



Ciena's Coherent Routing Paves the Way for True IP/Optical Convergence

How a purpose-built router equipped with coherent pluggables, optimized photonic line systems and a coordinated multi-layer controller achieves IP/optical convergence

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Key Takeaways

On any network, whether it's wireline or wireless, bandwidth consumption continues to rise at an unprecedented rate. Moreover, traffic patterns have become so erratic that traditional transport methods are not able to adapt. To tactically address this new reality, Ciena is completely transforming coherent routing by leveraging its decades of IP/optical expertise and innovation.

Ciena has introduced WaveRouter, a new platform architecture that is built on an open purpose-built router equipped with intelligent operating system software with performance data streaming, integrated with coherent pluggables, and augmented with optimized photonic line systems, for flexibility and programmability. Combined with the MCP (Manage, Control and Plan) coordinated multi-layer network controller, this open and disaggregated coherent routing architecture automates and simplifies network operations, scales, and evolves to adapt to erratic IP traffic flows, and fast-tracks sustainability by increasing reliability while providing a better integrated hardware/software experience than other metro routers.

Ciena's coherent routing paves the way for true IP/optical convergence

Although we've been talking about IP/optical convergence for more than two decades now, the concept has seen various views and opinions and, in the end, never materialized. The reality is that hop-by-hop transport architectures, which consist of forwarding chunks of data from node to node in a store-and-forward manner, has so far remained the most predominant approach of controlling the flow of data in the access. However, blending plugs in routers and hop-by-hop architecture was found to simplify networks and reduce cost, but only in situations that just needed point-to-point connectivity and demanded moderate capacity.

This is far from addressing today's world of unabated traffic growth and stochastic traffic patterns that characterize this post-pandemic era. Prior to the pandemic, the bulk of traffic occupied 4G and 5G mobile networks; during the pandemic, traffic moved to fixed broadband networks. Nowadays, as many people continue to work from home in many places in the world, traffic distributions and patterns have changed dramatically.

In addition, although 5G is still at an early stage, bandwidth consumption growth remains unabated and triggers erratic traffic patterns that require more and more any-to-any connectivity types of network architectures from access, edge, and backhaul to the metro core domain. As a result, transport and WAN aggregation networks need to evolve by converging the IP and the optical layers together through a novel approach known as true IP/optical convergence.

COHERENT ROUTING IS THE FOUNDATION OF TRUE IP/OPTICAL CONVERGENCE

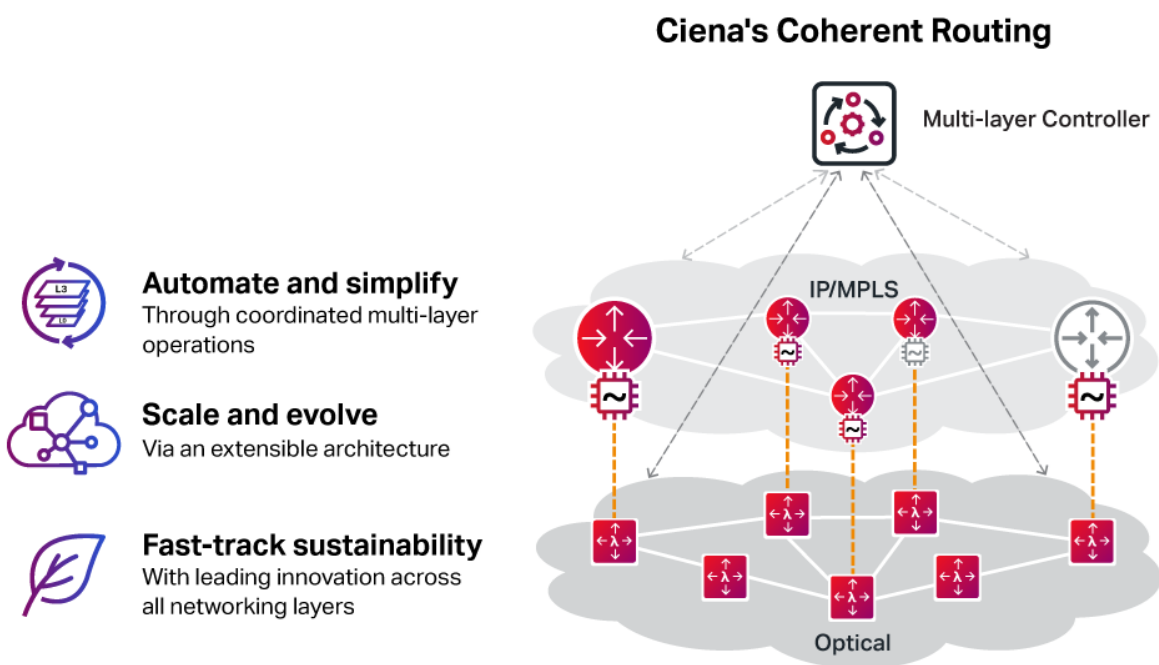
An effective coherent routing approach must have at minimum best-in-class routers, coherent plugs, and intelligent, flexible photonics. With that as a foundation, true IP/optical convergence is achieved by bringing together the latest in IP and optical technology innovation augmented with advanced multi-layer operations. In other words, IP/optical convergence is all about bridging the operational processes of IP and optical networks together, and that requires analysis, coordination, and control of the IP and optical layers of the network together to extract maximum value and efficiencies from all network layers.

