WHITE PAPER

MAXIMIZING BUSINESS PERFORMANCE AND RESILIENCE WITH MANAGED MULTISERVICE OPTICAL NETWORKING

INTRODUCTION

As the economy begins to move in an upward direction, businesses are recommitting themselves to driving productivity and increasing profitability, while protecting their organizations from any threats. To realize these business mandates, many large organizations are placing increasing emphasis on IT initiatives to both protect their business and drive it ahead of the competition. Business continuance and disaster recovery applications serve to protect critical systems and data, while Web-enabled applications enable companies to save costs, generate additional revenue, increase employee productivity and customer satisfaction, and improve cooperation with partners.

For enterprises that are geographically dispersed, carrying out these IT initiatives requires a high-bandwidth, highly available, secure networking infrastructure. To accomplish this, organizations depend on two types of networks to connect dispersed corporate locations. Metropolitan-area networks (MANs) operate within a specific metropolitan area, and wide-area networks (WANs) reach outside of the metropolitan area to interconnect locations across the state, country, or even the globe.

For many enterprises, these critical networking infrastructures are no longer keeping pace with the new demands being placed on them. Traditionally, businesses have responded to bandwidth demands by incrementally adding bandwidth and services to their MANs and WANs. However, over time, this approach has resulted in complex, costly, and difficult to manage networks that offer limited capabilities. According to a 2002 IDC survey, 44 percent of all companies and 58.4 percent of large companies report bandwidth congestion at the WAN or LAN.

Many enterprise organizations are discovering that managed optical services provide a high-speed, high-capacity, scalable, and secure networking solution that is both cost-effective and easy to manage. Some are replacing their existing complex patchwork MAN/WAN networks with a managed optical service at a lowered monthly cost. With an empowering optical network infrastructure, employees, customers, and business partners alike can maximize the full potential of IT initiatives to meet business mandates—no matter where they are located.

ACCOMMODATING BUSINESS AND TECHNOLOGY NEEDS

As enterprises evaluate their technology requirements, two priorities often emerge—protecting critical systems and data, and driving productivity with Web-enabled and collaborative applications. Preparing and protecting critical corporate systems and data is a real and ongoing concern for any organization. Executives ask themselves, “Is my company prepared to recover from a disaster? Would my critical systems and data be available?” In most industries, downtime is not a viable option. Consulting firm Contingency Planning Research estimates that the average hourly cost of downtime can range from $89,500 for an airline reservations center to $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.

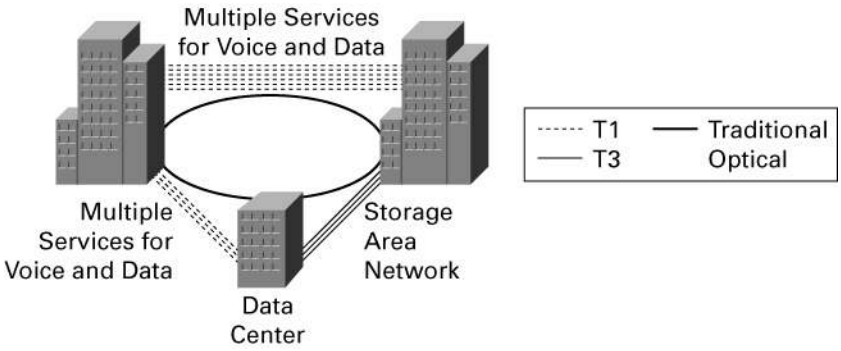
To increase productivity and customer reach, enterprises are deploying more Web-enabled and collaborative applications, including e-commerce, voice over IP (VoIP), video on demand (VoD), distance learning, and video conferencing. As deployment of high-bandwidth web-based applications expands, the demand for bandwidth grows in response. According to the same IDC survey, 37.9 percent of all companies and 41.6 percent of large companies report bandwidth congestion that affects Internet access.

