



White Paper

Storage Transport—Cisco's Storage + Optical Advantage

Enterprises appreciate the cost and administrative advantages of consolidating storage platforms and deploying storage area networks (SANs). Evolving business requirements, however, underscore the need for high-density, high-speed, and low-latency networks that enable data center scalability and improve manageability while controlling IT costs. The Cisco® Storage + Optical solution provides the leading high-density and high-bandwidth solution for data center transport scalability as well as an intelligent transport solution for SAN extension. The recent addition of the Cisco MDS 9513 to the Cisco 9000 Family of storage networking products and added support for 4-Gbps and 10-Gbps Fibre Channel (FC) can now take full advantage of the 10-Gbps transport service offered by the Cisco ONS 15454 multiservice transport platform (MSTP).

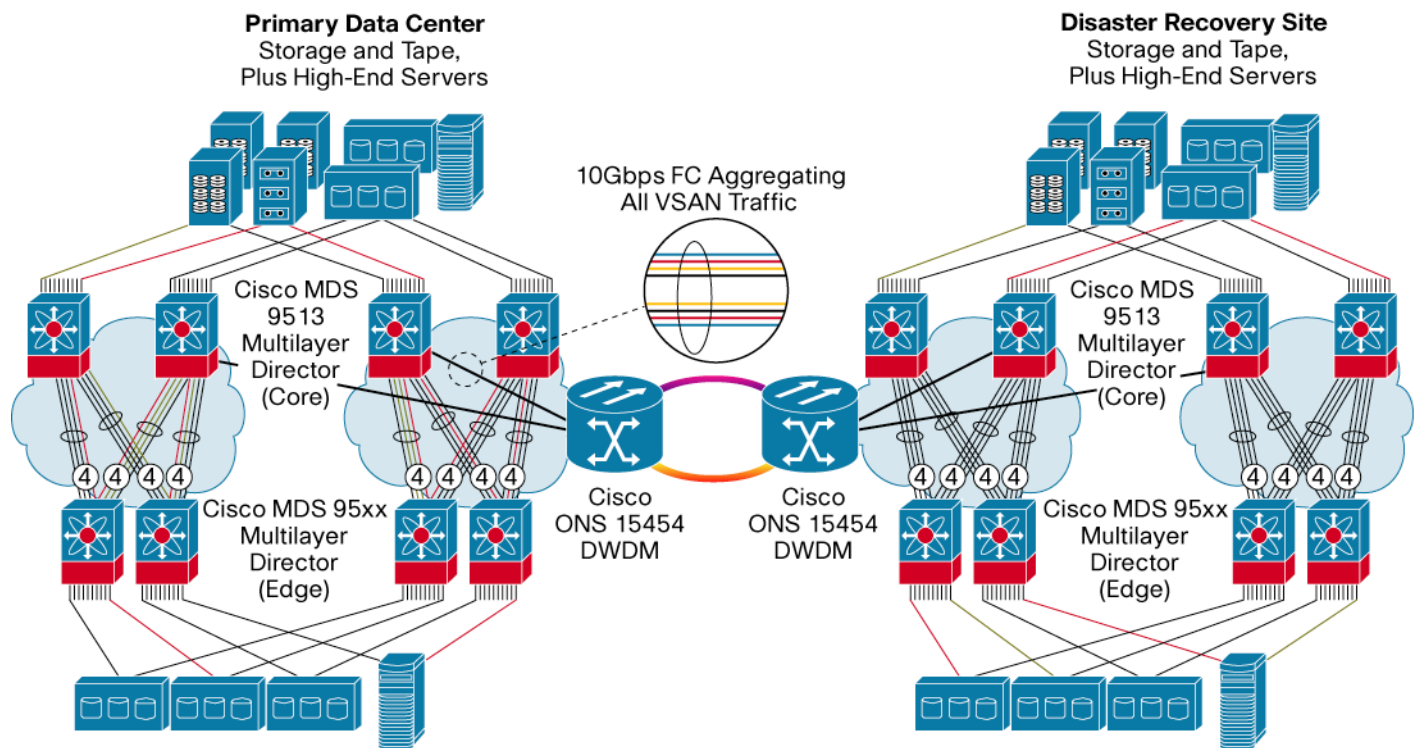
NEW CHALLENGES

The build-out of application- or department-based SANs is no longer viable, nor is 1-Gbps or 2-Gbps SAN connectivity sufficient to meet the needs of growing application server farms. Whether you need to back up growing amounts of data within a limited timeframe, increase volumes of database transactions, or support bandwidth- and storage-intensive applications such as those using various forms of imaging, these requirements all underscore the need for 4-Gbps and 10-Gbps Fibre Channel services.

