



WHITE PAPER

DELIVERING CUSTOMER-CENTRIC SERVICES WITH MANAGED MULTISERVICE OPTICAL NETWORKING

Meeting customer demands for high-speed, highly available services with managed optical networking solutions.

EXECUTIVE SUMMARY

To support increasingly demanding IT initiatives such as business continuance, disaster recovery, storage networking, and Web-enabled applications, enterprise businesses need networks that provide superior performance and availability. The managed optical networks that Service Providers (SP) offer (via Cisco Systems® optical platforms) delivers highly reliable and secure networking for mirroring data applications and transmitting large quantities of data at high speeds. Cisco® multiservice optical solutions offer a distinct opportunity for these service providers, allowing them to provide the services their customers demand and differentiate themselves from competitors.

CHALLENGE

Today's businesses continually seek new ways to increase productivity and profitability, while protecting their organizations from competitive and other threats. They place increasing emphasis on IT initiatives such as business continuance, disaster recovery, and storage networking, as well as Web-enabled applications, such as e-commerce, distance learning, online collaboration, customer relationship management, and IP telephony. Carrying out these IT initiatives requires a high-speed, highly available networking infrastructure.

The networking challenges faced by enterprise businesses represent a compelling opportunity for service providers who can deliver the right set of robust, customer-centric services. Managed optical services are SP offerings where they install, manage, and maintain your network, in addition to providing a high performance, flexible, extremely available networking solution that's both cost effective and easy to manage. This paper provides the SP business decision manager with an overview of a variety of managed optical services and the technologies that support them. In addition, the paper illustrates how Cisco Systems multiservice optical solutions allow providers to offer the services their customers demand, creating a substantial return on investment (ROI).

Business Drivers for Service Providers and Their Customers

As large enterprise organizations evaluate their technology requirements, two primary priorities often emerge: business continuance and support for high-bandwidth applications. Preparing and protecting crucial corporate systems and data is a real and ongoing concern for any organization. The consulting firm Contingency Planning Research estimates that the average hourly cost of downtime can range from US\$89,500 for an airline-reservations center to US\$6.5 million for a large brokerage firm. Any business conducting geographically dispersed or e-commerce operations, such as a retail brokerage, credit-card authorization service, or reservation call center, is greatly exposed to the costs of downtime. To mitigate this exposure, enterprises require highly available networking solutions supporting demanding data center to data center connectivity requirements.

Most enterprise businesses have also started focusing on lowering costs and increasing employee productivity. To accomplish this, businesses are deploying more bandwidth-intensive applications, such as voice over IP (VoIP), video on demand (VoD), networked storage, distributed computing, remote backups (per financial industries required regulations), distance learning (for the education industry), medical imaging (for the healthcare industry), videoconferencing, and CAD/CAM applications (for global engineering organizations).

To meet the demands for highly available, high-throughput networks, enterprises, and other commercial businesses have slowly increased their deployment of managed services to connect data-centric corporate facilities. Managed services offer numerous advantages including the ability

to work with a provider that offers core competencies in design, installation, testing, and management of highly available metro and regional networks. By outsourcing network management to a service provider, an enterprise IT organization can keep its resources focused on its core competencies, maximizing productivity. In addition outsourcing to a SP will help you:

- **Manage Profitability**—Outsourcing helps you reduce your capital and operational costs, by paying a predictable monthly fee for services.
- **Manage Risk**—Cisco recommended managed optical services delivers best-of-class platforms and years of service provider expertise. Therefore the potential risk is minimal and comfort level is high.
- **Manage Business Flexibility**—You can take advantage of the latest innovations service providers deploy without incorporating the cost. Hence your network is flexible and your options are always open.

To deliver the customized services that today's businesses require, service providers have to create high-performance, service-driven networks. To maximize their ROI, they need a solution that helps them to deploy multiple services over their network infrastructure. And to achieve or maintain profitability, they need to reduce capital expenditures and operating expenses.

PREVIEW OF CURRENT MANAGED OPTICAL SERVICES

Service providers can offer a variety of managed optical services to meet a range of enterprise customer and application needs. Flexible optical services can vary in complexity from simple, dedicated TDM links to customized solutions that provide maximum performance that is adapted for very specific applications.

Private Line Services

Private line services are dedicated, point-to-point, fixed-bandwidth, nonswitched links between two customer locations. They may be used for voice or data applications, but the service provider may find it difficult to offer any added value, without Layer 2 or Layer 3 visibility.

