

Introducing the Adaptive Network Vision

Why now?

The entire networking industry is being disrupted.

There is an eruption in network demand, driven by ultra-mobile users who want the ability to access the cloud and consume high-definition content, video, and applications when and where they so choose. This disruption of the network will only be exacerbated by the rapid and ongoing adoption of 5G and the Internet of Things (IoT), the use of which involves tens of billions of end-users, humans and machines, meshing with each other to drive increased consumer and business interactions.

For instance, what happens when users want to engage in an 8K-based virtual reality session hosted in the cloud, while traveling at high speed in their driverless cars? What happens when the physical devices currently used to support networking functions become virtual—and so do the user endpoints? Service providers are now realizing the level of complexity and variability this type of demand will introduce, and that their current networks are not up to the challenge.

Why? Today's networks are full of overbuilt legacy systems and protocols, leaving them unable to rapidly scale or adapt. Manual processes are often still required to set up, revise, and tear down even the simplest of services. Today's networks were simply not designed to adjust to these growing and unpredictable demands. When the birth of an overnight sensation can go viral and disrupt the network, how can service providers adapt?

In the background is a set of challenging market dynamics. Although everyone wants more from their service providers, they are not necessarily willing to pay more. This is driving the need for providers to continually lower their cost structures, reduce their operating expenses, accelerate their time to

revenue (to quickly respond to changing market conditions), and launch and retire new services at unprecedented speeds. In short, service providers need their networks to help them achieve better business outcomes in a new world of over-the-top competition and demanding, connected users, both humans and machines.

The Adaptive Network™ vision

To address these challenges, service providers have been looking at a number of technologies to create better cost structures and agility in their networks. Over the last few years, serious exploration and trials around open software, systems, and platforms, the use of open Application Programming Interfaces (APIs), multi-vendor management, streaming telemetry, analytics, Artificial Intelligence (AI), and service automation have been critical in helping to understand what is needed to evolve networks.

There is universal agreement that whatever technologies are at play, the industry needs a more responsive, automated, and agile network. Service providers believe automation is critical but maintaining 'control' over their networks to ensure great customer experiences takes priority. No one vendor can deliver best-in-breed hardware, software, and services for every application. As a result, providers are looking for network technologies that are open, secure, and intelligent. A premium is placed on openness, and multi-vendor, multi-domain interactions.

Some believe an autonomous network alone could be the answer. Ciena has a different vision, one that takes the importance of autonomous networking into account but looks beyond just automation to ensure networks can intelligently adapt to change, not just be automated in a reaction to change.

The Adaptive Network is Ciena's vision of an ideal network end-state that utilizes intelligent automation, guided by streaming telemetry, data-drive analytics, and intent-based policies to rapidly scale, self-configure, and self-optimize by constantly assessing network pressures and demands.

The Adaptive Network enables service providers to optimize their existing infrastructures while incorporating new technologies and ways of working. It's built on key foundational elements, which enhance network and business outcomes independently and are a force multiplier when working together. These foundational elements include:

Programmable Infrastructure (connect): A programmable virtual and physical packet and optical infrastructure is one that can be accessed and configured via common and open APIs, is highly instrumented with the ability to export real-time network performance data and can adjust its resources as needed to meet the demands of the applications running on top of it to optimally connect end-users.

Analytics and Intelligence (sense): Collecting network performance data via streaming telemetry, and analyzing this data using AI, provides the ability to more accurately predict potential network problems and anticipate trends by turning mountains of data into actionable insights. Leveraging these insights can help service providers develop smarter, data-driven business policies that enable them to sense and adapt to customer needs securely, and in real time, and thereby deliver new levels of service assurance.

Software Control and Automation (act): Service orchestration and software-defined control of individual domains, are critical to adaptive networking. Through the implementation of SDN, NFV, and open APIs, service providers can simplify the act of managing and automating the full lifecycle of their services from end to end, across multi-vendor, multi-domain hybrid networks.

