

## Cisco IP over DWDM Solution: Transport for the Approaching Zettabyte Era



### Building the Next Generation of Service Provider Networks

The Zettabyte Era is upon us. Cisco research indicates that the total volume of worldwide IP traffic is doubling every two years. By 2012, the world's IP networks will transport 44 exabytes of traffic – equivalent to 522 exabytes per year, or a little over half a Zettabyte – each month. This growth will be driven not just by an expanding user base, but by the emergence of a new generation of complex, highly personalized, bandwidth-intensive media applications.

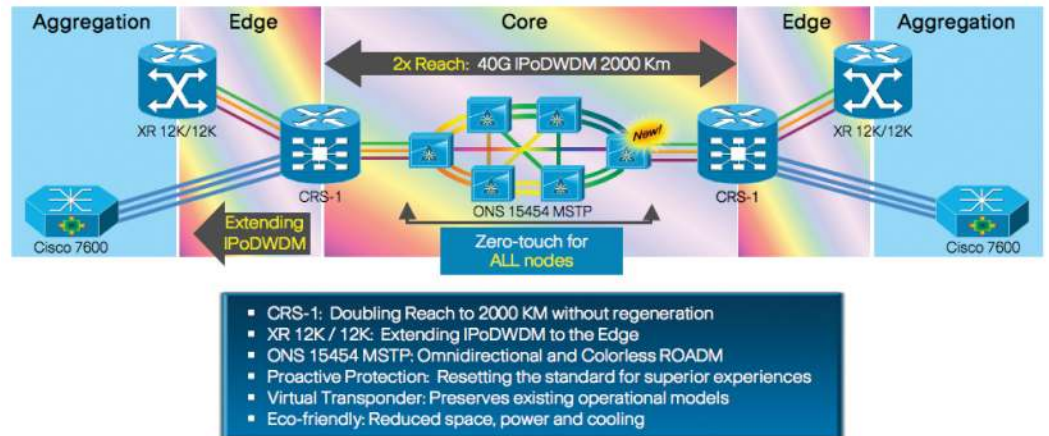
These trends are compelling service providers to rethink their approaches to core network architectures. How can network operators achieve the scalability to support the enormous bandwidth demands of the coming years? How can they extend intelligence throughout the network to deliver innovative services with superior quality? How can they move beyond the static optical networking model of the past to an environment that supports dynamic, end-to-end provisioning of any service, anywhere, any time? One architecture can make this vision a reality today: IP over dense wavelength-division multiplexing (IPoDWDM).

With the convergence of IP intelligence and DWDM transport technology in Cisco® IPoDWDM solutions, service providers around the globe are realizing:

- Significant capital savings by eliminating layers of transponders between IP and optical network layers
- Lower total cost of ownership through a simpler architecture with fewer network elements, remote manageability, and unprecedented wavelength flexibility
- Next-generation provisioning and protection capabilities through the integration of IP- and optical-layer intelligence

Now, Cisco is extending the value of its IPoDWDM portfolio even further with a suite of powerful new features that enhance scalability and efficiency, and fulfill the promise of infinitely flexible, end-to-end optical provisioning.

**Figure 1.** Resilient and Scalable IPoDWDM Transport Leadership – What's New



Cisco Carrier Routing System (CRS)



Cisco 12000 Series Routers



Cisco ONS 15454 Multiservice Transport Platform

### Extended Reach and Scalability with the Cisco CRS-1

The Cisco CRS-1 Carrier Routing System set the standard in IPoDWDM as the industry's first terabit IP routing platform to support International Telecommunication Union (ITU)-compliant tunable optical wavelengths, dramatically reducing capital expenses in core networks. Now, the Cisco CRS-1 also includes 40-Gbps interfaces that extend optical wavelengths to 2000 kilometers (km) and beyond with Cisco Raman amplification technology. This capability allows service providers to eliminate many regeneration sites and optimize fiber utilization by providing the capacity of multiple lower-speed wavelengths in a single, DWDM-ready, 40-Gbps wavelength. This exceptional reach and scalability makes Cisco IPoDWDM an ideal solution for emerging markets with dense urban centers separated by vast geographies – or for any environment that requires high scalability with low overhead.