Emerging Technology Challenges

As organizations protect their critical systems and data and deploy new high-bandwidth applications to increase productivity, they are encountering numerous challenges. Most obviously, they face an increasing demand for bandwidth and need near-continuous access to critical business systems and data. At the same time, they face a mandate to lower network costs and to reduce complexity. To respond effectively, the networks connecting office sites, operations, and data centers must offer scalable, high-performance bandwidth, be highly reliable and resilient, and be cost-efficient as well.

Today, many enterprises use three common MAN/WAN strategies—dedicated T1 or DS-3 circuits, "data-centric" ATM and Frame Relay networks, and traditional optical solutions. These strategies lack multiservice capabilities, therefore it is common to see numerous redundant low-bandwidth networks, each supporting a different service requirement—one network for voice, one or more for data, and one or more for storage (Figure 1). This creates a patchwork of MAN/WAN solutions, each with a mix of diverse technologies, resulting in a complex, costly network that is difficult to manage and won't scale as the business grows.

Figure 1
Redundant Networks Lead to Inefficiencies



Each of these networks has its own service agreements, and each can involve different technologies, vendors, billing arrangements, and training and optimization requirements. The complexity can be costly. Companies need a single network technology providing a similar level of convenience that efficiently supports all data, voice, and storage traffic to minimize complexity and support throughput requirements.

THE BASICS OF OPTICAL NETWORKING

Originally designed for service provider voice networks, optical networking technology is rapidly expanding to business end users. Large enterprises now consider it the transport medium of choice for mission-critical networks, including those used for storage, data centers, campus, and metro-area networking, and demanding applications that require low latency and high bandwidth, such as videoconferencing.

Optical networking uses thin glass or plastic optical fiber to transmit information in the form of light pulses. It is far more reliable and offers greater transmission capacity than conventional copper-wire networks.

SONET and Synchronous Digital Hierarchy (SDH) 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. Originally created as service provider equipment, SONET and SDH meet the needs of traditional voice traffic, where all traffic is high-priority and traffic patterns are generally predictable. The other optical protocols used, most notably in the enterprise environment, include Fibre Channel, FICON, ESCON, and other storage and mainframe transport protocols designed specifically for optical transmission.

Resilient Packet Ring

Because they were designed for the characteristics of voice traffic, SONET and SDH are limited in their ability to efficiently carry "bursty" data traffic. Voice traffic typically has consistent, well-characterized usage patterns, but data traffic "bursts" as large files are transferred. To overcome these limitations, industry groups are proposing a new protocol for optical transmission called Resilient Packet Ring (RPR). Resilient packet ring takes advantage of the multiple quality of service/class of service features of data traffic, in addition RPR creates shared bandwidth, which can be oversubscribed to promote network efficiency. Unlike point-to-point voice traffic, data traffic is characterized by the predominance of point-to-multipoint and multipoint-to-multipoint transmission, which RPR efficiently handles. Resilient Packet Ring runs on top of SONET and SDH, enabling the efficient transport of data traffic on service provider networks.

Wavelength-Division Multiplexing

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

In some ways, WDM is similar to a common radio. WDM and radio both transmit at specific frequencies, and both use finely tuned receivers (filters) to pick up only the intended signal. In optical networking, the transmission source is a laser, or lasers (WDM), 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 WDM or DWDM is a leading technology for extremely demanding enterprise networking solutions. The "density" refers to the closeness of the technology's signal frequencies to one another. DWDM platforms typically support all point-to-point and ring topologies, as well as a wide range of transmission distances. The technology can potentially transmit over hundreds or even thousands of kilometers using proper amplification and dispersion management techniques. Dense wave division multiplexing is transparent and protocol-independent, in fact it can carry any transport protocol including SONET, SDH, storage protocols, data, and video. In enterprise applications, metro DWDM platforms are most commonly used to support high-density synchronous storage applications and the extension of campus Gigabit Ethernet and 10 Gigabit Ethernet networks over metro distances.

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 supports multiple service types per wavelength for

efficient transmission. For example, the Cisco® ONS 15530 can mix four ports of Fibre Channel, two ports of Gigabit Ethernet, and 10 ports of ESCON—with all of these services aggregated onto a single wavelength. This flexibility enables companies to efficiently maximize the carrying capacity of all of their wavelengths over a single pair of fiber, lowering the total cost of ownership and reducing equipment requirements.