Ethernet Private Line Service

Ethernet Private Line (EPL) service is a dedicated point-to-point connection from one customer-specified location to another, with guaranteed bandwidth and payload transparency end to end. With its wire-speed performance and VLAN transparency, the Cisco EPL Service offers an ideal solution for transparent LAN interconnection and data-center integration. While TDM and OC-x-based facilities have traditionally provided EPL service, the Cisco EPL Service also supports wavelengths, Ethernet over SONET/SDH, and dedicated Ethernet platforms interconnected via fiber.

Dedicated SONET/SDH Services

Dedicated SONET/SDH services typically present the first entry point into optical networking for many organizations. A dedicated SONET/SDH service provides high speed and high availability between locations. Speed options with these services range from 155 Mbps to 10 Gbps, and the services use carrier-class platforms and diverse fiber paths to enhance their full redundancy. Service providers or system administrators can configure a SONET/SDH as a point-to-point service or as a ring service connecting two or more buildings. In addition to offering very high speeds and near-continuous availability, SONET services use the existing service provider fiber, which metropolitan areas have readily available. This fiber lets organizations extend the reach of their networks to up to thousands of kilometers.

Storage over SONET/SDH

Offering low latency, combined with excellent reliability and availability, SONET and SDH networks provide an ideal infrastructure for services supporting storage networking requirements. With multiservice optical platforms such as the Cisco ONS 15454 Series, service providers can carry storage protocols such as Fibre Channel and FICON cost-effectively over either metro areas or regional distances, using the existing service provider fiber infrastructure. SONET and SDH networks are an excellent solution for organizations that require geographically dispersed data or data centers, either to meet evolving regulations or to implement good business practices.

Ethernet over SONET/SDH

Service providers have begun to offer metro Ethernet services over optical networks that provide the speed and reliability benefits of SONET and SDH networks along with the familiarity of the Ethernet LAN interface. During the past three years, SONET/SDH networks have made huge advances in their ability to support data traffic, starting with the introduction of the Cisco ONS 15454, the first SONET platform to support data transport. With the recent emergence of Resilient Packet Ring (RPR), the ability of SONET/SDH networks to carry data has taken another significant leap forward. The Cisco optical platforms offer the rich array of data transport features and functionality expected from one of the worldwide leaders in data networking. Some examples include:

- Cisco IOS® Management, which provides easy integration into existing enterprise environments using a familiar management platform
- Advanced switching and routing services
- Ability to support multipoint and multi-ring spans

Custom Optical Services

For applications and enterprises that have the highest throughput requirements, service providers use the latest optical technology to offer custom, managed solutions that provide private, high-speed fiber optic networks. These custom solutions are designed, engineered, and implemented to meet the specific requirements of the most demanding applications and enterprises. The solutions range from wavelength services, where an enterprise leases service provider fiber wavelengths to connect its dispersed locations, to completely private solutions that are designed, built, and managed for a single customer.

SOLUTION

Managed optical networks provide highly reliable and secure networking for mirroring data applications and transmitting large quantities of data at high speeds. With Cisco optical networking solutions, service providers can easily and cost-effectively deliver the benefits of optical networking to their customers through a growing portfolio of managed optical services.

Optical networking uses thin glass or plastic optical fiber to transmit information in the form of light pulses. It provides far more reliability and offers greater transmission capacity than conventional copper-wire networks. Service providers can deploy optical networking using a variety of standards and technologies, each of which has exceptional advantages.

SONET and SDH—Optical Transport Protocols

The most common optical transport protocol standards used are SONET and SDH. These protocols define the speeds, framing, and recovery schemes for optical transport throughout the world. SONET technology is most commonly found in North America, and SDH is prevalent outside of North America. Created for service provider equipment, SONET and SDH meet the needs of traditional voice traffic, where all

connections are high priority and traffic patterns are generally predictable. Other optical protocols, most notably in the enterprise environment, include Fibre Channel, FICON, ESCON, and other storage and mainframe transport protocols designed specifically for optical transmission.

Wavelength-Division Multiplexing

Wavelength-division multiplexing (WDM) is the ability to transmit multiple independent optical signals over a single fiber, helping it to act like multiple fibers.