CISCO STORAGE + OPTICAL: AN END-TO-END SOLUTION

The combination of the Cisco MDS 9500 Series of Multilayer Directors and the Cisco ONS 15454 Multiservice Transport Platform (MSTP) provides a complete solution for SAN scalability including the optical transport services needed in today's high-bandwidth, low-latency SAN environments. The 10-Gbps Fibre Channel modules for the Cisco MDS 9500 directors, along with Cisco SAN-OS 3.0 software, allows aggregation of 1/2/4-Gbps Fibre Channel services into 10-Gbps Fibre Channel pipes. These 10-Gbps pipes can then be transported transparently over 10-Gbps wavelengths provided by the Cisco ONS 15454 MSTP using DWDM services (see Figure 1). Supporting up to 528 Fibre Channel ports, including up to 44 10-Gbps Fibre Channel connections, the new Cisco MDS 9513 Multilayer Director redefines enterprise SAN scalability by meeting the most demanding connectivity needs of very large data centers.

Figure 1. DWDM Transport for Aggregated 10-Gbps Fibre Channel



In addition to the high port densities and bandwidth supported by the Cisco MDS 9000 Family, two Cisco technologies—virtual SAN (VSAN) and Inter-VSAN Routing (IVR)—make it possible to build very large and highly stable SAN fabrics, allowing you to consolidate multiple SANs onto larger, more cost-effective storage and optical infrastructure. VSANs are used to map previously isolated SANs onto a common physical infrastructure, in effect collapsing the switch fabric while maintaining per-VSAN management and control of each virtual fabric. The VSAN technology is analogous to the virtual LAN (VLAN) technology used similarly in Ethernet environments. Inter-VSAN Routing takes SAN scalability and manageability to the next level by creating a path for a device in one VSAN to communicate with devices in other VSANs without sacrificing fabric isolation and stability. This is a particularly useful practice in longer SAN extensions over DWDM services because the remote ends are able to communicate without a full merging of the storage environments. The aggregated VSANs can then be transported across a common 10-Gbps optical network as part of a business continuance and disaster recovery deployment.

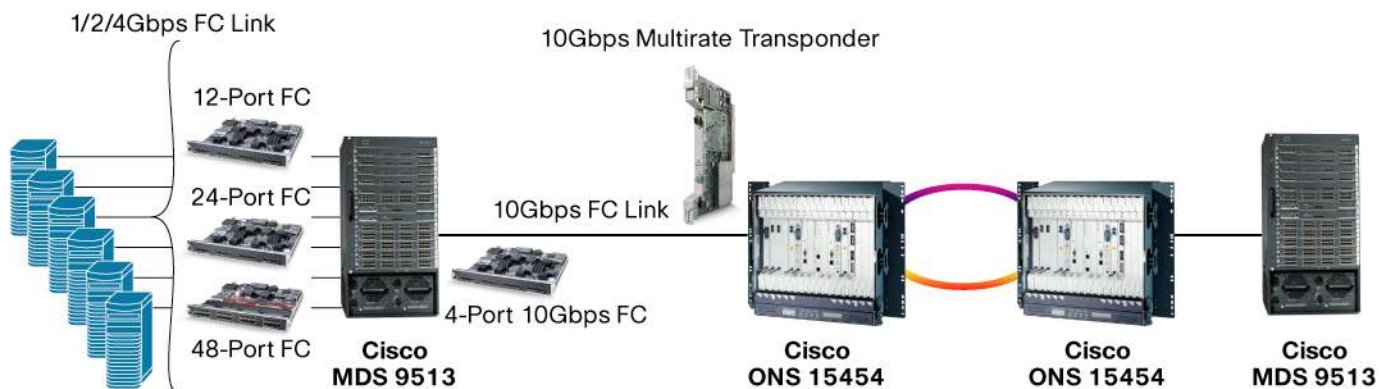
Note: The addition of 10-Gbps Fibre Channel support enables multiple VSANs operating across 1/2/4-Gbps Fibre Channel networks to be aggregated on to a common 10-Gbps Fibre Channel connection for cost-effective transport over distances using Cisco optical solutions.