THE BENEFITS OF A MULTISERVICE OPTICAL SOLUTION

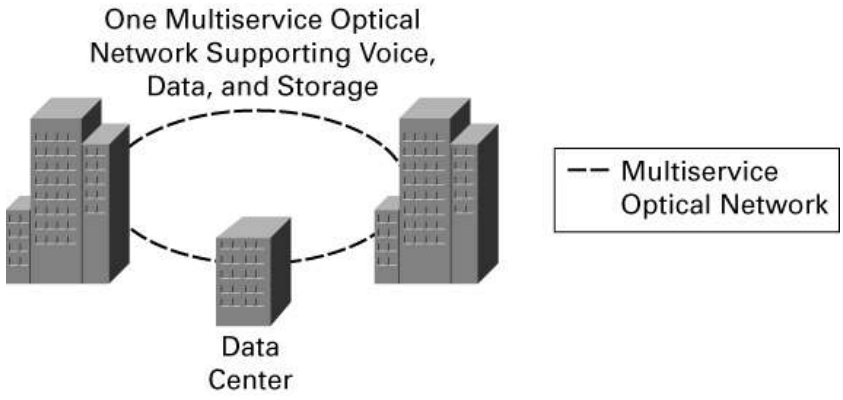
Many enterprise organizations are replacing their complex patchwork infrastructures with multiservice optical solutions. Multiservice optical networking takes optical networking to the next step in performance and service flexibility. The technology is often referred to as "next-generation" optical networking, reflecting the significant leap forward between it and traditional optical solutions. Multiservice optical networks provide support for an enterprise's voice, data, and storage needs, eliminating the need for redundant networks (Figure 2).

Multiservice optical solutions can not only reduce the complexity (and therefore the management cost) of a network, but can also lower monthly recurring leasing charges. As a company's network demands grow, there is a point where it makes economic sense to move to an optical service, rather than to lease yet another copper service such as a T1 line.

An optical solution does not eliminate the T1 services. Those familiar services still remain in place, but they now run over a central corporate asset—the optical service. For large organizations that have numerous T1s or T3s and increasing bandwidth needs to support Web-based applications, multiple data centers, or heavy data backup requirements, multiservice optical solutions offer numerous features and compelling economic benefits.

Figure 2

Multiservice Optical Networks Efficiently Consolidate Voice, Data and Storage Traffic



Unmatched Bandwidth and Performance

Today's optical systems can transmit data at speeds as high as 10 Gbps (per wavelength), compared with 1.544 Mbps for a T1 line or 45 Mbps for a T3 line. To put the speed of optical networking in perspective, a 10-Gbps optical link can transmit 20 gigabits of information—all 24 million volumes in the entire Library of Congress—in about 30 seconds. A T1 line would need more than two days to transmit this amount of data, and a typical dialup connection would require more than two months.

With this high-speed performance, many organizations can back up all the information they require in a timely fashion, and have additional bandwidth to support new business applications.

Optimal Resiliency and Recovery

With fully redundant systems and network paths, optical technology offers near-immediate recovery time in the event of network failure. For example, if a construction crew accidentally severed a buried fiber cable, traffic would switch to "failover," or redundant, fiber paths. These paths restore an optical network to full operation in less than 50 milliseconds, a disruption undetectable by the applications running over the network.

Reduced Complexity and Improved Manageability

Multiservice optical networking offers the ability to support multiple transport types, including voice, mainframe data, IP/Ethernet, and storage, all on the same platform and over the same optical service. This flexibility enables organizations to cost-effectively consolidate their existing multiple networks onto a single efficient multiservice network. Using a single multiservice optical network greatly reduces complexity and eases network management.

Optical solutions from Cisco Systems® offer unique advantages in terms of network management. Using Cisco IOS® Software and CiscoWorks enterprise management software, organizations can easily integrate Cisco optical solutions into their existing enterprise environments. After the optical equipment is deployed, network managers can provision services using the same Cisco management applications they have been using for years. Cisco optical platforms can also be managed using Cisco Transport Manager, a single cohesive application for provisioning and managing all Cisco optical platforms. This easy-to-use application simplifies management and accelerates deployment.