In some ways, WDM is similar to a radio. WDM and radio transmit at specific frequencies and use finely tuned receivers to pick up only the intended signal. In optical networking, the transmission source is a laser, and the transmission medium is the optical fiber. On the other end of the fiber are multiple optical receivers that pick up only one optical frequency. Using WDM technology, an optical fiber can transmit numerous optical signals that are independent from one another.

Dense Wavelength-Division Multiplexing

Dense wavelength-division multiplexing (DWDM) is a leading technology for extremely demanding enterprise networking solutions. The word “dense” refers to the closeness of the technology’s signal frequencies to one another. DWDM typically supports all point-to-point and ring topologies, as well as transmission distances up to 200 to 300 kilometers. The technology can transmit over even greater distances using amplification techniques. Because DWDM is completely protocol-independent and transparent, it can carry any type of transmission, such as data and video, any transport protocol, including SONET and SDH, and storage protocols.

Most metro DWDM platforms support up to 32 protected, or redundant, wavelengths, providing enormous density and scalability. Organizations can further increase density using service aggregation. Service aggregation allows multiple service types per wavelength, as well as per fiber, for very efficient transmission. For example, the Cisco ONS 15530 can mix 10 ports of Enterprise Series Connection (ESCON), 4 ports of Fibre Channel, and 2 ports of Gigabit Ethernet—all over a single wavelength. This flexibility helps companies use all their wavelength and fiber capacity efficiently.

Cisco is On the Edge of Emerging Optical Technologies

Many service providers use multiservice SONET/SDH provisioning platforms (MSPPs) to meet the escalating demand for value-add services. MSPP has evolved from a TDM-based network element to a platform that supports additional interfaces, including DWDM, Ethernet/IP, and storage-area networking (SAN). These multiservice interfaces reside on the same platform or network element and share a common management system.

Cisco’s MSPP solutions provide higher levels of service density, which lowers the cost-per-bit delivered throughout the network. The lower cost-per-bit equation also improves sales revenue and reduces total cost of ownership for the MSPP platform. Make no mistake SP’s have begun to take advantage of numerous new technologies that promote efficient MSPP solutions.

Resilient Packet Ring

Resilient Packet Ring (RPR) allows you to offer multipoint-to-multipoint Ethernet over a SONET/SDH network. The technology is a developing standard that uses a SONET ring infrastructure for data transmission, while also providing support for TDM services. RPR delivers the reliability and bandwidth of optical networking together with the cost benefits and application support of packet-based networking.

Virtual Concatenation

Virtual concatenation (VCAT) dramatically increases the efficiency of Ethernet and SAN over a SONET/SDH infrastructure, which can allow service providers to accommodate more customers per metro area. As synchronous transport signals/virtual containers (STSs/VCs) are provisioned, gaps can form in the overall information flow. Virtual concatenation addresses this issue by providing the ability to transmit and receive several fragments as a single flow.

Link Capacity Adjustment Scheme

Link capacity adjustment scheme (LCAS) makes adding and decreasing bandwidth a simpler, safer task. It provides a control mechanism for increasing or decreasing the capacity without creating outages, and it helps service providers meet the forever growing bandwidth needs of customer applications.

Generic Framing Procedure

Generic framing procedure (GFP) is a standard data encapsulation scheme that allows service providers to aggregate many different client signals into a single payload. MSPP users can utilize their SONET/SDH circuits as one large channel, where all protocols can take full advantage of unused bandwidth.

The Cisco ONS 15454 MSPP provides support for these emerging technologies, allowing service providers to deploy advanced, flexible services to meet a wide range of customer requirements.

The Cisco ML-Series line card adds Layer 2 Ethernet switching and Layer 3 IP routing to an optical transport platform. It delivers multimillion-packet-per-second performance at Layers 1, 2, and 3, helping to enable dramatic efficiencies from existing SONET/SDH infrastructures. The Cisco ML-Series card's expansive and customizable quality of service (QoS) implementation particularly promotes service differentiation and enhanced resource efficiency. Additionally, the ML-Series supports RPR, VCAT, LCAS, and GFP.

The Cisco ONS 15454 SL-Series line card lets service providers deliver Fibre Channel and FICON over SONET/SDH infrastructures. It also includes built-in support for VCAT, LCAS, and GFP. Line-rate support for 1-Gbps and 2-Gbps Fibre Channel interfaces, and flexible interface options enable the SL-Series to deliver complete SAN extension solutions.