The Cisco Storage and Optical solution offers significant advantages in terms of scalability and manageability of the SAN and optical transport network. Industry-leading port density combined with the enhanced Fibre Channel distance capabilities through enhanced buffer credit management services within the Cisco MDS 9000 and Cisco ONS 15454 platforms lowers the per-bit cost of transporting storage traffic and other services over various distances. Cisco Systems® offers a fully integrated and managed multiprotocol solution to customers today.

CISCO STORAGE + OPTICAL SOLUTION COMPONENTS

The Cisco Storage and Optical end to end solution consists of the Cisco MDS 9500 Series of Multilayer Directors and the Cisco ONS 15454 MSTP. The Cisco MDS 9500 Series includes the new Cisco MDS 9513 Director, for aggregating 1/2/4-Gbps Fibre Channel connections into a 10-Gbps Fibre Channel pipe. The 10-Gbps Fibre Channel connection can then be transported via the Cisco ONS 15454 10-Gbps Multirate Transponder Card transparently over an ITU-compliant wavelength to a remote data center (see Figure 2).

Figure 2. Easy SAN Scalability and Optical Transport



The Cisco ONS 15454 MSTP provides capital and operational efficiencies by addressing the increasing demand for multiple services, greater transport capacity, networking flexibility, multiple distance options, and management simplicity in a single platform. In a single network element, this next-generation multiservice platform integrates transparent wavelength and SONET/SDH transport as well as switching capabilities. Supporting up to 64 2.5- or 10-Gbps protected wavelengths, the Cisco ONS 15454 is a high-density, high-bandwidth, and high-capacity platform for aggregating and transporting time-division multiplexing (TDM)-based services (T1/T3, OC-3/STM-1, OC-48/STM-16, etc.) and data services (for example, Fibre Channel, IBM Enterprise Systems Connection/Fiber Connectivity, Ethernet). Data cards for the Cisco ONS 15454 MSTP allow multiple SAN or Gigabit Ethernet signals to be carried over one or more high-bandwidth 10-Gbps wavelengths.

The Cisco ONS 15454 MSTP's dynamic wavelength service is enabled by incorporating reconfigurable optical add/drop multiplexer (ROADM) technology. ROADMs enable faster deployment of additional wavelengths where needed without disrupting existing traffic. This process helps accelerate network upgrades to meet rapidly changing traffic demands, enables rapid topology deployment (point-to-point, ring, mesh), and reduces maintenance costs.

The Cisco Storage+Optical solution offers easy upgrades to 4- and 10-Gbps SAN connectivity while delivering scalable, dynamic optical transport for SAN extension and other enterprise applications.

CISCO STORAGE + OPTICAL INTEGRATED MANAGEMENT

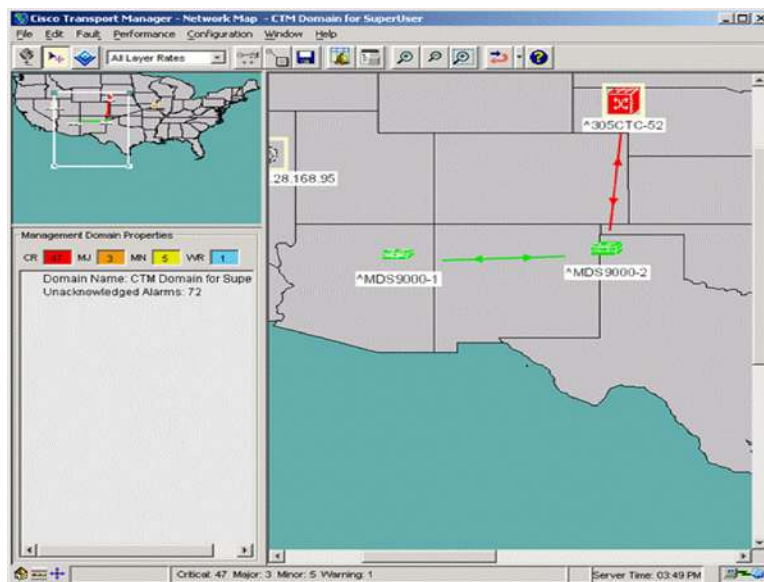
Cisco's Storage + Optical integrated management systems provide a consolidated view of both the storage and optical networks, thus simplifying operational functions and further reducing operational expenditures

Cisco Transport Manager an integrated element management system for the Cisco ONS 15000 Series optical transport systems, simplifies management and accelerates deployment of the Cisco ONS 15454 MSTP. Cisco Transport Manager provides advanced configuration, fault, performance, and security management of Cisco optical network elements, networks, and sub-networks; support for all services (DWDM, Fibre Channel, Ethernet, etc.); and open interfaces to operations support systems (OSSs). With a proven record of reliability and scalability, Cisco Transport Manager delivers the full power of the wide range of advanced Cisco optical systems.