An Evolutionary Strategy for Network Convergence

Network convergence, or the ability to support multiple protocols on a shared networking infrastructure, greatly reduces network costs and complexity. One way to create a converged network infrastructure is by moving voice, storage, and data traffic to a single IP-based network. Although many organizations recognize the benefits of converged networking, many are not yet ready to migrate to an all-IP infrastructure.

Multiservice optical networking enables an organization to reap the benefits of network convergence by providing a unified network infrastructure that supports voice, storage, and data transport, without requiring the move to IP-based protocols. This enables an organization to continue to use in-place equipment and operations investments, yet achieve the cost benefits of convergence today, before a complete migration to IP.

THE ADVANTAGES OF A MANAGED SERVICE

Organizations that are migrating to a multiservice optical networking solution can choose from three deployment options. They can deploy an optical solution themselves if they own their optical fiber or have fiber available to lease. They can work with a systems integrator or service provider who will design and install the solution, while owning or leasing the fiber themselves. Or they can choose a managed service, working with a service provider who will perform all the design, installation, and testing, as well as ongoing management.

Each option has specific benefits. Organizations that choose to manage their networks exercise a great degree of control, but are also responsible for network administration, provisioning, and upgrades. For many enterprise companies, a managed service provides a more compelling set of advantages, and enables the organization to concentrate on its core business priorities.

Technical Expertise

In general, few enterprise IT organizations have expertise in optical networking technology. For service providers, however, optical expertise is a core capability. Service providers have trained experts on staff who can design and deploy optical solutions quickly and successfully, and provide 24-hour service. By outsourcing network management to a service provider, an enterprise IT organization can keep its resources focused on its core competencies, maximizing productivity.

Cost-Effectiveness and Scalability

Using a managed service can also help companies manage costs. Service providers offer numerous service options that enable an enterprise to take advantage of a "pay as you grow" approach. This flexible approach lets companies significantly reduce up-front costs as well as fixed monthly costs. Service provider service contracts are also much shorter than fiber leases—often only three years, compared to a typical fiber lease of 10, 15, or even 20 years.

Extended Reach

Another attractive advantage to working with a service provider is the provider's ability to offer a superior fiber footprint. Service providers' readily available fiber (both quantity and location) is essential for solutions designed for business resilience or support for growth. Service providers can offer cross-town or across-the-country connectivity with their fiber networks already in place.

This extended reach is critical for organizations that are adding new facilities. For example, many financial organizations are mandated to have secondary data centers a specified number of miles away from their primary data sites. A financial organization with an optical solution that is already on a service provider's network could simply tap into the provider's extensive fiber reach to choose its secondary data site.

OPTICAL SERVICE DESCRIPTIONS

There are two common optical services being deployed—dedicated SONET/SDH services, (storage over SONET/SDH and Ethernet over SONET/SDH) and custom DWDM optical services. Each of these services offer different capabilities and applications support (Table 1).

Dedicated SONET/SDH Services

Dedicated SONET/SDH services are typically the first entry point into optical networking for many organizations. A dedicated SONET or SDH service provides high-speed, high-availability, and secure transport between locations. These services are available in speeds ranging from 155 Mbps to 10 Gbps, and are typically fully redundant, using carrier-class platforms and redundant diverse fiber paths. They can be configured as a point-to-point service or as a ring service connecting three or more buildings. In addition to offering high speeds and near-continuous availability, SONET services make use of the existing service provider fiber, which is readily available in metropolitan areas. This fiber lets organizations extend the reach of their networks 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 data replication and business continuance solutions. With multiservice optical platforms such as the Cisco ONS 15454, storage protocols such as Fibre Channel and FICON can be cost-effectively carried over either metro areas or longer distances, using the existing service provider fiber infrastructure. Storage over SONET and SDH supports both synchronous and asynchronous storage applications, depending on the distance required. SONET and SDH networks are an excellent solution for organizations that require connectivity between geographically dispersed data centers, either to meet evolving regulations or to achieve good business practices.

