

# Cisco MDS 9148 Multilayer Fabric Switch

## Product Overview

The Cisco® MDS 9148 Multilayer Fabric Switch (Figure 1) is a high-performance, flexible, cost-effective platform with the industry's highest port density and lowest power consumption available in a compact one rack-unit (1RU) chassis form factor. It provides 48 line-rate 8-Gbps ports for storage networking deployments in small, medium-sized, and large enterprise environments. The Cisco MDS 9148, based on a purpose-built "switch-on-a-chip" application-specific integrated circuit (ASIC), offers outstanding value by providing high-availability, security, and ease of use at a cost-effective price. With the flexibility to expand from 16 to 48 ports in 8-port increments, the Cisco MDS 9148 offers the densities required to scale from an entry-level departmental switch to top-of-the-rack switch to edge switch connectivity into enterprise core SANs. The Cisco MDS 9148 delivers a nonblocking architecture, with all 48 1/2/4/8-Gbps ports operating at line rate concurrently.

The Cisco MDS 9148 supports Zero-Touch installation as well as the Cisco Device Manager Quick Configuration Wizard, which allow it to be deployed quickly and easily in networks of any size. Powered by Cisco MDS 9000 NX-OS Software, it includes advanced storage networking features and functions and is compatible with Cisco MDS 9500 Series Multilayer Directors and Cisco MDS 9200 and other 9100 Series Multilayer Fabric Switches, providing transparent, end-to-end service delivery in core-edge deployments.

**Figure 1.** Cisco MDS 9148 Multilayer Fabric Switch



## Highlights

- High-performance with exceptional flexibility: The Cisco MDS 9148 offers up to 48 autosensing Fibre Channel ports capable of speeds of 1, 2, 4, and 8 Gbps in a compact 1RU form-factor chassis with 8 Gbps of dedicated bandwidth for each port and an aggregate platform bandwidth of 768 Gbps. The Cisco MDS 9148 comes with three preconfigured models for 16, 32, or 48 ports. The 16- and 32-port models can be upgraded onsite to enable additional ports by adding one or more 8-port Cisco MDS 9148 On-Demand Port Activation licenses.
- Intelligent storage networking services at a cost-effective price: The Cisco MDS 9148, powered by Cisco MDS 9000 NX-OS Software, offers intelligent storage networking capabilities such as virtual SANs (VSANs), Inter-VSAN Routing (IVR), link aggregation using PortChannels, quality of service (QoS), and security. These features make it easy to design, deploy, provision, and manage the Cisco MDS 9148 either as a standalone departmental SAN switch or as a top-of-the-rack switch or an edge switch in an enterprise core-edge SAN.

- **Smart Zoning:** When the Smart Zoning feature is enabled, Cisco MDS 9000 Family fabrics provision the hardware access control entries specified by the zone set more efficiently, avoiding the superfluous entries that would allow servers (initiators) to talk to other servers, or allow storage devices (targets) to talk to other storage devices. This feature makes larger zones with multiple initiators and multiple targets feasible without excessive consumption of hardware resources. Thus, smart zones can correspond to applications, application clusters, hypervisor clusters, or other data center entities, saving the time that administrators previously spent creating many small zones, and enabling the automation of zoning tasks.
- **Simplified scalable deployment of virtual machine-aware SANs:** In a virtual machine environment in which many host operating systems or applications are running on a physical host, the Cisco MDS 9148 uses N-Port ID Virtualization (NPIV) technology to provide independent management for each virtual machine. Furthermore, the Cisco MDS 9148 provides Cisco N-Port Virtualization (NPV) and fabric-port (F-port) trunking and channeling features to enable SANs to be scaled without reaching Fibre Channel domain ID limits. The Cisco FlexAttach feature enables transparent server deployment and movement without SAN reconfiguration.
- **High-availability platform for mission-critical deployments:** The Cisco MDS 9148 is designed for environments in which downtime is unacceptable. It offers nondisruptive software upgrades, dual redundant hot-swappable power supplies (with integrated fans), dual redundant hot-swappable fan trays, VSANs for fault isolation, Inter-VSAN Routing (IVR) for sharing resources across VSANs, PortChannels for Inter-Switch Link (ISL) resiliency, and F-port trunking for resiliency on uplinks from a Cisco MDS 9148 operating in NPV mode.
- **Comprehensive security framework:** The Cisco MDS 9148 supports as standard role-based access control (RBAC) using RADIUS or TACACS+ authentication, authorization, and accounting (AAA) functions, VSAN fabric isolation, intelligent packet inspection at the port level, Fibre Channel Security Protocol (FC-SP) host-to-switch and switch-to-switch authentication, Secure FTP (SFTP), Secure Shell Version 2 (SSHv2) and Simple Network Management Protocol Version 3 (SNMPv3) implementing Advanced Encryption Standard (AES), control-plane security, hardware-enforced zoning, broadcast zones, and management access. Although rarely needed in most switch fabric installations, an extensive set of even more innovative and powerful security features and functions is available with the optional Cisco MDS 9000 Family Enterprise Package License.
- **Simplified storage management:** The Cisco MDS 9148 supports SAN plug-and-play capabilities, including new Zero-Touch Installation deployment and provisioning, and offers built-in storage network management, with all features available through a command-line interface (CLI) or the Cisco Data Center Network Manager (DCNM) for SAN Essentials Edition (formerly Cisco Fabric Manager), a centralized management tool with task-based wizards that simplifies management of a standalone switch or multiple switches and fabrics.
- **Sophisticated diagnostics:** Industry-leading intelligent diagnostics such as Fibre Channel ping, Fibre Channel traceroute, Switched Port Analyzer (SPAN), Cisco Fabric Analyzer, and an integrated Call Home capability to enhance reliability, facilitate faster problem resolution, and reduce service costs.
- **Reduced total cost of ownership (TCO):** Common platform architecture and the use of Cisco MDS 9000 NX-OS Software intelligent storage networking services across all Cisco MDS 9000 Family switches reduce ongoing operating expenses by providing a consistent set of provisioning, management, and diagnostic capabilities.

