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Cisco Partner

Evolution to Routed Optical Networking

Benefits

Communication service providers operate critical networks during a health crisis or other events that create demand spikes to maintain business, education, or governmental operations from remote locations. These spikes, however prolonged, come in addition to the continual increase in demand to support streaming content, teleservices in health care, and to connect future 5G IoT enabled devices. Providers have traditionally relied on augmenting fiber and optical infrastructure to support mobile, business, and residential demand growth but this approach continues to be budget and labor intensive.

A new architecture is emerging and it stands to disrupt the way networks have been built for the past 10 to 20 years. This new network architecture effectively overlays the current optical switching layer and puts the switching functions back into the router layer which simplifies the management of the entire network. This is a new paradigm for many of the transport operators, but it may provide the best overall Total Cost of Ownership (TCO). Cisco refers to this new architecture as the Routed Optical Network.

New 400 Gbps routers are delivering massive increases in router scale and capacity, resulting in a significantly lower cost per bit router. At the same time, DCO optics have decreased in size and power consumption to the point that 400G DCO optics are now residing on a router card at much higher densities. The key attribute of the IP transport network is that with 400G DCO optics integrated into the router, the router network now provides the routing and switching functions for all network traffic. This new approach is made possible by recent evolution of silicon technology used in two main areas: Network Processing Units (NPU) used in Layer 3 routers, and DSPs used in coherent transmission optical interfaces.

Overview

Building a network that utilizes IP end-to-end will simplify operations by removing layers of translations and reducing the amount of redundant equipment needed to operate parallel networks. Additionally, with coherent optics, service providers will be able to build a 400GE converged hop-to-hop IP and optical network. This simplification eliminates physical devices in the network and allows for the introduction of automation to reduce the planning complexity for upgrades, expansions or changes on the network helping to lower operational costs.

With an end-to-end IP network and integrated 400GE optics, implementing upgrades or expansion plans are simplified with automation tools that allow network engineers to test configurations, or to model the traffic impacts on the network prior to activation. The automation tools can be integrated into all areas of the IP network and consume real time telemetry data to provide actionable intelligence or network status back to the engineers. By using automation in this fashion, network engineers can reduce service-impacting configuration errors and reduce the instance rate of unexpected traffic flow impacts that might result from implemented changes. This results in a simpler network that delivers up to 45% TCO savings and is more flexible to support new revenue generating services.

Whether expanding to a greenfield network or running across a third-party line system, Routed Optical Networking will simplify the network and enable a faster time to market for all types of services. It will also enable automation for key areas of the network, such as: planning, optimization, upgrade management, and maintaining all the network functions to build a true software defined network. The real-time information of node state and condition is coupled with pre-determined trigger mechanisms for managing and optimizing service routes. The path computation, orchestration, and management toolkits that form the automation ecosystem that are open, programmable, modular, operationally ready, and consistent with existing practices.