Ethernet over SONET/SDH

Service providers are now offering metro Ethernet services over optical networks that provide the speed and reliability benefits of SONET and SDH networks. Since 1999, SONET and SDH networks have made huge strides in the 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 RPR, a new protocol defining standards for data transport over optical networks, the ability of SONET and SDH networks to carry data has taken another significant leap forward. Cisco's optical platforms offer the data transport features and capabilities expected from the world leader in data networking. Some examples include:

- Cisco IOS Software management, which provides easy integration into existing enterprise environments using a familiar management platform
- Advanced Ethernet/IP (Layer 2 and Layer 3) intelligence on its optical platform
- Flexible connectivity to support point-to-point and multipoint switched services as well as ring-to-ring spans

Custom DWDM Optical Services

Many service providers offer custom optical solutions for enterprise applications that have high throughput requirements. These custom services provide private, high-speed, fiber-optic connectivity, using the latest optical DWDM technology. The solutions are also designed, engineered, and implemented to meet the specific requirements of the most demanding enterprise applications. These solutions range from a mere wavelength service, (where the service provider hands off a wavelength connection at each end), to a completely private solution that is designed, built, and managed for a single customer. Cisco ONS 15500 DWDM optical platforms offer unmatched port density and scalability to support the most demanding storage applications.

Table 1. Managed Optical Service

Type of Service	Description	Typical Application
Dedicated SONET/SDH service	Interconnects separated LANs across a MAN or WAN	Connecting major operations centers, LANs, TDM, OC-3/STM-1 through OC-192/STM-64
Ethernet over SONET/SDH	Interconnects separated LANs across a MAN or WAN	Connecting major operations centers, LANs, VoIP, Ethernet, Fast Ethernet, Gigabit Ethernet
Storage over SONET/SDH	Interconnects separated SANs across a MAN or WAN	Connecting data centers, 1- or 2-Gigabit FICON/Fibre Channel
Custom DWDM and wavelength services	Interconnects separated LANs and SANs across a MAN or WAN; the ability to turn up additional wavelengths offers significant scalability	Connecting major operations centers and data centers; high-density services include 1- or 2-Gigabit FICON/Fibre Channel, ESCON, Gigabit Ethernet, SONET/SDH, digital video, ATM, and other protocols

PUTTING MULTISERVICE OPTICAL TO WORK (A CASE STUDY)

World-class businesses are already taking advantage of the benefits of multiservice optical networking. The experiences of two very different companies are highlighted here. First, read how InterContinental Hotels Group has deployed Cisco optical networking solutions to improve customer service through enhanced network reliability, while reducing network operating and local carrier expenses.

Then learn how Bank of America uses Cisco multiservice optical platforms to extend vital applications such as intelligent customer care and provide the needed bandwidth to quickly deploy new applications.

InterContinental Hotels Group

The second-largest hotel group in the world, InterContinental Hotels Group (IHG) manages 515,000 rooms in 3,300 hotels located across 100 countries. The global company owns such recognized brands as InterContinental Hotels, Crowne Plaza, Holiday Inn, Holiday Inn Express, and Staybridge Suites.

To manage its voice- and data-intensive guest services, reservation systems, and corporate business operations, IHG depends on its MAN network to provide connectivity between its Atlanta area locations. Network administrators moved to take action when they realized that the Atlanta MAN core, spanning 87 miles, was straining to handle existing operations and was incapable of handling projected future growth.

The IHG is located in a high-growth area, and its local access and third-party service providers were unable to provide additional voice and data circuits in a timely fashion, leading them to look for alternatives. The group also found that its separate voice, data, and storage networks were unnecessarily complex to manage, and dependent on numerous telecommunications vendors for contracts, billing, service, and support. The company realized it needed to redesign its MAN to accommodate its far-reaching telecommunications, data operations, simplify management, and lower cost.

Willard InterContinental, Washington, D.C.