## Main Features and Benefits

### Exceptional Flexibility for High-Performance SANs

The Cisco MDS 9148 offers up to 48 autosensing Fibre Channel ports capable of speeds of 8, 4, 2, and 1 Gbps in a compact 1RU form-factor chassis. With 8 Gbps of dedicated bandwidth for each port and aggregate platform bandwidth of 768 Gbps, the Cisco MDS 9148 is designed to meet the performance and scalability requirements of the most demanding environments.

The flexibility of the Cisco MDS 9148 is provided by the Cisco MDS 9148 On-Demand Port Activation license, which allows the addition of eight 8-Gbps ports. Customers have the option of purchasing preconfigured models of 16, 32, or 48 ports and upgrading the 16- and 32-port models onsite all the way to 48 ports by adding these licenses. With advanced storage networking capabilities built into the platform, the Cisco MDS 9148 is an ideal choice either as a standalone departmental SAN switch or as a top-of-the-rack switch or an edge switch in an enterprise core-edge SAN.

The Cisco MDS 9148 supports hot-swappable autosensing Small Form-Factor Pluggable (SFP) and Enhanced SFP (SFP+) optics with interfaces for 8, 4, 2, and 1 Gbps. Individual ports can be configured with either short- or long-wavelength optics for connectivity up to 860 meters (m) and 31 kilometers (km), respectively.

### VSANs for Virtualization, Segmentation, and Isolation

VSAN, an industry standard for fabric virtualization capabilities, enables more efficient storage network use by creating hardware-based isolated environments within a single physical SAN fabric or switch. Up to 32 VSANs are supported per switch. Each VSAN can be zoned as a typical SAN and maintains its own fabric services and management domains for added scalability and resilience. VSANs allow the cost of SAN infrastructure to be shared among more users while helping ensure segregation of traffic and retaining independent control of configuration on a VSAN-by-VSAN basis.

### Integrated VSAN Routing (IVR) for Highly Available, Scalable SANs

To deploy efficient, cost-effective, consolidated storage networks, the Cisco MDS 9148 supports IVR functionality. IVR allows selective transfer of data traffic between specific initiators and targets on different VSANs while maintaining isolation of control traffic within each VSAN, thereby maintaining fabric stability and availability. Integrated IVR lowers TCO by eliminating the need for external routing appliances, greatly increasing routing scalability while delivering line-rate performance, simplifying management, and eliminating the challenges associated with maintaining separate systems.

### Advanced Traffic Management for Resilient SANs

Advanced traffic management capabilities integrated into the Cisco MDS 9148 simplify deployment and optimization of core-edge fabrics.

- Virtual output queuing helps ensure line-rate performance on each port, independent of traffic pattern, by eliminating head-of-line blocking.
- Each port group consisting of 4 ports has a pool of 128 buffer credits, with a default of 32 buffer credits per port. When extended distances are required, up to 125 buffer credits can be allocated to a single port within the port group. This extensibility is available without additional licensing.
- PortChannels allow users to aggregate up to 16 physical Inter-Switch Links (ISLs) into a single logical bundle, providing load-balancing bandwidth use across all links. The bundle can consist of any port from the switch, helping ensure that the bundle remains active even in the event of a port group failure.

- Fabric Shortest Path First (FSPF)-based multipathing provides the intelligence to load balance across up to 16 equal-cost paths and, in the event of a switch failure, dynamically reroute traffic.
- QoS can be used to manage bandwidth and control latency, to prioritize critical traffic.
- Comprehensive port and flow statistics facilitate sophisticated performance analysis and service-level agreement (SLA) accounting.

### **Simplified Scalable Deployment of Virtual Machine-Aware SANs**

Cisco MDS 9148 provides the same consistent, policy-based SAN capabilities to individual virtual machines as those available to physical servers. With NPIV, a standard Fibre Channel protocol feature, individual virtual machines assume a full identity on the SAN so that Fibre Channel services such as zoning, QoS, performance monitoring, and security can be provided to each virtual machine.

Given that the number of Fibre Channel domain IDs in a Fibre Channel SAN environment is limited, larger core-edge enterprise SAN environments using the Cisco MDS 9148 as a top-of-the-rack switch or as an edge switch can be deployed by enabling the Cisco NPV feature on the edge Cisco MDS 9148 so that no Fibre Channel domain IDs are used by that switch. NPV aggregates locally connected hosts into one or more uplinks to core switches in a pass-through manner without using a Fibre Channel domain ID. The F-port trunking feature enables multiple VSANs to be transported on the uplink from a Cisco MDS 9148 operating in NPV mode to the core switch.

The Cisco FlexAttach feature gives Cisco MDS 9148 customers the flexibility to add, move, or replace servers easily without the need to reconfigure SAN switches or storage arrays. It provides this flexibility by virtualizing the SAN identity of a server, which enables a server to retain its SAN identity even if the server is moved or replaced.