Services (accelerate): Technical and professional services are required to help customers build, operate, and continually improve their networks, accelerating their journey to the Adaptive Network.

Realizing the vision

Ciena supports 85% of the world's largest service providers, as well as cloud and regional service providers, enterprise (financial services, healthcare, media & entertainment, retail), public sector, utilities, and all levels of education. By playing

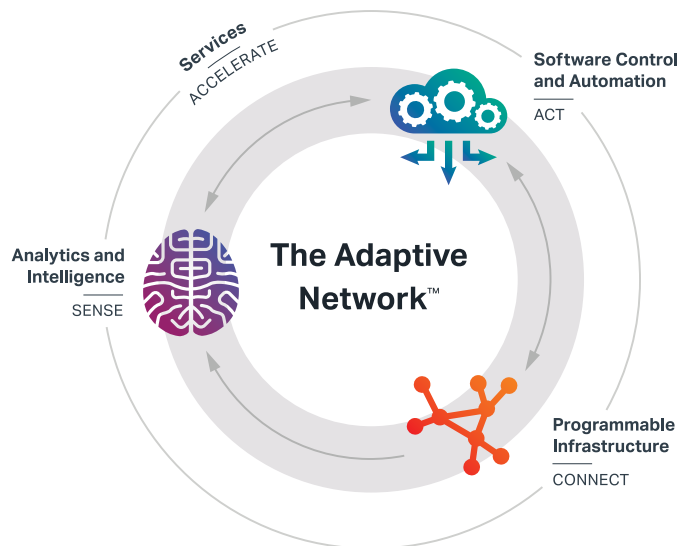


Figure 1. Foundational elements of the Adaptive Network

a pivotal role in its customers' networks and business strategies, Ciena has developed an understanding of its customers' needs that is unmatched in the industry. Ciena harnessed this knowledge and experience to articulate its Adaptive Network vision.

Implementing the Adaptive Network vision will take time. It will be an evolutionary journey of the service providers' current network itself as well as the associated operational processes. Each service provider will have a different starting point, depending upon their current network infrastructure, operations processes, market dynamics, and business objectives. To help its customers begin to understand how this vision can be operationalized within their network environments, Ciena has developed the Adaptive Network framework (Figure 2). The framework shows how Ciena is uniquely positioned to help customers make this journey successful, offering a broad portfolio of hardware and software products and services uniquely designed to meet the requirements of the Adaptive Network. Figure 2 maps the key products and services within Ciena's portfolio that are critical to enabling the Adaptive Network vision.

The following sections of this paper explain the importance of each of the foundational elements of the Adaptive Network. This explanation includes how Ciena has invested across its portfolio to provide increasing value at each step taken as service providers move toward and ultimately achieve a fully implemented Adaptive Network and all of the business value it provides.