Solution

The IHG selected a dedicated SONET managed service to connect all of its locations in the Atlanta area. The new network required a fully redundant ring with alternative routing. Their managed SONET service uses the next-generation, Cisco ONS 15454 Multiservice Provisioning Platform (MSPP), which dramatically decreases the time it takes service providers to provision and upgrade customer requests. Furthermore fewer devices are needed, which simplifies network management and decreases the resources needed to install, provision, and maintain the network.

"What really caught our eye was the ability to run Ethernet over the metropolitan-area network," says Allen Rensel, IHG's senior technical advisor for Global Networks. "This reduced our WAN complexity, and made it easier to extend support. If we have any network issues over the MAN, we just use standard Ethernet troubleshooting techniques." As a result of the redesign, Rensel can now deploy new circuits within days rather than months.

The solution also provided IHG with the scalability needed to add and extend data center applications. "The improved bandwidth opens the floodgate for us in terms of new corporate and Internet applications, speedier application development, access to disaster-recovery solutions provided by offsite disaster-recovery service providers, and the capability to add offsite processing," says Rensel.

And in addition to improved access, control, and bandwidth, Rensel is saving IHG money. "We use many T1 circuits, for which we used to pay a minimum of $125 per month each in local access charges. Now our network serves as the backbone for those circuits, and we are realizing a 90 percent reduction in T1 local access costs," says Rensel.

While Rensel has yet to fully quantify the improvement, he says the redesign improved the reliability and speed of the property management systems, reducing checkin and checkout times for guests.

Bank of America Corporation

Bank of America Corporation is the second-largest bank in the world, with offices in 150 countries. The company operates approximately 4200 U.S. banking centers, 13,000 ATMs, and an Internet Website used by seven million customers—more online users than any other bank in the United States.

To support its banking operations, the company's network was comprised of an Asynchronous Transfer Mode (ATM) network infrastructure interconnected with traditional T1 and T3 circuits, provided by a combination of local and long-distance carriers. The architecture posed several problems, including a dependence on different carriers, provisioning troubles, and a shortage of bandwidth. In addition, it used multiple parallel infrastructures for different service types, each requiring separate support and management efforts. The limited scalability and bandwidth made it difficult for the bank to deploy new initiatives such as a company-wide customer relationship management (CRM) application.

Solution

Using the Cisco ONS 15454 MSPP, Bank of America built a multiservice optical core network that connects 13 major operations centers using managed wavelength services. Local offices are tied to the 13 regional computer centers and corporate locations, creating a consolidated, high-bandwidth, high-availability networking infrastructure. As a result, Bank of America's WAN can now efficiently support consolidated voice, video, and data traffic—without encountering provisioning obstacles.

"Bank of America took advantage of the same economics that carriers take advantage of all the time," Cisco Regional Manager Jim Walsh explains. "Now the bank has the power to increase bandwidth by adding a wavelength any time the company wants to. This flexibility is critical to an organization such as Bank of America, which is a recognized technology and operations leader."

The Cisco ONS 15454 MSPP offers multiservice networking capabilities that support traditional voice requirements as well as data, and now storage. Bank of America created a smooth migration path (using the Cisco ONS 15454) for consolidating and removing time-division multiplexing (TDM) and existing private branch exchange (PBX) equipment.

"We are actually consolidating those older, in-place services onto the ONS environment with the goal of eventually moving those services to a complete IP environment," says Craig Hinkley, Bank of America's senior vice president of Network Architecture and Strategic Direction. "A multiservice optical network simplifies our operational model, simplifies capacity performance-management practices, and gives us one single infrastructure in which people need to train and become skilled," Hinkley explains. "Since it is IP-based, the skill sets available to support those environments are more readily available. Now, we have one integrated corporate asset to take advantage of."

With its unparalleled bandwidth capabilities, the optical network gives Bank of America the capacity it needs to add, extend, and scale applications quickly and inexpensively.

"Now we have this surplus of capacity that allows us to provide quick turnaround for new applications, even very data-intensive applications such as data replication. And when a business partner comes to us and says, 'I need to have this capability, I need to turn up this application and have data available at multiple locations,' I can say, 'Sure, we can do that,'" Hinkley says. "Our optical network reduces our time to market, giving us a technology advantage and, in some cases, a strategic advantage in the marketplace over our competitors."