The Cisco MDS 9148 is supported as an option by the Virtual Computing Environment (VCE) coalition, a collaboration by Cisco, EMC, and VMware, which provides the Vblock™ Infrastructure Packages framework for integrated virtualization solutions.

### **High-Availability Platform for Mission-Critical Environments**

The Cisco MDS 9148 is designed for mission-critical availability. With nondisruptive software upgrades, hot-swappable redundant fans and power supplies, and the unique capability to automatically restart failed processes, the platform defines a new standard for fabric switch availability.

High availability is implemented at the fabric level through the industry's most robust and highest-performance ISLs. The standard PortChannel feature allows users to aggregate up to 16 physical ports into one logical bundle. The bundle can sustain the failure of any physical link without causing a reset. Additionally, FSPF multipathing provides the intelligence to load-balance across up to 16 equal-cost paths and, if a switch fails, to dynamically reroute traffic.

The F-port channeling feature enables up to 16 physical uplinks between a Cisco MDS 9148 operating in NPV mode and the core switch to be bundled into a PortChannel. The Cisco MDS 9148 offers outstanding fabric switch availability, reducing TCO.

## Comprehensive Security

Recognizing the need for unassailable business security, the Cisco MDS 9148 provides a comprehensive framework to protect highly sensitive data crossing today's enterprise networks. Included as standard with every Cisco MDS 9148 are features such as VSAN isolation, role-based access control (RBAC), secure FTP (SFTP), intelligent packet inspection at the port level, hardware zoning using access control lists (ACLs), extended broadcast zoning, secure shell (SSH), control-plane security, simple network management protocol (SNMP), and FC-SP switch-to-switch plus host-to-switch access authentication. These features, in conjunction with the rarely needed, but even more innovative and powerful features in the optional Cisco MDS 9000 Family Enterprise Package License, will make the Cisco MDS 9148 the most secure platform in its class.

## Simplified Management

The Cisco MDS 9148 provides four principal modes of management: the Cisco MDS 9000 Family CLI, the Quick Configuration Wizard, the Cisco DCNM, and integration with third-party storage management tools.

- **Consistent, logical CLI:** Adhering to the syntax of the widely known Cisco IOS® Software CLI, the Cisco MDS 9000 Family CLI is easy to learn and delivers broad management capabilities. The Cisco MDS 9000 Family CLI is an extremely efficient and direct interface designed to provide optimal capabilities to administrators in enterprise environments.
- **Zero-Touch Installation:** The Zero-Touch Installation feature provides easy, plug-and-play deployment and provisioning capabilities without the need for serial cable console access and is enabled through new Dynamic Host Configuration Protocol (DHCP) client support that stores a common default Cisco MDS 9148 switch configuration. Zero-Touch Installation automatically assigns an IP address (through DHCP) or provides a default address if there is no DHCP server. Zero-Touch Installation also provides a default user password for the administrator user and automatically launches the Quick Configuration Wizard.
- **Quick Configuration Wizard:** The Quick Configuration Wizard helps eliminate management complexity and creates a readily available SAN environment for small- and medium-sized-business (SMB) applications. The wizard allows server access to storage to be set up quickly and easily in a single step using an intuitive GUI.
- **Cisco DCNM:** Cisco DCNM can be licensed for management of a combination of SAN and LAN environments. Cisco DCNM streamlines the provisioning of the unified fabric and proactively monitors the LAN and SAN components. Cisco DCNM for SAN Essentials Edition (formerly Cisco Fabric Manager), which comes standard with the Cisco MDS 9148, is an easy-to-use application that simplifies management across multiple switches and converged SAN fabrics. Focused on supporting efficient operations and management of virtual machine-aware fabrics, Cisco DCNM for SAN Essentials Edition provides a robust framework and comprehensive feature set that meets the routing, switching, and storage administration needs of present and future virtualized data centers. The optional Cisco DCNM for SAN Advanced Edition (formerly Cisco Fabric Manager Server) extends the standard Cisco DCNM for SAN Essentials Edition software by providing server federation, historical performance monitoring for network traffic hotspot analysis, centralized management services, and advanced application integration. All standard Cisco DCNM for SAN Essentials Edition features and functions are fully integrated with the optional Cisco DCNM for SAN Advanced Edition capabilities.
- **Application Programming Interfaces (APIs):** The Cisco MDS 9148 provides an extensive set of APIs for integration with third-party and user-developed management tools. The APIs are based on industry-standard protocols, including SNMP and the Storage Networking Industry Association (SNIA) Storage Management Initiative Specification (SMI-S).

## Advanced Diagnostics and Troubleshooting Tools

Management of storage networks requires proactive diagnostics, tools to verify connectivity and route latency, and mechanisms for capturing and analyzing traffic. The Cisco MDS 9148 integrates the industry's most advanced analysis and debugging tools. Power-on self-test (POST) and online diagnostics provide proactive health monitoring. The Cisco MDS 9148 provides the integrated hardware functions required to implement diagnostic capabilities such as Fibre Channel traceroute to detail the exact path and timing of flows, and SPAN to intelligently capture network traffic. After traffic has been captured, it can be analyzed with the Cisco Fabric Analyzer, an embedded Fibre Channel analyzer. With the Cisco MDS 9148, Cisco delivers a comprehensive tool set for troubleshooting and analysis of an organization's storage network.

## Product Specifications

Table 1 lists the standard feature product specifications for the Cisco MDS 9148.