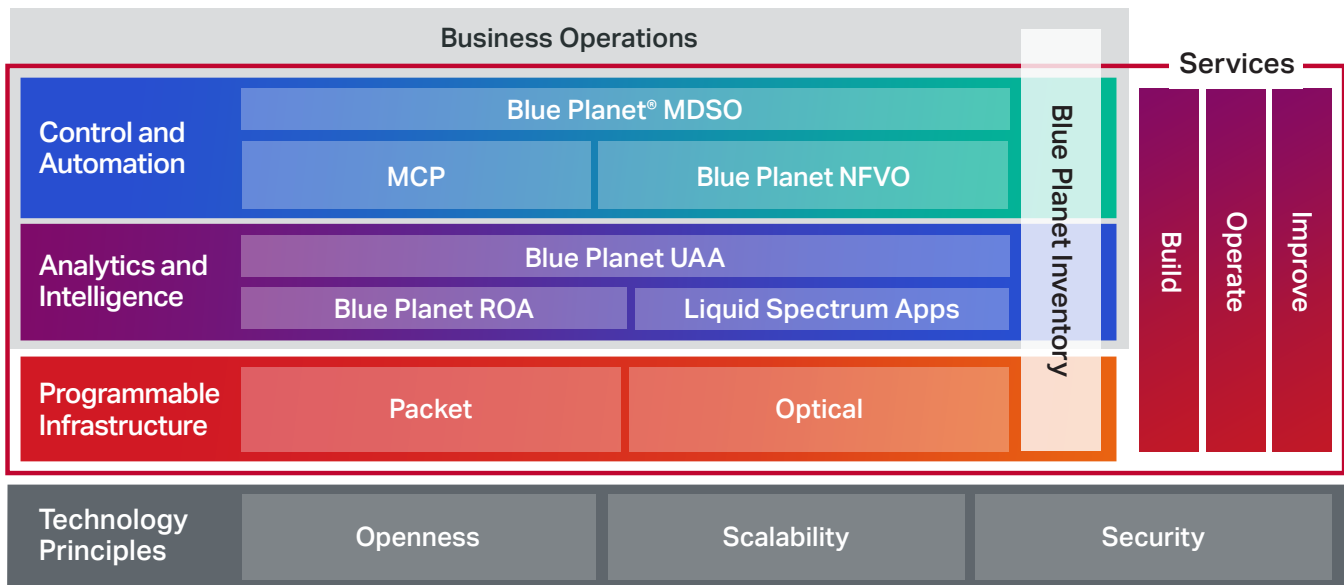


Figure 2. The Adaptive Network framework – Ciena's products and services enable the Adaptive Network vision

Programmable Infrastructure (connect)

Automation and analytics are critical to the Adaptive Network, but without the right infrastructure, these capabilities alone will not drive the intended business results. Achieving the level of scale and network responsiveness needed in the Adaptive Network requires a highly programmable infrastructure of both physical and virtual devices providing advanced network telemetry and tunable bandwidth to meet changing capacity needs.

This is a key differentiator for Ciena, as it continues to lead the market in programmable infrastructure innovation.

Ciena's packet and optical platforms offer the most advanced instrumentation in the industry, providing critical link and network signal performance data, and exposing this information through open APIs to Blue Planet® Unified Assurance and Analytics (UAA) applications or any other third-party analytics tools. This allows providers to drive better business decisions based on real-time network insights. Ciena was also the first to deliver a coherent modem that can tune capacity from 100G to 400G in 50G increments, allowing service providers to better match capacity to system margin—a capability is now enhanced with the introduction of WaveLogic™ 5, delivering tunable capacity from 200G to 800G in 50G steps. And it was Ciena that introduced the market to the concept of Liquid Spectrum™. Ciena's Liquid Spectrum solution combines highly instrumented, programmable hardware with advanced software applications to help service providers fundamentally change the way optical networks are designed, built, and managed. These are just some of the innovations Ciena has brought to market to

deliver the responsiveness service providers need to evolve to the Adaptive Network.

The following provides an overview of Ciena's platforms that are essential to achieving a more programmable infrastructure:

- WaveLogic Ai and WaveLogic 5 Extreme – programmable, intelligent coherent optics that can quickly adapt to new demands and optimize link capacity for any network path—with tunability from 100G to 400G and from 200G to 800G respectively
- WaveLogic Photonics – a reconfigurable, flexible-grid photonic layer that enables dynamic rerouting of wavelengths across the network
- WaveLogic 5 Nano – family of 100G-400G footprint-optimized pluggable coherent optics that extend the scalability benefits of coherent technology to new areas of the network and enable high bandwidth connectivity to end-users and devices
- 6500 and Waveserver® platforms – feature open APIs and modern data models, such as REST and gRPC, for real-time network telemetry and measurement, as well as provisioning at scale
- Packet Networking portfolio – provides a broad set of open, programmable, purpose-built switching and routing platforms that leverage coherent pluggable optics for added simplicity and scalability. Network performance is enhanced through end-to-end control and planning using Ciena's Manage, Control and Plan (MCP) domain controller. Furthermore, extensive performance metrics allow network operators to ensure ongoing optimal network performance (such as latency, QoS, and Bit Error Rate).

