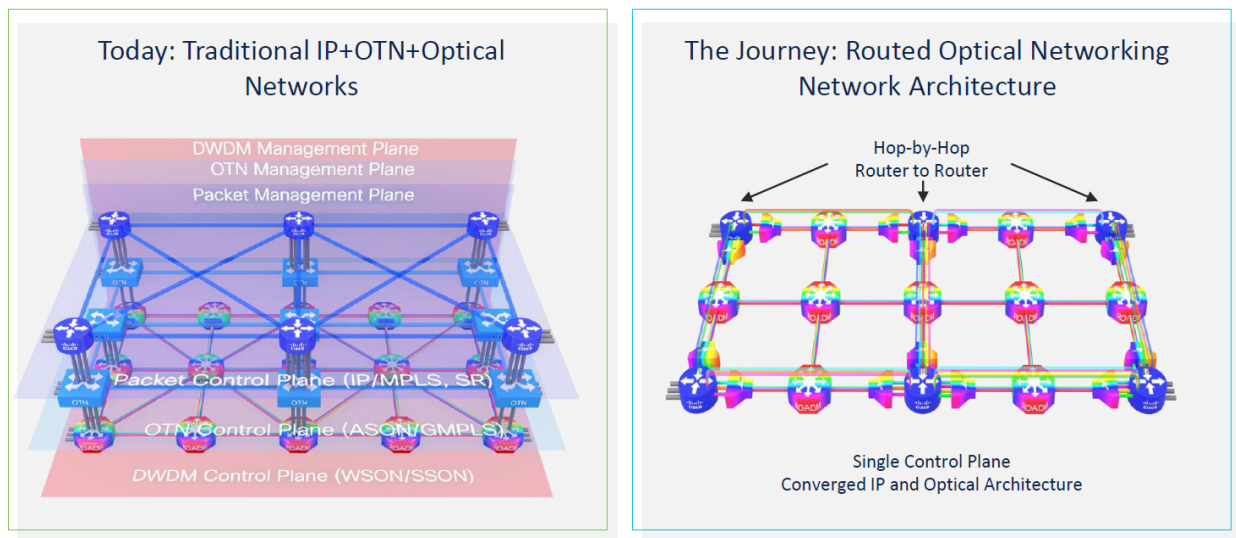## 4 Steps to Help Your IPoDWDM Adoption

What is IP/Optical Convergence

At its most basic, IP/Optical convergence refers to the streamlining and simplification of networking layers, in particular optical (Layer 0) and IP (Layer 3).


Source: Cisco

As an example, Cisco used the 2021 edition of its annual Cisco Live! event to unveil Routed Optical Networking, a Cisco brand of IP over DWDM (IPoDWDM), a new router-based network architecture that sees optics integrated into routers to simplify the network, save costs, and enable better IP and optical layer integration.

IPoDWDM New Innovation Trends

To support the IP over DWDM development, there are some important innovation trends the industry is working on:

- Optics in router such as QSFP DD 400G ZR/ZR+, 400G-capable DWDM wavelength, Coherent Optics, OTN supported, router & switch port direct pluggable, 120km reach, standards based, game changing in price, performance, density and usage
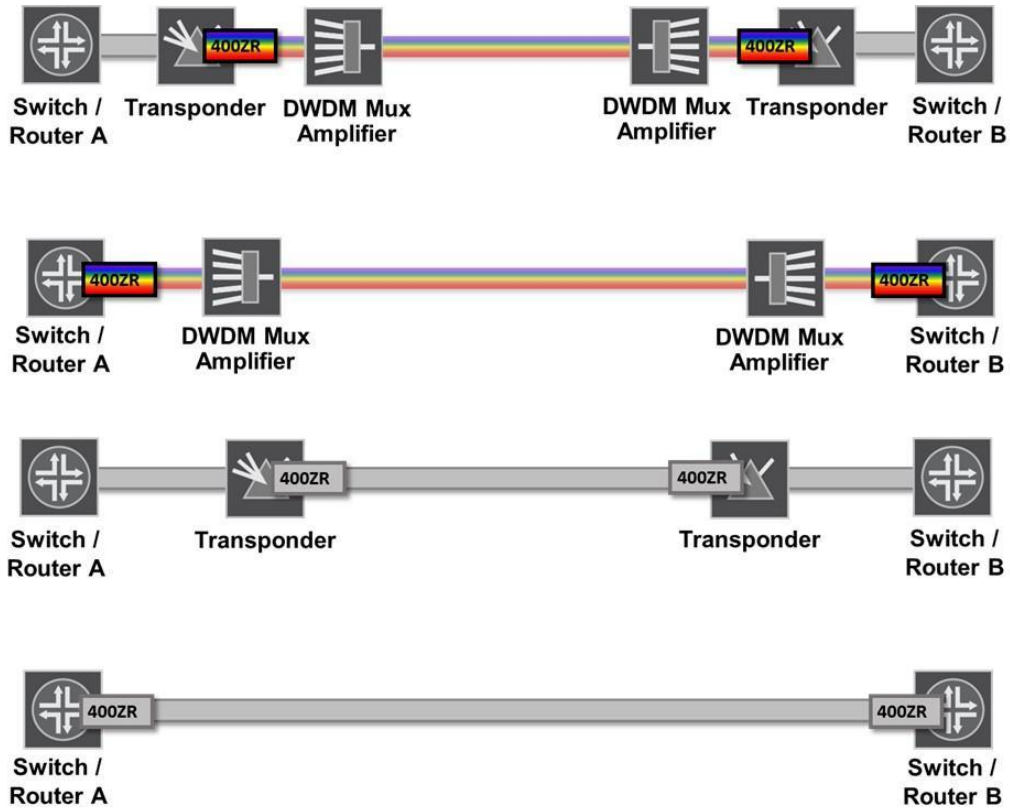
QSFP DD 400G ZR/ZR+ optics usage in IP/Optical network

- Multilayer Automation: Standards based, multi products, multi vendor, API centric programmable software defined network(SDN), multilayer (IP+Optical) planning, design, provision, management and operation
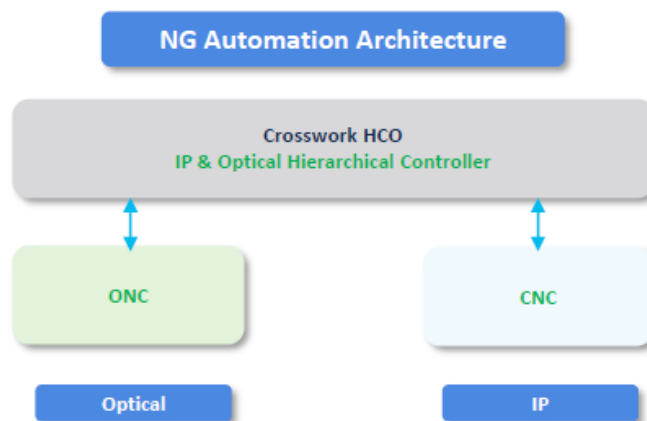
Source: Cisco