**Table 1.** Product Specifications

Item	Specification
<b>Minimum software requirements</b>	<ul style="list-style-type: none"> <li>• Cisco MDS 9000 NX-OS Software Release 5.0(1) supporting Cisco MDS 9148 and Cisco Fabric Manager</li> <li>• Cisco MDS 9000 NX-OS Release 5.2(1) supporting Cisco DCNM for SAN</li> <li>• Zero-touch installation capability is scheduled for a future release of Cisco MDS 9000 NX-OS Software</li> </ul>
<b>Performance and port configuration</b>	<ul style="list-style-type: none"> <li>• Port speed: 8-, 4-, 2-, and 1-Gbps autosensing with 8 Gbps of dedicated bandwidth per port</li> <li>• Buffer credits: Up to 128 for a group of 4 ports, with a default of 32 buffer credits per port and a maximum of 125 buffer credits for a single port in the group</li> <li>• Ports per chassis: Up to 48 8-Gbps ports <ul style="list-style-type: none"> <li>◦ Base configuration with 16 ports; additional configurations for 32 and 48 ports available</li> <li>◦ Upgrade ports in 8-port increments from any configuration with the port activation license</li> </ul> </li> <li>• PortChannel: Up to 16 ports in a PortChannel with automatic load balancing</li> </ul>
<b>Security</b>	<ul style="list-style-type: none"> <li>• VSAN fabric isolation</li> <li>• Intelligent packet inspection @ port level</li> <li>• Hardware zoning by access control lists (ACLs)</li> <li>• Extended broadcast zoning</li> <li>• FC-SP switch-to-switch authentication</li> <li>• FC-SP host-to-switch authentication</li> <li>• RBAC using RADIUS or TACACS+ authentication, authorization, and accounting (AAA) functions</li> <li>• Management access</li> <li>• Secure FTP (SFTP)</li> <li>• Secure Shell Version 2 (SSHv2)</li> <li>• Simple Network Management Protocol Version 3 (SNMPv3) implementing Advanced Encryption Standard (AES)</li> <li>• Control-plane security</li> </ul>
<b>Virtual Computing Environment (VCE) coalition</b>	Cisco MDS 9148 is supported as a VCE coalition option for Vblock1 <sup>®</sup> , Vblock2 <sup>®</sup> , Vblock <sup>™</sup> 300, and Vblock <sup>™</sup> 700
<b>Compatibility</b>	Fibre Channel protocols <ul style="list-style-type: none"> <li>• FC-PH, Revision 4.3 (ANSI/INCITS 230-1994)</li> <li>• FC-PH, Amendment 1 (ANSI/INCITS 230-1994/AM1 1996)</li> <li>• FC-PH, Amendment 2 (ANSI/INCITS 230-1994/AM2-1999)</li> <li>• FC-PH-2, Revision 7.4 (ANSI/INCITS 297-1997)</li> <li>• FC-PH-3, Revision 9.4 (ANSI/INCITS 303-1998)</li> <li>• FC-PI, Revision 13 (ANSI/INCITS 352-2002)</li> <li>• FC-PI-2, Revision 10 (ANSI/INCITS 404-2006)</li> <li>• FC-PI-3, Revision 2.1 (BSR INCITS 460-200x)</li> <li>• FC-PI-4, Revision 8.0 (INCITS 450-2009)</li> <li>• FC-FS, Revision 1.9 (ANSI/INCITS 373-2003)</li> </ul>

Item	Specification
	<ul style="list-style-type: none"> <li>• FC-FS-2, (BSR INCITS 424-200x)</li> <li>• FC-FS-3, Revision 0.9 (BSR INCITS PN-1861-D-200x)</li> <li>• FC-LS, Revision 1.62 (ANSI/INCITS 433-2007)</li> <li>• FC-AL, Revision 4.5 (ANSI/INCITS 272-1996)</li> <li>• FC-AL-2, Revision 7.0 (ANSI/INCITS 332-1999)</li> <li>• FC-AL-2, Amendment 1 (ANSI/INCITS 332-1999/AM1-2003)</li> <li>• FC-AL-2, Amendment 2 (ANSI/INCITS 332-1999/AM2-2006)</li> <li>• FC-SW-2, Revision 5.3 (ANSI/INCITS 355-2001)</li> <li>• FC-SW-3, Revision 6.6 (ANSI/INCITS 384-2004)</li> <li>• FC-SW-4, Revision 7.5 (ANSI/INCITS 418-2006)</li> <li>• FC-SW-5, (BSR INCITS 461-200x)</li> <li>• FC-GS, (ANSI INCITS 288-1999)</li> <li>• FC-GS-3, Revision 7.01 (ANSI/INCITS 348-2001)</li> <li>• FC-GS-4, Revision 7.91 (ANSI/INCITS 387-2004)</li> <li>• FC-GS-5, (ANSI INCITS 427-2007)</li> <li>• FC-GS-6, (BSR INCITS 463-200x)</li> <li>• FC-BB, Revision 4.7 (ANSI/INCITS 342-2001)</li> <li>• FC-BB-2, Revision 6.0 (ANSI/INCITS 372-2003)</li> <li>• FC-BB-3, Revision 6.8 (ANSI/INCITS 414-2006)</li> <li>• FCP, Revision 12 (ANSI/INCITS 269-1996)</li> <li>• FCP-2, Revision 8 (ANSI/INCITS 350-2003)</li> <li>• FCP-3, Revision 4 (ANSI/INCITS 416-2006)</li> <li>• FCP-4, (BSR INCITS PN-1828-D-200x)</li> <li>• FC-SB-2, Revision 2.1 (ANSI/INCITS 349-2001)</li> <li>• FC-SB-3, Revision 1.6 (ANSI/INCITS 374-2003)</li> <li>• FC-VI, Revision 1.84 (ANSI/INCITS 357-2002)</li> <li>• FC-FLA, Revision 2.7 (INCITS TR-20-1998)</li> <li>• FC-PLDA, Revision 2.1 (INCITS TR-19-1998)</li> <li>• FC-Tape, Revision 1.17 (INCITS TR-24-1999)</li> <li>• FC-MI, Revision 1.92 (INCITS TR-30-2002)</li> <li>• FC-MI-2, Revision 2.6 (INCITS TR-39-2005)</li> <li>• FC-SP, Revision 1.6 (ANSI/INCITS 426-2007)</li> <li>• FC-DA, Revision 3.1 (INCITS TR-36-2004)</li> <li>• SNPing (ANSI INCITS 443-2008)</li> <li>• MIB-FA (INCITS/TR-32:2003 (R2008))</li> <li>• FAIS Revision 1</li> <li>• Extensive IETF-standards-based TCP/IP, SNMPv3, and Remote Monitoring (RMON) MIBs</li> <li>• Class of service: Classes 2, 3, and F</li> <li>• Fibre Channel standard port types: E, F, and FL</li> <li>• Fibre Channel enhanced port types: SD, and TE</li> </ul>
<b>Fabric services</b>	<ul style="list-style-type: none"> <li>• Name server</li> <li>• Registered state change notification (RSCN)</li> <li>• Login services</li> <li>• Broadcast</li> <li>• In-order delivery</li> <li>• Name-server zoning</li> </ul>
<b>Advanced services</b>	<ul style="list-style-type: none"> <li>• NPIV</li> <li>• VSANs</li> <li>• PortChannels</li> <li>• NPV mode</li> <li>• FlexAttach</li> <li>• F-port trunking and channeling</li> <li>• IVR</li> </ul>