- Ciena's Adaptive IP™ – a new and innovative solution providing essential IP capabilities required to support new and emerging use cases and applications, such as 5G and IoT. It allows providers to benefit from cloud-like scale, software-based virtualization, and intelligent automation for an overall simpler solution to manage and maintain. Ciena's streamlined set of disaggregated IP capabilities, coupled with open APIs and streaming telemetry, allows for leveraging a faster software-based innovation cycle for a more agile and programmable IP network, from access to metro.

Adaptive Network use cases
Learn more



Analytics and Intelligence (sense)

As providers face an explosion of data and demand across their networks, the implications may seem complex. But these challenges also have their benefits, as they grant providers access to a growing wealth of information that, if harnessed effectively, can help them make more effective decisions to optimize their network performance and deliver a better customer experience. Having easy access to all the information needed to accurately plan and optimize network resources can help providers meet both current and future demand, enabling them to anticipate potential network and service disruptions before they even happen, and even allow them to dynamically adjust network bandwidth requirements based on their customers' needs. These may seem like impossible tasks, but as networks evolve, such data-driven decision-making will become table stakes of service providers' survival.

As service providers evolve toward a more responsive and flexible network, Blue Planet allows providers to leverage powerful analytics and AI to mine insights from their networks and sharpen their competitive edge. The following outlines Ciena's analytics and artificial intelligence offerings:

- Blue Planet Unified Assurance and Analytics (UAA) – open software that leverages the latest innovations in AI and Machine Learning (ML) to provide unprecedented network insight, helping transform and simplify network and service assurance operations. The UAA suite includes multiple Assurance and AI Apps for optimizing network efficiency, such as Network Health Predictor (NHP) which can proactively identify specific areas of risk in multi-vendor networks to keep the network running smoothly, and Services Assurance which

provides dynamic modeling of relationships between multi-vendor application, physical, and virtual components to maintain a real-time view of the service topology.

- Blue Planet Route Optimization and Analysis (ROA) – software that uniquely combines routing, traffic, and performance analytics for real-time, path-aware operational monitoring to troubleshoot problems that can cause service disruptions. ROA gives service providers the ability to visualize and compute service paths across Layer 3 IP/MPLS networks, including real-time monitoring of the network control plane and overlay services, as well as automated calculation and configuration of Traffic-Engineered (TE) tunnels to optimize traffic.
- Blue Planet Inventory (BPI) federates operational data from the Programmable Infrastructure, as well as multi-vendor control and automation systems, to provide a unified view of all network and service resources across a provider's infrastructure. This inventory is informed with real-time network information, providing a "single source of truth" for the network to simplify critical business processes and enable intelligent automation of network services. This significantly lowers order error rates, accelerates time to revenue, improves network resource planning and utilization, and lowers OPEX and CAPEX.
- Liquid Spectrum Applications – integrated with Ciena's MCP software, these provide real-time visibility into network performance, eliminate several lengthy manual processes existing in optical networks today, and allow for proactive system optimization. Liquid Spectrum apps available today include:
 - Channel Margin Gauge – gives providers instant visibility into the efficiency of their networks and lets them know if they can run their deployed optics at higher capacities
 - Planning Tool Calibrator – accesses real-time fiber characterization data, which then feeds into planning tools to ensure optimal network designs, without all the manual-link engineering and spreadsheet-checking processes currently in use today
 - Bandwidth Optimizer – simplifies and accelerates wavelength turn-up through real-time monitoring and automation, providing users with optimal capacity, spectral assignment, and equipment needs based on service requirements.
 - Wave-Line Synchronizer - automates wavelength provisioning by matching transponder settings to the photonic line system reducing manual provisioning steps and eliminating associated human errors.