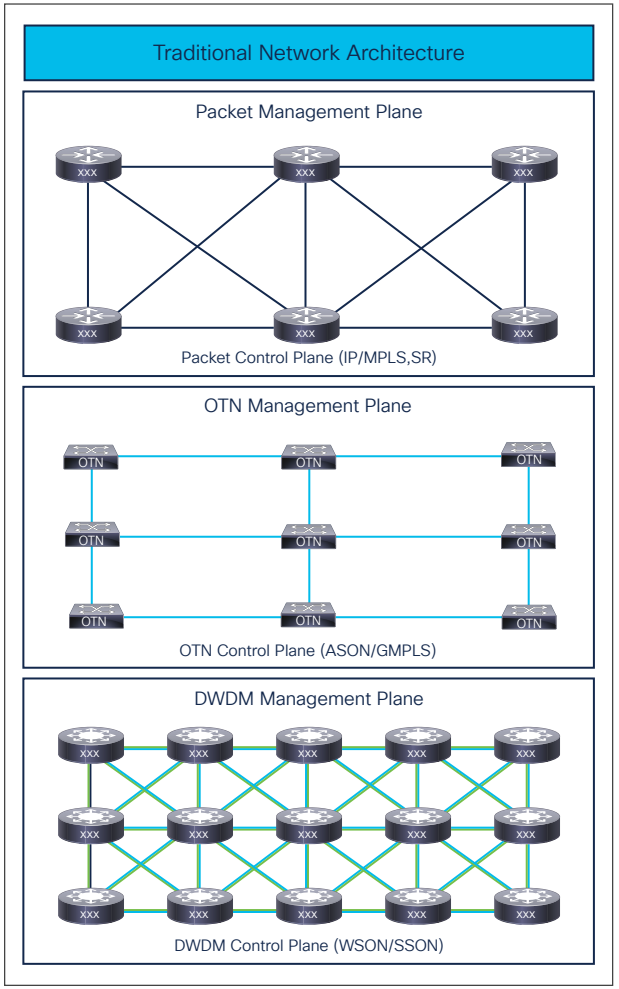

Figure 1. Traditional networks have three layers to cover the IP to Optical transition

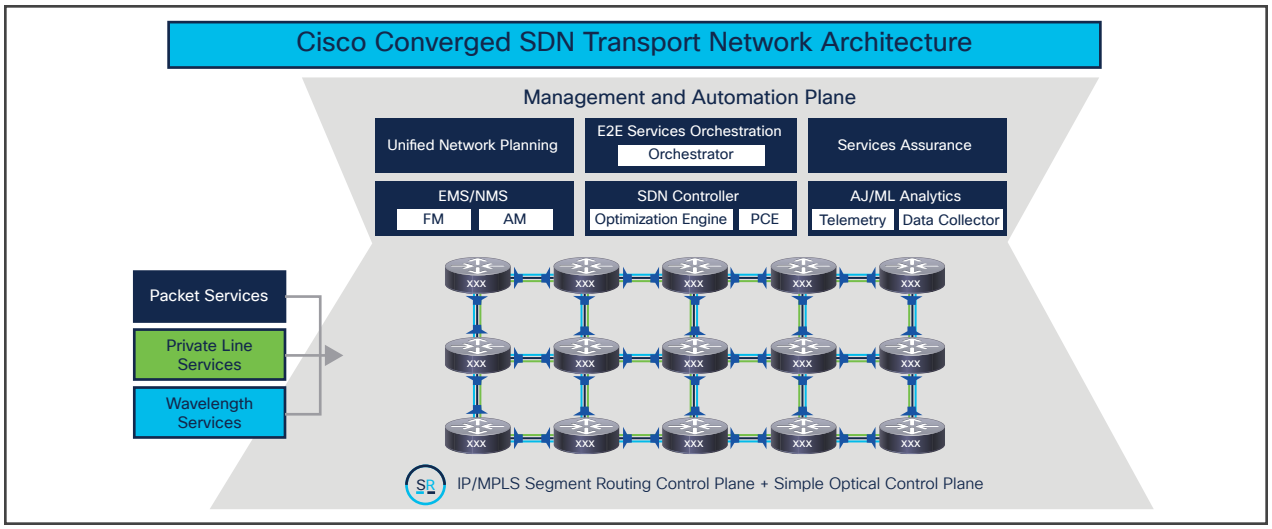

Figure 2. Cisco Converged SDN Transport Network Architecture

What it does

The Routed Optical Networking within the Converged SDN Transport framework transitions networks from the siloed infrastructure to a new architecture that relies on a single control plane based on IP/MPLS in a converged hop-to-hop IP and optical network. This drives significant simplification and cost savings. It addresses the complexities and redundant networking layers that present bottlenecks to scalability and enables end-to-end automation in the communication service provider network infrastructure through:

- Assimilation of any Time-Division Multiplexing (TDM) and wavelength services into Private Line Emulation circuits to ensure against latency and improve resiliency of high revenue services
- Direct integration of high capacity optical interfaces (coherent) directly on the routing devices without density penalties that existed in IP over Dense Wavelength-Division Multiplexing (IPoDWDM)
- Full hop-to-hop IP routing architecture characterized by a single networking/switching layer in the IP domain and simple point-to-point optical infrastructure with or without the cost and complexity of Colorless Directionless Contentionless (CDC) Reconfigurable Optical Add-Drop Multiplexers (ROADMs)
- Single, routed optical networking across IP/routing and optical transport infrastructure for:
  - Unified capacity and network planning
  - Path optimization
  - Service assurance, inventory and element management

The result is a single network infrastructure that can be planned, designed, implemented, and operated as a single entity through network automation.