Item	Specification
<b>Diagnostics and troubleshooting tools</b>	<ul style="list-style-type: none"> <li>• POST diagnostics</li> <li>• Online diagnostics</li> <li>• Internal loopbacks</li> <li>• SPAN (remote SPAN not supported)</li> <li>• Fibre Channel traceroute</li> <li>• Fibre Channel ping</li> <li>• Fibre Channel debug</li> <li>• Cisco Fabric Analyzer</li> <li>• Syslog</li> <li>• Port-level statistics</li> </ul>
<b>Management</b>	<ul style="list-style-type: none"> <li>• Access methods <ul style="list-style-type: none"> <li>◦ Out-of-band 10/100/1000 Ethernet port</li> <li>◦ EIA/TIA-232 serial console port</li> <li>◦ In-band management using IP over Fibre Channel</li> </ul> </li> <li>• Access protocols <ul style="list-style-type: none"> <li>◦ CLI</li> <li>◦ SNMP</li> <li>◦ SMI-S</li> </ul> </li> <li>• Security <ul style="list-style-type: none"> <li>◦ RBAC using RADIUS or TACACS+ authentication, authorization, and accounting (AAA) functions</li> <li>◦ VSAN-based roles</li> <li>◦ SSHv2</li> <li>◦ SNMPv3</li> </ul> </li> </ul>
<b>Management applications</b>	<ul style="list-style-type: none"> <li>• Zero-Touch Installation deployment and provisioning with DHCP (scheduled for a future release of Cisco MDS 9000 NX-OS Software)</li> <li>• Cisco MDS 9000 Family CLI</li> <li>• Quick Configuration Wizard</li> <li>• Cisco Device Manager</li> <li>• Cisco DCNM for SAN Essentials Edition</li> <li>• Cisco DCNM for SAN Advanced Edition (optional software package)</li> </ul>
<b>Availability</b>	<ul style="list-style-type: none"> <li>• Nondisruptive In-Service Software Upgrade (ISSU)</li> <li>• Process monitoring and stateful process restart</li> <li>• Per-VSAN fabric services</li> <li>• Redundant, hot-swappable power supplies and redundant, hot-swappable power supply and fan trays</li> <li>• Hot-swappable SFP and SFP+ optics</li> <li>• PortChannels aggregating up to 16 ports with redundant load balancing</li> <li>• F-port channeling and trunking</li> <li>• Online diagnostics</li> </ul>
<b>Serviceability</b>	<ul style="list-style-type: none"> <li>• Configuration file management</li> <li>• Call Home</li> <li>• Port beaconing</li> <li>• System LEDs</li> <li>• SNMP traps for alerts</li> </ul>
<b>Environmental</b>	<ul style="list-style-type: none"> <li>• Physical dimensions (H x W x D) of 1RU: 1.72 x 17.16 x 18.89 in. (4.47 x 43.59 x 47.98 cm)</li> <li>• Weight of switch with dual power supplies: 22.2 lb (10 kg)</li> <li>• Ambient operating temperature: 32 to 104°F (0 to 40°C)</li> <li>• Ambient nonoperating temperature: -40 to 158°F (-40 to 70°C)</li> <li>• Humidity (RH), ambient (noncondensing) operating: 10 to 90%</li> <li>• Humidity (RH), ambient (noncondensing) nonoperating and storage: 5 to 95%</li> <li>• Operating altitude: -197 to 6500 ft (-60 to 2000m)</li> </ul>