Software Control and Automation (act)

The operations environment for service providers is growing increasingly complex. While advancements like Network Functions Virtualization (NFV) and Software-Defined Networking (SDN) enable on-demand virtualized services, existing network management and static Operational Support Systems (OSS) lack the scale and flexibility to meet the requirements of these more dynamic network technologies. Simple automation techniques like custom scripting are often used to reduce repetitive manual tasks, but providers must look for more robust automation capabilities to reduce operational complexity and improve efficiency, at scale. To address these requirements, Ciena has invested organically as well as inorganically with multiple acquisitions to develop multi-vendor and multi-domain closed-loop automation, allowing service providers' businesses to run smarter and much more efficiently.

Deployed at more than 150 of the world's largest service providers worldwide, Ciena's automation capabilities are field-proven to help customers evolve to the Adaptive Network. These include the following:

- Multi-Domain and NFV Orchestration - Blue Planet Multi-Domain Service Orchestration (MDSO) allows service providers to rapidly create, deploy, and automate the end-to-end delivery of services across both physical and virtual networks. It provides a scalable and open software abstraction layer that enables seamless service automation across any mix of vendors and network layers, helping providers to eliminate management silos and drastically simplify network operations. Leveraging an agile, DevOps-style approach toward resource onboarding and service development, it allows providers to easily and rapidly incorporate new networking resources and bring innovative new services to market.

Blue Planet software is highly modular, with the ability to combine functionality into pre-packaged intelligent automation solutions designed to address common customer challenges. These solutions combine software and services to intelligently automate key operational processes (such as order-to-service, trouble-to-resolve, etc.) and deliver a quantified business outcome.

In addition, Ciena's MCP provides a software-defined domain controller for automating Ciena packet-optical networks and services. In addition to full FCAPS capability, MCP centralizes multi-layer network and service management and online planning in a unified interface enabling a strategic shift from

legacy network management to open, scalable software control that easily integrates into the service provider's business processes.

Technology principles that underpin the Adaptive Network

Evolving toward the Adaptive Network should not be undertaken without a full understanding of the technology principles that underpin this type of network evolution: openness, security, and scalability.

Openness is critical in the Adaptive Network to allow service providers choice in the technologies they can deploy to enable their network evolution. Providers that embrace openness will be able to select the technology solutions that best meet their needs in terms of operational fit, performance, power consumption, and telemetry, resulting in dramatically lower costs, increased agility, simpler scalability, and a network architecture that is highly flexible to take advantage of future innovations that may not be apparent today.

Ciena's vision of the Adaptive Network is directly supported by its technology investment strategy to offer customers the greatest degree of choice in how they evolve and execute their network strategies. This philosophy was introduced over nine years ago and has defined how the company approaches product development. As a result, through important design principles such as modularity and open APIs, Ciena can now address the broadest range of openness and consumption models in the market. For example, the company has delivered open interfaces that make packet-optical WANs more programmable and interoperable, including open APIs and open line system capabilities.

Ciena offers open tools and environments, like its Emulation Cloud™ and Blue Planet DevOps Tools, to enable its customers to add, design, and model services and simplify operations. And Ciena facilitates and participates in an open ecosystem across the industry—among both large and small vendors—to mix and match best-of-breed technology for any given customer architecture.

Security is paramount in the Adaptive Network to ensure it can remain responsive and flexible, to adapt to changing market dynamics. Service providers must consider the following security requirements as they evolve their networks:

- Ability to secure and protect the exponential growth in data traffic over the network

- Increased levels of automation and fewer manual processes require greater security measures to detect and mitigate security breaches
- More open, best-of-breed environments must be governed by security protocols to ensure the protection of data across heterogeneous networks

Ciena can help service providers mitigate data security risks through a set of capabilities designed to ensure the confidentiality, integrity, and availability of data in the network. Ciena provides a highly secure Programmable Infrastructure that ensures continuous protection of all in-flight data from unauthorized entities by combining always-on, high-capacity, wire-speed optical encryption with user authentication and intrusion-detection forensics. In addition, Blue Planet MDSO supports fast, seamless deployment of multi-vendor security Virtual Network Functions (VNFs), enabling providers to distribute and manage virtual security, network appliances (such as firewalls, IDPS, and proxy services) as needed, ensuring consistent security levels across the network. Blue Planet also provides sophisticated tools for managing network performance, orchestrating data flows, and analyzing network trends, helping service providers identify and react to potential cybersecurity attacks faster to minimize the impact of a security breach. In addition, Ciena is committed to securing its own business by protecting its information assets as well as those of partners and customers. Ciena delivers solutions confident in the security processes and controls that go into every design, deployment, and operation of a Ciena-enabled network.