The Cisco Fabric Manager is a multiprotocol element and fabric manager for the Cisco MDS 9000 Series of Multilayer Directors and Fabric Switches. Element management allows the storage network administrator to configure the switch and track statistics and events. The Cisco Fabric Manager provides the capability to manage the fabric as a collection or network of devices. The fabric manager application uses a comprehensive and automatically discovered topology of the fabric. Once the Cisco Fabric Manager is invoked, the topology discovery process begins. Using information polled from any seed Cisco MDS 9000 Family switch, including NameServer registrations and the Fabric Configuration Server, the Cisco Fabric Manager re-creates a fabric topology and represents it to the user in a customizable map.

Both Cisco Transport Manager and Fabric Manager possess the ability to cross-launch each other. Cisco Transport Manager Release 6.x and above can identify and display Cisco MDS 9000 Family nodes along with link- and domain-level inventory of Cisco MDS 9000 Family devices. Future releases will support more advanced options including provisioning and end-to-end management. Figure 3 shows an integrated view of Cisco ONS 15000 and Cisco MDS 9000 Family devices.

Figure 3. Consolidated View of the Storage and Optical Environment



KEY CISCO STORAGE + OPTICAL DIFFERENTIATORS

Table 1. Key Differentiators of Storage+Optical Solution

Cisco MDS 9000 Series	Cisco ONS 15454
<ul style="list-style-type: none"> • Virtual SAN (VSAN) to enable scalable SAN design, growth, and consolidation of storage and network resources • Supporting up to 528 ports, including up to 44 10-Gbps Fibre Channel connections • Integrated Inter-VSAN Routing enables sharing of common resources across VSANs • Integrated multi-protocol support including Fibre Channel, iSCSI, and FICON for flexible, lowest-cost connectivity options within the datacenter • Integrated SAN extension for cost effective business continuity 	<ul style="list-style-type: none"> • Data and Storage aggregation over 10Gbps wavelength: <ul style="list-style-type: none"> – Buffer-to-Buffer Credit up to 1,400 Km – Full Performance Monitoring Statistics – SAN Environment Certification – EMC, Hitachi, IBM, HP – Trunk Side: Tunability across Full C-band/L-band (80chs at 50GHz each) – Client side: Pluggable optics XFP

Cisco MDS 9000 Series

- Integrated **compression and encryption** reduces leased line charges and cost of separate encryption devices
- **Network-hosted storage applications**—enables Information Lifecycle Management
- **Diagnostic and troubleshooting tools**—reduces downtime and improves performance
- Integrated **security** suite
- Scalable Architecture provides investment protection—enables current products to scale up to **240 4Gbps ports** and provide **10Gbps ISL** connectivity

Cisco ONS 15454

- DWDM Transport for **different Client** protocols:
 - OC-192/STM-64
 - 10GE LAN PHY/10GE WAN PHY/10G FC
 - E-FEC/FEC/No FEC SW Provisionable
 - ITU-T G.709 compliant **Digital Wrapper** (SW provisionable)
 - Supports Path and Equipment **protection** (Y-cable or 1+1)
 - Embedded OC-192/STM-64/10GE PM (**RMON standard**)
 - Integrated Management

SUMMARY

Consolidating data centers and supporting an increasing number of network-enabled application services have become essential for businesses to stay competitive. The Cisco MDS 9000 Family of storage products facilitate SAN consolidation by delivering high port density and bandwidth—including 4- and 10-Gbps Fibre Channel—with the flexibility to create VSANs across a common physical infrastructure. With 10-Gbps Fibre Channel aggregation, you can make optimal use of the 10-Gbps wavelength service provided by the Cisco ONS 15454 MSTP for your disaster recovery and business continuity requirements. Integrated management of the Cisco Storage and Optical solution, using Cisco Transport Manager and Fabric Manager, further lowers total cost of ownership while allowing for data center scalability. These industry-leading capabilities help you to rapidly deploy SAN and optical transport technologies in the most efficient and easily managed fashion and achieve application resiliency at minimal cost.

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