- Private Line Emulation: hop-to-hop IP network is lack of committed/dedicated resources from A to Z, also lack of traditional payload type support including SONET/Fiber Channel/OTN, but that's the OTN network's advantage. With the emulation, the IPoDWDM network can utilize OTN optical network's advantages to support constant network load, timeslot allocation, as well as transparency, but also utilize IP network's advantages to improve bandwidth usage by consuming bandwidth only when the customer is sending data.
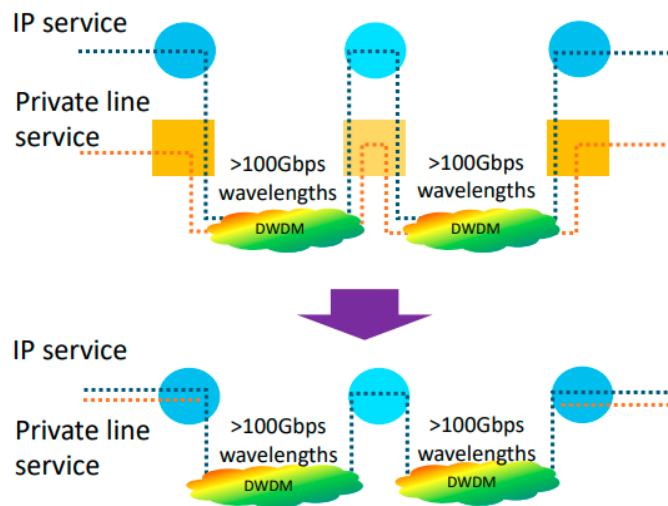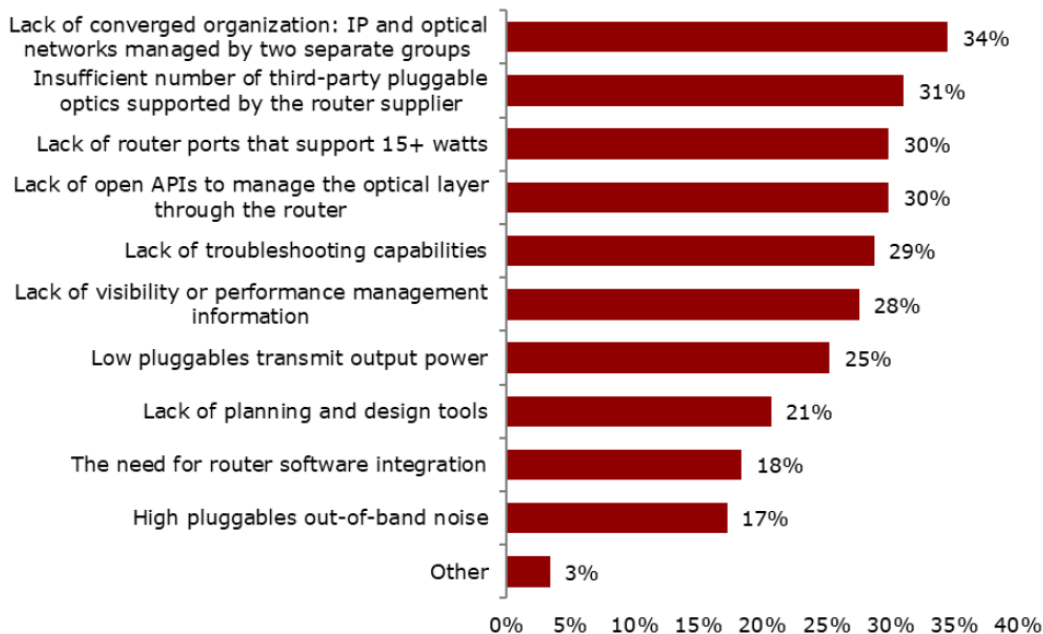

Private Line Service support in IPoDWDM network

Top Barriers to IPoDWDM adoption

The technical trends are clear, that network infrastructure owners are thinking about, or evaluating, or planning on this network evolution strategy, not only service providers, but also enterprise companies and various originations with network infrastructures.

Light Reading, the leading digital media platform, has performed a site survey this year, to collect the top barriers to IPoDWDM adoption: use coherent DWDM pluggables in routers and switches, it described the current obstacles that widely exist and covers many technical and non-technical aspects. Most barriers rely on the whole industry to make efforts to resolve, especially equipment/optics vendors and organizations for Standardization, but the top one still comes from the internal side: people and process and platform.

What are the top barriers to coherent DWDM pluggables adoption in routing/switching products (IPoDWDM)?

Barrier	Percentage
Lack of converged organization: IP and optical networks managed by two separate groups	34%
Insufficient number of third-party pluggable optics supported by the router supplier	31%
Lack of router ports that support 15+ watts	30%
Lack of open APIs to manage the optical layer through the router	30%
Lack of troubleshooting capabilities	29%
Lack of visibility or performance management information	28%
Low pluggables transmit output power	25%
Lack of planning and design tools	21%
The need for router software integration	18%
High pluggables out-of-band noise	17%
Other	3%

Source: Light Reading, 2022

4 Steps to Help Your IPoDWDM Adoption

Based on the above introduction as well as the rich experience of IP over DWDM projects and rich experience to manage IP over DWDM networks. The below 4 steps are summarized to help your IP over DWDM adoption.