Scalability in the Adaptive Network is required, as mobile device proliferation, streaming video, cloud computing, IoT, and the evolution to 5G will all put massive pressure on network capacity. Meeting the demand will require network capacity increases in orders of magnitude, as well as the need to respond to unpredictability in traffic patterns. The Adaptive Network must scale from both capacity and operational perspectives—transporting maximum capacity using minimal equipment to get the most efficiency from fiber assets and using software-based control to offer the ability to automate processes and adjust bandwidth in real time to meet changing customer and traffic requirements.

Ciena has designed its portfolio to meet the scalability required by the Adaptive Network. Ciena's industry-leading, programmable WaveLogic coherent optics allow providers to maximize capacity over existing fiber investments using minimal hardware, and operate alongside a flexible,

reconfigurable WaveLogic Photonics layer to flexibly adjust traffic paths as needed. In addition to a highly scalable programmable infrastructure, Ciena's Blue Planet software leverages a modular, micro services-based architecture to help service providers achieve software control and automation with greater scale, agility, and performance.

Accelerating the journey

Although technology plays a critical role in any network evolution, service providers also need a trusted partner with a consultative approach and the right expertise to navigate the ever-changing industry environment to proactively address unforeseen challenges and risks. This is where Ciena Services comes into play. Ciena Services brings the most experienced technical personnel and proven methodologies to any size network transformation, mitigating project risk and accelerating the journey toward the Adaptive Network.

Our Services portfolio is organized into three categories

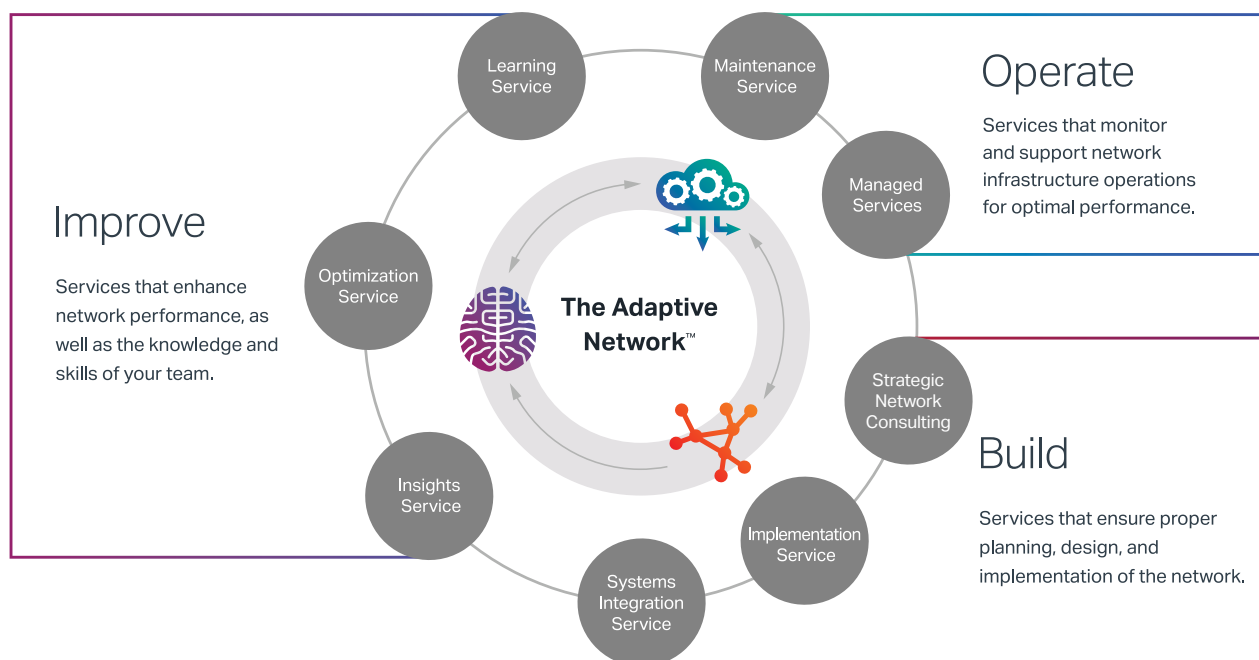
Build Services:

- **Strategic Network Consulting** - Our consulting experts leverage deep industry expertise, robust tools and a modernization methodology that has been proven in hundreds of network projects worldwide.
- **Implementation Service** - Ciena's Implementation Service offers expert planning, design, and deployment for building out Ciena-based networks, wherein Ciena takes responsibility—and offers full visibility—right from project initiation and management through successful deployment and testing, including complete on-site and remote support available globally.
- **Systems Integration Service** - Built upon Ciena's depth of expertise and experience in enabling some of the world largest and most complex networks, our Systems Integration Service provides multiple offers to help customers achieve their business and network goals. We work with customers to create a comprehensive solution to virtualize functions at their network edge and provide solution validation for customers as they upgrade and evolve their networks.

Operate Services:

- **Maintenance Service** - Provides highly responsive and proactive software and hardware support for our customers' operational networks, identifying potential issues ahead of time. Ciena provides highly trained and experienced engineers, access to Ciena's Global Technical Support team, 24X7.

Ciena Services



- **Managed Services** - Provides expert management of a provider's infrastructure from their own NOC facilities, following ITIL best practices for incident and problem management.

Improve Services:

- **Learning Service** - Ciena's Learning Service enables customers to learn, grow, and thrive through on-demand, virtual, and in-person training to boost skills and achieve strategic business priorities and drive better business outcomes.
- **Optimization Service** - This white glove service utilizes our professionals' expertise, networking insights, and predictive and prescriptive analytics to provide a proactive assessment of your network environment to understand and capitalize on current strengths, identify weak spots, and offer deep visibility to help you explore and prioritize opportunities for improvement.
- **Insights Service** - Our Insights Service offers a hosted solution that provides advanced and predictive network visibility and analytics in an Analytics-as-a-Service model. The service provides insight and easy-to-understand data visualization of the network from layers 0 through 2.

Having co-created some of the most complex networks in the world, there's no environment Ciena Services cannot transform, making them a critical component and an accelerating force in the journey to the Adaptive Network.

Conclusion

Users' ever-increasing expectations—and the technology breakthroughs that continue to feed them—have created an unprecedented level of pressure and complexity for today's service providers. Some strategic approaches suggest that complexity is the enemy, and that a fully automated network is the answer. Ciena takes a broader view, believing that a network—just like the humans who invented it—must grow smarter, more agile, and more responsive every day. Therefore, service providers must strive to achieve the Adaptive Network.

Ciena's Adaptive Network vision has been in the making for many years, starting with OPⁿ and the introduction of WaveLogic 3 programmable coherent optics in 2012, followed by WaveLogic Photonics reconfigurable photonic layer in 2014, then the introduction of WaveLogic Ai in 2016. These were followed by a series of key launches in 2017, including MCP, Waveserver Ai, and Liquid Spectrum. In 2018, Ciena continued its focus on the Adaptive Network with the introduction of Adaptive IP. Then came the announcement of Blue Planet Unified Assurance and Analytics, WaveLogic 5 programmable 800G and coherent pluggables in 2019, followed by Waveserver 5 in 2020. This track record of innovation demonstrates Ciena's ongoing commitment to helping its customers achieve greater automation, intelligence, and programmability in their networks. Ciena will continue to invest in and evolve its portfolio to deliver on the Adaptive Network vision.



Was this content useful?

Yes

No