Item	Specification
<b>Power and cooling</b>	<ul style="list-style-type: none"> <li>Power supplies (300W AC) (maximum of 2 per switch) <ul style="list-style-type: none"> <li>AC Input: 100 to 240 VAC nominal (+/-10% for full range)</li> <li>Frequency: 50 to 60 Hz nominal (+/-3 Hz for full range)</li> <li>Maximum power consumption: <ul style="list-style-type: none"> <li>With 4-Gbps optics (48 ports fully populated): 99W with 0.89A at 110 VAC and 0.45A at 220 VAC</li> <li>With 8-Gbps optics (48 ports fully populated): 101W with 0.90A at 110 VAC and 0.46A at 220 VAC</li> </ul> </li> </ul> </li> <li>Airflow: Rear to front (toward ports)</li> </ul>
<b>Safety</b>	<ul style="list-style-type: none"> <li>UL 60950 -1</li> <li>CAN/CSA-C22.2 No. 60950 -1</li> <li>EN 60950 -1</li> <li>IEC 60950 -1</li> <li>AS/NZS 60950</li> <li>IEC 60825</li> <li>EN 60825</li> <li>21 CFR 1040</li> </ul>
<b>EMC</b>	<ul style="list-style-type: none"> <li>FCC Part 15 (CFR 47) Class A</li> <li>ICES-003 Class A</li> <li>EN55022 Class A</li> <li>CISPR22 Class A</li> <li>AS/NZS CISPR22 Class A</li> <li>VCCI Class A</li> <li>EN55024</li> <li>KN24</li> <li>EN50082-1</li> <li>EN61000-3-2</li> <li>EN61000-3-3</li> <li>EN61000-6-1</li> <li>CISPR24</li> <li>NEBS</li> <li>GR-63-Core NEBS Level 3</li> <li>GR-1089-Core NEBS Level 3</li> <li>ETSI</li> <li>ETS 300 019 Storage Class 1.1</li> <li>ETS 300 019 Transportation Class 2.3</li> <li>ETSI 300 019 Stationary Use Class 3.1</li> </ul>

## Ordering Information

Table 2 provides ordering information for the Cisco MDS 9148.

**Table 2.** Ordering Information for Cisco Direct

Product Name	Part Number
<b>Base Model Bundles (See Note 3)</b>	
Cisco MDS 9148 48-Port Multilayer Fabric Switch with 16 8-Gbps active ports and 16 8-Gbps SW optics, Dual Power Supplies, Power Cords and Fans, VSANs, PortChannels, and Cisco DCNM for SAN Essentials Edition. Includes generic Cisco Accessory kit.	DS-C9148D-8G16P-K9
Cisco MDS 9148 48-Port Multilayer Fabric Switch with 32 8-Gbps active ports and 32 8-Gbps SW optics, Dual Power Supplies, Power Cords and Fans, VSANs, PortChannels, and Cisco DCNM for SAN Essentials Edition. Includes generic Cisco Accessory kit.	DS-C9148D-8G32P-K9
Cisco MDS 9148 48-Port Multilayer Fabric Switch with 48 8-Gbps active ports and 48 8-Gbps SW optics, Dual Power Supplies, Power Cords and Fans, VSANs, PortChannels, and Cisco DCNM for SAN Essentials Edition. Includes generic Cisco Accessory kit.	DS-C9148D-8G48P-K9
Cisco MDS 9148 48-Port Multilayer Fabric Switch with 16 8-Gbps active ports and 16 4-Gbps SW optics, Dual Power Supplies, Power Cords and Fans, VSANs, PortChannels, and Cisco DCNM for SAN Essentials Edition. Includes generic Cisco Accessory kit.	DS-C9148D-4G16P-K9