Network Assessment

It is important to take an overview of the current network, in order to plan for the future. Whoever performs the new network design needs to digest the existing network first to secure a feasible and smooth migration from the current network to the new network. A network assessment is always the 1st step, and having an experienced consultant and service company can always be helpful to handle it professionally and thoroughly.

There are certain ways to perform the assessment:
- o Gather the current running and operation info: remote access the NMS management platform, or simply running customized data gathering scripts
- o Gather the current design and engineering documentation
- o Gather the services and traffics details, via digesting the configuration file and technical workshop discussions

o Perform site surveys to gather the rack and space resource, power capacity availability, distance and current infrastructure status, etc.

o Perform Fiber Characteristic Testing on OSP fibers, to gather the fibers availability and performance, in order to make the proper fiber splicing or patching plan

o Finally, analyze the gathered data, wrap up the professional assessment report to support the next step, design/planning as well as hardware/materials procurement and network deployment

Design and Planning

Traditionally, IP network design and Optical network design are handled by different groups and peoples in the telecom market and enterprise market. Different technical skill sets are required to handle the design and planning tasks:

- For IP network design: layer2 and layer3 features, MPLS/IGP/BGP protocols, IPv4/IPv6 addressing and subnetting, ACL/QoS/Security features, etc.
- For Optical network design: optical topology, wavelength plan, ROADM/Amplifiers usage, dispersion compensation, etc.

IPoDWDM requires a better angle to understand both IP and Optical technologies, provide an overview from the architecture side, analyze the TCO and follow market trends. This is required in order to design and plan a future network oriented, and to support a long term business strategy.

The actual design can be divided into 3 pieces:
- ❖ Architecture Design: adopt the right technology
- ❖ High-Level Design: support the hardware and software procurement
- ❖ Low-Level Design: support the engineering deployment and migration

Deployment and Migration

The traditional network deployment is divided into IP network deployment and optical network deployment. While the IP network focuses on device configuration and L2/L3 features provision after rack and stack installation. The optical network focuses on network commissioning and circuits grooming after the rack and stack installation,

which highly rely on the physical fibers connection wellness and OSP fibers' performance.

The IPoDWDM network deployment and migration needs the combination skill sets on IP layer and Optical layer in one team. The team needs to understand optical layer signal flow and channel performance, as well as routing protocols and VLAN usage and traffic control.

Service requires traditional engineering service experts to handle:
- ✔ Logistics/Warehouse/Staging
- ✔ Installation/Test Turn-up
- ✔ System Testing
- ✔ Network Cutover
- ✔ Circuits Migration
- ✔ Project Management
- ✔ Engineering Documentation
- ✔ Knowledge Transfer/Training

Managed Service

Once the network goes live, it's important to ensure the network is running smoothly and minimize the failure risks and support the needed expansion and changes based on the business requirements. People, platform and process are the key factors to the success. If there is enough resources and ability internally, that's great. More and more customers feel like they need help, to build a new team, build a new process and integrate a new platform. Which is why resorting to external professional service resources is always a considerable way to go, which can be more reliable, less risky and lower cost.

The related managed services can be divided into 3 services
- ❖ NOC support: 7/24 for 365 days or NBD(next business day)
- ❖ Remote Engineering Support: most technical support tasks can be handled remotely, either via meetings or discussions, or RDP(remote desktop protocol) access for configuration and provision changes.

❖ Front-Line Maintenance: some field activities are still needed, either for routine operation support such as RMA replacement or field troubleshooting, or for specific project tasks such as cards adding/sites change, etc.

About Kore-Tek

We work exclusively with Routed WAN Transport and Optical Networks while offering architecture, integration, engineering, and managed services. Founded by engineers with decades of routing and optical networking experience under our collective belts, we are uniquely positioned to design, implement, migrate, support, and streamline transport networks for our partners and customers.

We were founded by network specialists who wanted to work on a faster, more efficient way to move information. People who knew they could do more to connect people, businesses, and industries together than what was being done through copper. So we created Kore-Tek, a WAN transport and optical engineering company, to offer the best possible WAN transport network architecture, integration, engineering, and managed services.

Because we work exclusively with transport networks, we can provide quality field engineering, and support expertise unmatched in the industry. We know how to fulfill the most demanding and complex projects so they go off without a hitch.

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