IN 2019, CIENA LAUNCHED ONE OF THE INDUSTRY'S FIRST PURPOSE-BUILT COHERENT ROUTERS

Ciena's 5171 has now become a flagship coherent routing platform driven by its next-generation IP NOS (network operating system) for access and aggregation. This router addressed a broad range of use cases to extend the 100G edge and deployment options, including outdoor cabinets for harsh environments. Not stopping there, Ciena introduced additional purpose-built coherent routers: the 8140, 8190, and WaveRouter for the metro and paved the way to achieve

true IP/optical convergence through a coherent routing approach. The latter goes beyond routers simply equipped with coherent plugs and boasts intelligent flexible photonics along with coordinated, multi-layer operations delivered through advanced software control and automation. It's worth adding that coordinated multi-layer operations consist of analyzing, coordinating, and controlling the IP and optical layers of the network to extract the maximum value and efficiencies from all network layers. Figure 1 illustrates the principles of coherent routing to achieve true IP/optical convergence.

Figure 1: Ciena's coherent routing and true IP/optical convergence



Source: Ciena

Metro networks need to be designed for multi-layer convergence, to support any-to-any high-capacity routing and switching metro applications. Ciena's newest coherent routing platform, WaveRouter, delivers the first instance of true IP/optical metro convergence, using multi-dimensional, ultra-high metro capacity, and multi-layer awareness control leveraging four major capabilities of Ciena's comprehensive IP/optical portfolio:

- Purpose-built router hardware and operating system
- WaveLogic™ 5 Coherent Optics
- Optimized photonic line systems
- MCP (Manage, Control and Plan) multi-layer network controller

COHERENT ROUTING STARTS WITH A ROBUST PURPOSE-BUILT ROUTER

The onslaught of new applications such as Ultra High Definition (UHD) video streaming, the Internet of Things (IoT), Artificial Intelligence (AI), Augmented/Virtual Reality (AR/VR), and mobile gaming overloading networks drove the need to rethink the routing domain. The need for cost-effective advanced platforms that are fully programmable, scalable, disaggregated, and Software-Defined Networking (SDN)-ready, and which support open interfaces and stream real-time telemetry quickly emerged. These purpose-built routers have the right speeds, feeds, switching capacities, form-factors, environmental attributes, and power supply options to address all the various unique requirements from access to metro, whether it's 4G to 5G mobile network evolution, business services, cloud, Fiber Deep, broadband, or edge computing applications.

Finally, Ciena's purpose-built coherent routers are based on an Adaptive IP™ approach, and designed to be open, automated, and lean. Ciena's Adaptive IP combines routing and switching technology with performance analytics and intelligent automation software to improve flexibility, scalability, and faster time-to-revenue—providing a more future-proof IP network architecture, from access to metro.

THEN, PURPOSE-BUILT ROUTERS ARE INTEGRATED WITH COHERENT PLUGGABLES

These routers are integrated with Ciena's WaveLogic 5 Nano 100G-400G coherent pluggables, which are available in both interoperable and high-performance variants enabling network providers to benefit from pay-as-you-grow modularity and allocate the capacity and performance needed for their network links.

These include 100/200G pluggables for access, interoperable 400ZR and ZR+ for metro DCI and extended reach point-to-point links, as well as higher performance 400G pluggables compatible with existing metro ROADM networks.

ADD OPTIMIZED PHOTONIC LINE SYSTEMS FOR FLEXIBILITY AND PROGRAMMABILITY

Ciena's flexible, self-configurable photonic underlay is used to ensure a converged network can easily extend to new locations and evolve to support future generations of coherent technology. With embedded instrumentation and programmability, Ciena's intelligent photonics support application-responsive networking to unleash ultimate scalability and flexibility when managing IP traffic flows.

AND FINALLY, MANAGE, CONTROL AND PLAN (MCP)

When combined with MCP's software-defined control and analytics, Ciena's Coherent Routing provides a converged, highly scalable network that can adjust capacity based on demand in the most cost-effective manner. Ciena's Coherent Routing coordinates, simplifies and automates

network operations across layers, which is fundamental to unlocking the efficiencies of network convergence. With coordinated, multi-layer operations, Ciena's MCP Applications provides rapid lifecycle management and quick accurate planning which ensures the best path design and performance with the right equipment and protocols.

Additional cost efficiencies are gained through MCP's open APIs that enable automation of converged IP and optical operational workflows throughout the entire network lifecycle. To adapt capacity to demand and maximize the infrastructure return on investment (ROI), MCP's multi-layer analytics find potential capacity bottlenecks and, through software-defined control, fine-tune performance of network resources when and where they are needed to deliver the best possible customer experience. In addition to network performance optimization, unique features, such as multi-layer alarm correlation to affected customer services, significantly reduce troubleshooting time. And all of this is possible through a single pane of glass – using either the GUI or APIs. Working from a unified view of the converged architecture, network providers can reduce operational complexity to drive better network performance and deliver any-to-any connectivity to new locations in the network.

BOTTOM LINE: THE RESULTING PLATFORM AUTOMATES AND SIMPLIFIES, SCALES AND EVOLVES, AND FAST-TRACKS SUSTAINABILITY

Altogether, Ciena's IP and optical innovation has led to the realization of its Coherent Routing. Ciena's key components including its purpose-built routers, its WaveLogic 5 Coherent Optics, its optimized photonic line systems and its multi-layer (IP/Optical) awareness and control of high-power transport interfaces with MCP create an open and disaggregated coherent routing platform that:

- Automates and simplifies network operations through a coordinated multi-layer controller, which not only improves network performance but also generates significant cost efficiencies.
- Efficiently scales and evolves via an extensive architecture through Ciena's Adaptive IP approach combined with its WaveLogic 5 Nano 100G-400G coherent pluggables.
- Fast-tracks sustainability with leading innovation across all networking layers as Ciena's coherent routing produces higher reliability while minimizing the number of routers and coherent optics otherwise needed to perform the same task. In addition, this design eliminates manual provisioning and therefore leads to fewer errors.

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