Product Name	Part Number
Cisco MDS 9148 48-Port Multilayer Fabric Switch with 32 8-Gbps active ports and 32 4-Gbps SW optics, Dual Power Supplies, Power Cords and Fans, VSANs, PortChannels, and Cisco DCNM for SAN Essentials Edition. Includes generic Cisco Accessory kit.	DS-C9148D-4G32P-K9
Cisco MDS 9148 48-Port Multilayer Fabric Switch with 48 8-Gbps active ports and 48 4-Gbps SW optics, Dual Power Supplies, Power Cords and Fans, VSANs, PortChannels, and Cisco DCNM for SAN Essentials Edition. Includes generic Cisco Accessory kit.	DS-C9148D-4G48P-K9
<b>Power Cord Configure-to-Order Options</b>	
Power Cord, 250VAC 10A IRAM 2073 Plug, Argentina	CAB-9K10A-AR
Power Cord, 250VAC 10A 3112 Plug, Australia	CAB-9K10A-AU
Power Cord, 250VAC 10A GB1002 Plug, China	CAB-9K10A-CH
Power Cord, 250VAC 10A CEE 7/7 Plug, EU	CAB-9K10A-EU
Power Cord, 250VAC 10A SI16S3 Plug, Israel	CAB-9K10A-ISR
Power Cord, 250VAC 10A CEI 23-16/VII Plug, Italy	CAB-9K10A-IT
Power Cord, 125VAC 13A KSC8305 Plug, Korea	CAB-9K10A-KOR
Power Cord, 250VAC 10A SABS 164/1 Plug, South Africa	CAB-9K10A-SA
Power Cord, 250VAC 10A, Straight C15, MP232 Plug, SWITZ	CAB-9K10A-SW
Power Cord, 125VAC 15A CNS10917-2, Taiwan	CAB-9K10A-TWN
Power Cord, 250VAC 10A BS1363 Plug (13 A fuse), UK	CAB-9K10A-UK
Power Cord, 125VAC 13A NEMA 5-15 Plug, North America	CAB-9K12A-NA
Cabinet Jumper Power Cord, 250 VAC 13A, C14-C15 Connectors	CAB-C15-CBN
<b>Spare Components (See Note 1)</b>	
Cisco MDS 9000 Family 8/4/2-Gbps Fibre Channel-SW, SFP, LC, Spare	DS-SFP-FC8G-SW=
Cisco MDS 9000 Family 8/4/2-Gbps Fibre Channel-Shortwave, SFP+, LC, 4 pack, Spare	DS-SFP-FC8G-SW-4=
Cisco MDS 9000 Family 8/4/2-Gbps Fibre Channel-Longwave, SFP+, LC (10-km reach), Spare	DS-SFP-FC8G-LW=
Cisco MDS 9000 Family 8/4/2-Gbps Fibre Channel-Extended Reach, SFP+, LC (31km reach), Spare	DS-SFP-FC8G-ER=
Cisco MDS 9000 Family 4/2/1-Gbps Fibre Channel-SW, SFP, LC, Spare	DS-SFP-FC4G-SW=
Cisco MDS 9000 Family 4/2/1-Gbps Fibre Channel-SW, SFP, LC, 4-Pack, Spare	DS-SFP-4G-SW-4=
Cisco MDS 9000 Family 4 Gbps CWDM Long Distance SFP, LC, Spare (See Note 1 for xxxx options)	DS-CWDM4Gxxxx=
Cisco MDS 9000 Family 8 Gbps CWDM Long Distance SFP, LC, Spare (See Note 1 for xxxx options)	DS-CWDM8Gxxxx=
Cisco MDS 9000 Family 4 Gbps DWDM Long Distance SFP, LC, Spare (See Note 1 for xx.x options)	ONS-SC-4G-xx.x=
Cisco MDS 9148 Generic Cisco Accessory Kit for MDS 9148, Spare	DS-9148-KIT-CSCO=
Cisco MDS 9148 300W AC power supply, Spare	DS-C48-300AC=
Cisco MDS 9148 fan tray, Spare	DS-C48-FAN=
<b>Configure-To-Order License Options (See Note 2)</b>	
Cisco MDS 9148 On-Demand Port Activation License (Uninstalled) to activate 8 incremental ports with 8 8-Gbps SW optics, Configure-To-Order (See Notes 3 & 4)	M9148PL8-8G-SFP
Cisco MDS 9148 On-Demand Port Activation License (Uninstalled) to activate 8 incremental ports with 8 4-Gbps SW optics, Configure-To-Order (See Notes 3 & 4)	M9148PL8-4G-SFP
Cisco MDS 9148 On-Demand Port Activation License for electronic delivery; activates increment of 8 ports, Spare	L-M9148PL8-8G=
Cisco MDS 9000 Family Enterprise Package License (Uninstalled), Configure-To-Order (See Note 4)	M9100ENT1K9
Cisco Data Center Network Manager (DCNM) for SAN Advanced Edition (Uninstalled), Configure-To-Order (See Note 5)	DCNM-SAN-M91-K9
<b>Spare License Options (See Note 2)</b>	
Cisco MDS 9148 On-Demand Port Activation License to activate 8 incremental ports with 8 8-Gbps SW optics, Spare	M9148PL8-8G-SFP=
Cisco MDS 9148 On-Demand Port Activation License to activate 8 incremental ports with 8 4-Gbps SW optics, Spare	M9148PL8-4G-SFP=

Product Name	Part Number
Cisco MDS 9000 Family Enterprise Package License, Spare	M9100ENT1K9=
Cisco Data Center Network Manager (DCNM) for SAN Advanced Edition, Spare	DCNM-SAN-M91-K9=
Cisco DCNM for SAN Advanced Edition Configurable Pack for MDS 9000 Series, Spare	DCNM-SAN-PAK=
Cisco E-delivery Data Center Network Manager (DCNM) for SAN Advanced Edition, Spare	L-DCNM-S-M91-K9=
Cisco E-Delivery DCNM for SAN Advanced Edition Configurable Pack for MDS 9000 Series, Spare	L-DCNM-S-PAK=
<b>Spare Power Cords</b>	
Power Cord, 250VAC 10A IRAM 2073 Plug, Argentina, Spare	CAB-9K10A-AR=
Power Cord, 250VAC 10A 3112 Plug, Australia, Spare	CAB-9K10A-AU=
Power Cord, 250VAC 10A GB1002 Plug, China, Spare	CAB-9K10A-CH=
Power Cord, 250VAC 10A CEE 7/7 Plug, EU, Spare	CAB-9K10A-EU=
Power Cord, 250VAC 10A SI16S3 Plug, Israel, Spare	CAB-9K10A-ISR=
Power Cord, 250VAC 10A CEI 23-16/VII Plug, Italy, Spare	CAB-9K10A-IT=
Power Cord, 125VAC 13A KSC8305 Plug, Korea, Spare	CAB-9K10A-KOR=
Power Cord, 250VAC 10A SABS 164/1 Plug, South Africa, Spare	CAB-9K10A-SA=
Power Cord, 250VAC 10A Straight C15, MP232 Plug, SWITZ, Spare	CAB-9K10A-SW=
Power Cord, 125VAC 15A CNS10917-2, Taiwan, Spare	CAB-9K10A-TWN=
Power Cord, 250VAC 10A BS1363 Plug (13 A fuse), UK, Spare	CAB-9K10A-UK=
Power Cord, 125VAC 13A NEMA 5-15 Plug, North America, Spare	CAB-9K12A-NA=
Cabinet Jumper Power Cord, 250 VAC 13A C14-C15 Connectors, Spare	CAB-C15-CBN=

The part numbers and associated configurable options in Table 3 can be ordered only by Cisco original storage manufacturer (OSM) and storage technology integration (STI) partners.

