficient, less complex, and more profitable service delivery model—so something must change. In working with the world's largest CSPs on some of the most complex edge transformation projects, Ciena has developed a deep understanding of how these networks must evolve. Ciena is deploying the next generation of networks in the industry—and in partnership with customers, establishing the requirements that define them. Based on this, Ciena has

identified the following set of next-generation metro and edge requirements as critical to enable CSPs to maximize their business potential.

While these requirements will define the next generation of metro and edge networks, they are also inherent characteristics of the [Adaptive Network™](#)—Ciena's vision of the ideal network end-state. Based upon a programmable infrastructure—guided by data-driven analytics and intelligent automation—and embracing the key principles of openness, security, and scalability, the Adaptive Network is designed to rapidly scale, self-configure, and self-optimize by constantly assessing network pressures and demands.



Ciena understands that it takes more than just IP expertise to conquer the edge—it requires a deep understanding of holistic network evolution. Guided by the Adaptive Network vision, Ciena has the experience and breadth of portfolio to help CSPs evolve to the next generation of metro and edge networks with a simpler, more open, and more automated approach.

**Simple:** Ciena's portfolio provides a simplified approach to next-generation metro and edge architectures, starting with IP/Optical convergence. Ciena offers a breadth of 100G to 400G pluggable coherent optics, deployable across Ciena's Routing and Switching platforms and augmented with seamless integration to Ciena's industry-leading photonic line systems, link engineering, and network design software tools.

In addition, Ciena's innovative Adaptive IP™ approach leverages intelligent data-driven automation software coupled with programmable routing infrastructure designed to take the complexity out of IP networks. As part of Ciena's Adaptive IP approach, Ciena also help CSPs simplify their operations across network layers.

Ciena's Adaptive IP Apps provide advanced visibility into network performance and routing behavior that enables improved IP automation and service assurance, resulting in a better customer experience. In addition, [Ciena's Manage, Control and Plan \(MCP\)](#) next-generation domain controller provides a user-friendly GUI that offers rich network and service topology visualization and control. This allows CSPs to quickly navigate data, which is correlated across multiple technology layers, accelerating multi-layer network optimization.

**Open:** CSPs are seeking best-of-breed network environments to get maximum performance by leveraging the latest technology innovations from a broad and more secure vendor supply chain. Key to stitching multi-vendor network and software elements together is the use of open APIs, standardized data models, and standards-based network interfaces—all of which is provided across Ciena's portfolio. Furthermore, Ciena supports the full range of architecture choices, including fully integrated Layer 0 to Layer 3 platforms, application-optimized open line systems, and a broad selection of coherent optics optimized for different use cases available in different form factors, performance profiles, and cost points. In addition, Ciena D-NFVI Software and Service Aware Operating Software (SAOS) is compatible with Ciena's Routing and Switching platforms, as well as third-party white box hardware, allowing CSPs to build a best-of-breed virtualized edge.

**Automated:** Ciena's Optical platforms and Routing and Switching platforms are highly instrumented and generate vast amounts of detailed network telemetry. Through open APIs, this information can be sent to [Blue Planet® Unified Assurance and Analytics \(UAA\)](#) solutions and Ciena's MCP Applications to deliver real-time network insights across multi-layer, multi-vendor networks. Through seamless integration with policy subsystems, these insights can be operationalized by MCP and Blue Planet's Multi-Domain Service Orchestration (MDSO) and NFV Orchestration (NFVO) solutions, allowing CSPs to intelligently automate their network operations and the delivery of services across both physical and virtual networks.

In addition to these strategic solutions, Ciena also provides a broad range of professional services and expertise to every project. Perfected in large-scale network transformation projects, Ciena Services experts leverage industry best practices to ensure customers' success as they target new and exciting opportunities at the network edge.

### Own the edge

When it comes to the edge, will the status quo cut it?



### Committed to enabling CSPs to own the edge

Guided by the Adaptive Network vision and leveraging a holistic portfolio, Ciena can support the most strategic next-generation metro and edge use cases CSPs are challenged with today. As a result, Ciena is working with many CSPs globally—such as AT&T and Verizon, among others—to enable their evolution to the next generation of metro and edge architectures. With an intimate understanding of next-generation networking requirements and a deep portfolio, Ciena remains focused on helping customers realize a simpler, open, and automated path to owning the edge.



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Yes

No