WHITE PAPER

A Framework for IP/Optical Convergence: Building from Existing Networks

The communications landscape is fundamentally changing. Market dynamics associated with changing enterprise cloud as well as residential and data center connectivity are creating new use cases and exciting revenue growth opportunities for Communications Service Providers (CSPs). But from an IP networking perspective, these emerging use cases are also creating new challenges—driving new traffic patterns, the move to virtualized and distributed applications, and the need for higher bandwidth and lower latency connectivity to end-users. Many network providers are currently evaluating IP/Optical convergence as part of their IP network modernization strategy to address these emerging requirements and to achieve a more cost-efficient, resilient and unified network. What are the key elements required to realize the benefits of IP/Optical convergence? There is no 'one size fits all' solution, as architecture evolution needs to start with the CSP's current network reality. While the desired end-state vision is a simpler, streamlined converged IP/Optical network to accelerate service velocity and capitalize on new opportunities possible with 5G, IoT, and multi-access edge computing, there are many unique paths to get there.

What's happening in the market?

Consumer traffic flows are shifting heavily toward the home to support Small Office Home Office (SOHO), gaming, and e-learning. Furthermore, enterprises are accelerating their digital transformation and are moving toward Virtualized Network Functions (VNF) and cloud applications including Software-Defined WAN (SD-WAN) to reduce costs. Deployment decisions for 5G are beginning to pick up as operators evaluate xHaul upgrade options and plan their evolution from 4G to 5G.

These market shifts are driving traffic toward the edge of the network. From an applications perspective, this means computing power will need to move from being centralized to becoming distributed. Applications will continue to become virtualized as they move closer to the edge of the network to reduce latency and improve Quality of Experience (QoE) for end-users. This will require cloud service termination and peering points closer to the edge of the network.

As a result, many service providers are in planning discussions now about the creation of new metro and edge cloud on-ramp access points. They are also exploring new technologies—all so they will be ready to support the new traffic flows and the potentially exponential number of new services they will have to deliver over the next several years. As they look to modernize their IP networks, they are evaluating IP/Optical convergence as part of their strategy. In fact, according to a recent study, 87 percent of providers view IP/Optical convergence as important or critical for their next-generation networks.[1]

Challenges with traditional network designs

Why change? A key challenge of traditional access, aggregation, and metro networks is their static design. Traditionally, separate access and aggregation networks were built to support different service types and Service Level Agreements (SLAs). Moreover, all traffic flows move from the access to the metro in a hub-and-spoke configuration, with all services entering the metro regardless of the end destination.

This architecture makes it challenging to insert applications closer to access and aggregation zones, resulting in the network being too rigid to support next-generation distributed services and

1 Source: Heavy Reading, "IP and Optical Convergence Survey", May 2021, n = 220