Figure 1 shows some of the Cisco emerging optical technologies described above.

Figure 1.

Cisco ONS 15454 Series Emerging Optical Technologies



WHY CISCO?

Cisco Systems is a leader in next-generation optical networking solutions, offering a complete end-to-end metro optical portfolio. Cisco helps service providers to implement high-availability optical networking infrastructures that support mission-critical applications and the demanding requirements of storage and other high-bandwidth applications. Cisco optical solutions deliver a wide variety of advantages, helping your customers to lower networking costs and increase productivity.

Solution leadership—Cisco delivers a complete, end-to-end solution for metro optical solutions, supporting a range of services such as voice, video, data, and storage while providing unmatched scalability and manageability.

Product and technology leadership—More than 1000 customers have deployed Cisco multiservice optical platforms, with more than 40,000 Cisco ONS 15454 units shipped to date. Cisco continues to bring innovation to the optical networking market, with advances in existing platforms, new product introductions, and integrated management capabilities. Cisco delivers unmatched support for storage-area networking, with market-leading interface densities and storage over SONET capabilities. Cisco also offers optical solutions that support advanced switching and routing features.

Market-Leading Interface Density and Flexibility—The Cisco optical portfolio offers the highest density of storage and Gigabit Ethernet service interfaces of any standalone metro DWDM platform in the industry. Cisco also offers extremely flexible platforms that deliver the multiservice capabilities service provider customers demand, including support for Fibre Channel, FICON, ESCON, GDPS, Ethernet, Fast Ethernet, and Gigabit Ethernet, as well as traditional TDM interfaces, from T1 all the way up to OC-192.

Ease of Integration into Existing Enterprise Environment—With management using Cisco IOS Software and CiscoWorks, service providers can easily integrate the Cisco optical data solutions into existing network environments.

Major Storage Vendor Certifications—Cisco optical solutions have achieved partner certifications from a number of major storage vendors including IBM, EMC, Hewlett-Packard, and Hitachi Data Systems, to provide standards-based and highly reliable business continuity and disaster recovery solutions. Therefore the SP does not have to waste valuable time certifying the Cisco optical solution.

Putting Multiservice Optical to Work

World-class businesses are already taking advantage of the benefits of multiservice metro optical networking. In fact, the Cisco Systems IT department depends on Cisco optical networking solutions provided by the local exchange company (LEC) to support its mission-critical WAN access in San Jose, California and other Cisco locations in the United States.

The Cisco Systems IT department provides support for the company's extensive internal and external networking infrastructure, providing support for voice, data, and video applications. Its largest 50-building MAN location in San Jose normally transports WAN-based traffic on OC-48 (2.488 Gbps) LEC-provided rings. As Cisco IT's legacy ring contracts neared their expiration, the company decided to upgrade its services to support new network applications, deliver superior bandwidth and network efficiency, and reduce costs. The Cisco IT department needed a solution that could support better use of provisioned bandwidth; ease circuit provisioning, moves, and maintenance; and improve availability. The solution would also provide a standardized campus telecommunications access strategy and establish a common setup between campuses.

SOLUTION

After examining several different service providers, Cisco awarded the contract to the incumbent LEC. The LEC is migrating Cisco IT's current OC-48 SONET service to an OC-192 SONET solution based on the Cisco ONS 15454 MSPP in the network core, providing more bandwidth and more service at a lower cost. The Cisco ONS 15454 provides a comprehensive suite of TDM and transparent wavelength service interfaces together with industry-leading performance and intelligence. The LEC also offered real-time network monitoring and security services based on its Cisco ONS 15454 capabilities. Its network operation centers (NOCs) monitors dedicated SONET networks for service degradation or failures on a 24-hour basis. To ease capacity planning, the LEC offers visual depictions of ring capacity during regularly scheduled account reviews or on a demand basis. Lists of active circuits are also available to network administrators using the Cisco Transport Controller for the Cisco ONS 15454

The new service offering will provide direct SONET access for 70 percent of Cisco campus buildings, and dramatically improved network performance throughout the company. Available bandwidth for Cisco data centers will increase by 400 percent and the overall bandwidth campus-wide by 30 percent. At the same time, it reduced the communications cost to Cisco Systems by approximately US\$18,000 per month.

FOR MORE INFORMATION

For more information about Cisco Managed Multiservice Optical Solutions, visit: <http://www.cisco.com/go/optical>

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