Network automation can also help with optimized utilization of fiber capacity, so providers get more out of their fiber assets. Segment Routing Path Computation Elements (SR-PCE) and other network orchestration or path optimization tools can be used to ensure maximum utilization on existing capacity to lower the instance of overbuilding the network.

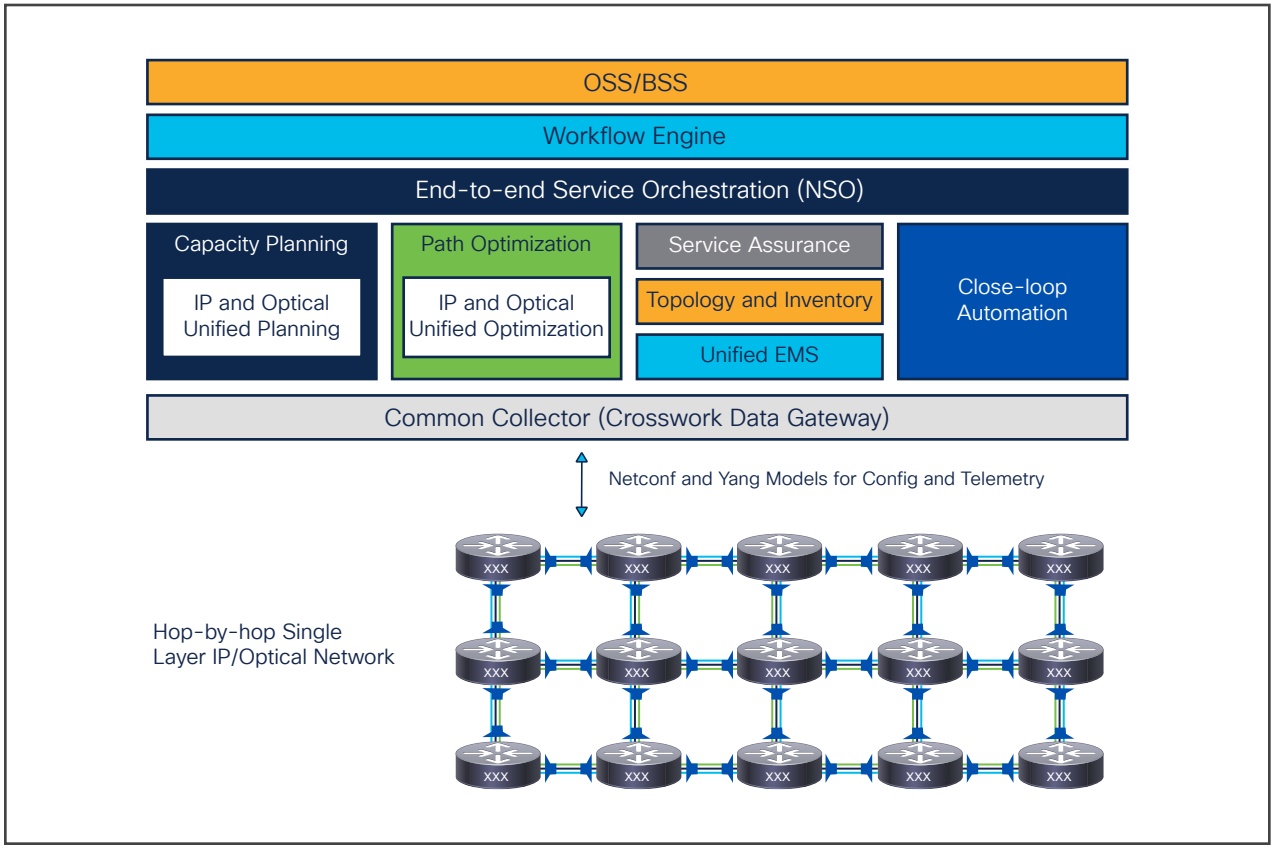

Figure 3. Routed Optical Networking offers a simplified architecture that integrates with OSS and automation tools for reduced operational complexity

Conclusion

Attempting to meet the bandwidth and performance demands of your customers with constant capacity upgrades will erode your margins and significantly increase the complexity of your transport network. Building a Routed Optical Network as part of a Converged SDN Transport framework can help you meet these challenges with a simplified network architecture and operations process. Using network automation tools will improve the utilization, resiliency and flexibility of your network while helping to control costs.

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