CISCO: LEADING THE INDUSTRY WITH NEXT-GENERATION OPTICAL SOLUTIONS

In 1999 Cisco Systems introduced the first next-generation optical platform—the Cisco ONS 15454. Unlike traditional optical platforms, next-generation optical equipment can support data and now storage traffic natively, and is easy to deploy and manage. That market-defining product introduction was quickly followed by next-generation DWDM optical platforms, including the Cisco ONS 15540 and Cisco ONS 15530 solutions, which offer the highest density of storage and Gigabit Ethernet service interfaces of any standalone metro DWDM platform in the industry.

Cisco optical platforms are extremely flexible, delivering the multiservice capabilities enterprises need, 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.

Cisco continues to push the optical platforms market forward with two new interfaces on the Cisco ONS 15454— the SL-Series interface providing support for storage protocols, and the ML-Series interface offering advanced data routing capabilities. Another significant introduction on the Cisco ONS 15454 is support for integrated DWDM capabilities. Advancements are being made in the Cisco ONS 15540 and ONS 15530 solutions as well, including the ability to support extended distances for Fibre Channel/FICON and Gigabit Ethernet applications. This significantly increases distances supported for disaster-recovery solutions over a metro DWDM. With its ongoing introduction of market-defining technology, Cisco continues to drive the future of optical networking.

"Now we have this surplus of capacity that allows us to provide quick turnaround for new applications, even very data-intensive applications such as data replication.

Craig Hinkley
Bank of America
Senior VP of Network Architecture
and Strategic Direction

WHY CISCO OPTICAL SOLUTIONS?

Cisco Systems is the leader in next-generation optical networking solutions, offering a complete end-to-end metro optical portfolio. Cisco enables enterprises to implement high-availability optical networking infrastructures that support mission-critical applications and the demanding requirements of SAN and other high bandwidth applications. Cisco optical solutions deliver numerous advantages, enabling enterprises to lower networking costs and drive productivity:

Solution leadership—Cisco delivers complete, end-to-end, metro optical solutions, supporting interfaces for voice, video, data, and storage transport, while providing unmatched scalability and manageability.

Product and technology leadership—Cisco remains the leader in next-generation optical networking since the introduction of the Cisco ONS 15454, the industry's first multiservice provisioning platform. Cisco continues to bring innovation to the optical networking market, with advances in existing platforms, new product introductions, and integrated management capabilities. Cisco delivers the needed flexibility and scalability for storage area networking, with market-leading interface densities and storage-over-SONET capabilities.

Market-Leading Interface Density and Flexibility—Cisco's optical portfolio offers market-leading density for storage and Gigabit Ethernet services with their Cisco ONS 15500 metro DWDM platforms. Cisco metro platforms are also extremely flexible supporting 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. This flexibility continues with the ability to mix Fibre Channel, FICON, ESCON, and Gigabit Ethernet services over the same wavelength, maximizing the carrying capacity of the metro network.

Ease of Integration into Existing Enterprise Environments—Cisco optical platforms incorporate Cisco IOS Software and can be managed by CiscoWorks, which is widely deployed within the enterprise market. As a result, the enterprise gets a single management platform to manage its LAN, SAN, and optical network, which greatly simplifies network operations.

All Major Storage Vendor Certifications—Cisco optical solutions have achieved partner certifications for performance from all major storage vendors, including IBM, EMC, Hewlett Packard, and Hitachi Data Systems, providing standards-based and highly reliable business continuity and disaster recovery solutions.

To learn more about Cisco multiservice optical solutions, visit:
http://www.cisco.com/go/optical

Corporate Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-4000
800 553-NETS (6387)
Fax: 408 526-4100

European Headquarters
Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: 31 0 20 357 1000
Fax: 31 0 20 357 1100

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel: 408 526-7660
Fax: 408 527-0883

Asia Pacific Headquarters
Cisco Systems, Inc.
168 Robinson Road
#28-01 Capital Tower
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

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