### **IPoDWDM at the Edge with Cisco XR12000/12000 Series Routers**

Cisco XR12000/12000 Series Routers have long provided a highly scalable IP platform for points of presence (POPs) beyond core networks. Now, with the integration of 10-Gbps ITU-compliant tunable optical interfaces, these versatile platforms extend all of the cost savings and flexibility of IPoDWDM to the edge of provider networks. With the ability to extend mesh optical networks to the edge (and employ optical interfaces with 2000+ km reach), service providers can easily and remotely provision edge services without costly site visits.

### **Zero-Touch Provisioning with Cisco ONS 15454 Multiservice Transport Platforms**

The expanded Cisco IPoDWDM solution strengthens Cisco's leadership in IP transport with powerful new enhancements to the industry's leading DWDM platform. The Cisco ONS 15454 Multiservice Transport Platform (MSTP) leads the way in innovative optical functionality with omnidirectional add/drop multiplexing of wavelengths and color-independent ports. These capabilities provide unprecedented flexibility to remotely reconfigure wavelengths to any color or any degree in mesh networks and deliver true "zero-touch" wavelength provisioning.

### **Proactive Protection for Superior Customer Experiences**

Cisco IPoDWDM solutions provide unprecedented resiliency, setting a new standard for quality of experience in next-generation video and business applications. With the ability to integrate Layer 1 optical protection services with Layer 3 intelligence, Cisco IPoDWDM networks can recognize signal degradation as it occurs and dynamically re-route traffic before a failure, significantly reducing or totally eliminating packet loss.

This IPoDWDM proactive mechanism supports recovery in 15 milliseconds (ms) or less – more than three times faster than the industry standard of 50 ms established by SONET/SDH networks. And it allows service providers to switch optical circuits entirely at the Layer 3 level – eliminating the need to reserve unused Layer 1 bandwidth for protection.

### **Management Flexibility with Virtual Transponders**

The integration of IP and DWDM intelligence in Cisco IPoDWDM solutions allows service providers to manage both IP and transport services as a single system. However, for providers with separate IP and transport management infrastructures, IPoDWDM also supports virtual transponder technology, which segments element management based on function, not physical location, allowing each organization to maintain control over its environment.

### **Lower Carbon Footprint**

Cisco IPoDWDM architecture does more than simply lower capital and operational expenses. By consolidating and simplifying the network, it provides an eco-friendly alternative to conventional network architectures. Cisco IPoDWDM solutions:

- Eliminate multiple layers of equipment, including, in some cases, entire regeneration sites
- Reduce network footprint, power consumption, and cooling requirements
- Minimize the number of site visits required to service and provision the network, reducing overall carbon emissions

## Delivering the Next-Generation Network Today

The applications of the future will place extraordinary demands on IP and optical networks. Fortunately, new network technologies not only can meet those demands, but can provide groundbreaking capabilities to deliver services more flexibly and cost-effectively than ever before.

Combining a rich history of DWDM and reconfigurable optical add/drop multiplexer (ROADM) innovation with worldwide leadership in IP technology, Cisco is uniquely positioned to provide the ideal IPoDWDM solution and deliver on the promise of the IP Next-Generation Network. But Cisco IPoDWDM capabilities – including new levels of IP and DWDM convergence and highly flexible mesh provisioning – are not simply ideals for the future. These innovations are operating in service provider networks around the world today, and delivering real benefits in the approaching Zettabyte Era.

## Find Out More

To learn more about the Cisco IPoDWDM solution and some of the customers who are benefiting from this architecture today, visit: <http://www.cisco.com/go/IPoDWDM>

For more information about Cisco IP and optical platforms for service providers, refer to the following Websites:

Cisco CRS-1 Carrier Routing System

[www.cisco.com/go/crs](http://www.cisco.com/go/crs)

Cisco XR12000/12000 Series Router

[www.cisco.com/en/US/products/ps6342/index.html](http://www.cisco.com/en/US/products/ps6342/index.html)

[www.cisco.com/go/12000](http://www.cisco.com/go/12000)

Cisco ONS 15454 MSTP

[www.cisco.com/go/mstp](http://www.cisco.com/go/mstp)



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