**Table 3.** Cisco OSM and STI Vendor Ordering Information

Product Name	Part Number
<b>Base Models (Optical Transceivers Not Included)</b>	
Cisco MDS 9148 48-Port Multilayer Fabric Switch with 16 8-Gbps active ports, Dual Power Supplies, Power Cords and Fans, VSANs, PortChannels, and Cisco DCNM for SAN Essentials Edition. Includes Accessory kit.	DS-C9148-16P-K9
Cisco MDS 9148 48-Port Multilayer Fabric Switch with 32 8-Gbps active ports, Dual Power Supplies, Power Cords and Fans, VSANs, PortChannels, and Cisco DCNM for SAN Essentials Edition. Includes Accessory kit.	DS-C9148-32P-K9
Cisco MDS 9148 48-Port Multilayer Fabric Switch with 48 8-Gbps active ports, Dual Power Supplies, Power Cords and Fans, VSANs, PortChannels, and Cisco DCNM for SAN Essentials Edition. Includes Accessory kit.	DS-C9148-48P-K9
<b>Power Cord Configure-to-Order Options</b>	
Power Cord, 250VAC 10A IRAM 2073 Plug, Argentina	CAB-9K10A-AR
Power Cord, 250VAC 10A 3112 Plug, Australia	CAB-9K10A-AU
Power Cord, 250VAC 10A GB1002 Plug, China	CAB-9K10A-CH
Power Cord, 250VAC 10A CEE 7/7 Plug, EU	CAB-9K10A-EU
Power Cord, 250VAC 10A SI16S3 Plug, Israel	CAB-9K10A-ISR
Power Cord, 250VAC 10A CEI 23-16/VII Plug, Italy	CAB-9K10A-IT
Power Cord, 125VAC 13A KSC8305 Plug, Korea	CAB-9K10A-KOR
Power Cord, 250VAC 10A SABS 164/1 Plug, South Africa	CAB-9K10A-SA
Power Cord, 250VAC 10A Straight C15, MP232 Plug, SWITZ	CAB-9K10A-SW
Power Cord, 125VAC 15A CNS10917-2, Taiwan	CAB-9K10A-TWN
Power Cord, 250VAC 10A BS1363 Plug (13 A fuse), UK	CAB-9K10A-UK
Power Cord, 125VAC 13A NEMA 5-15 Plug, North America	CAB-9K12A-NA
Cabinet Jumper Power Cord, 250 VAC 13A C14-C15 Connectors	CAB-C15-CBN

Product Name	Part Number
<b>Accessory Kit Configure-to-Order Options</b>	
Generic Cisco Accessory Kit for Cisco MDS 9148	DS-9148-KIT-CSCO
EMC Accessory Kit for Cisco MDS 9148	DS-9148-KIT-EMC
HDS Accessory Kit for Cisco MDS 9148	DS-9148-KIT-HDS
HP Accessory Kit for Cisco MDS 9148	DS-9148-KIT-HP
IBM Accessory Kit for Cisco MDS 9148	DS-9148-KIT-IBM
<b>SFP and SFP+ Optics Options with OSM or STI Product SKUs (See Note 3)</b>	
Cisco MDS 9000 Family 8/4/2-Gbps Fibre Channel-SW, SFP+, LC (Configure-to-Order)	DS-SFP-FC8G-SW
Cisco MDS 9000 Family 4/2/1-Gbps Fibre Channel-SW, SFP, LC (Configure-to-Order)	DS-SFP-FC4G-SW
Cisco MDS 9000 Family 8/4/2-Gbps Fibre Channel-SW, SFP+ LC, spare	DS-SFP-FC8G-SW=
Cisco MDS 9000 Family 4/2/1-Gbps Fibre Channel-SW, SFP, LC, spare	DS-SFP-FC4G-SW=
Cisco MDS 9000 Family 4 Gbps CWDM Long Distance SFP, LC, Spare (See Note 1 for xxxx options)	DS-CWDM4Gxxxx=
Cisco MDS 9000 Family 8 Gbps CWDM Long Distance SFP, LC, Spare (See Note 1 for xxxx options)	DS-CWDM8Gxxxx=
Cisco MDS 9000 Family 8/4/2-Gbps Fibre Channel-LW, SFP+, LC, Spare	DS-SFP-FC8G-LW=
Cisco MDS 9000 Family 8/4/2-Gbps Fibre Channel-Extended Reach, SFP+, LC, Spare	DS-SFP-FC8G-ER=
Cisco MDS 9000 Family 4 Gbps DWDM Long Distance SFP, LC, Spare (See Note 1 for xx.x options)	ONS-SC-4G-xx.x=
<b>Configure-To-Order License Options (See Note 2)</b>	
Cisco MDS 9148 On-Demand Port Activation License (Uninstalled) wo/SFPs; activates increment of 8 ports, Configure-To-Order (See Note 4)	M9148PL8-8G
Cisco MDS 9000 Family Enterprise Package License (Uninstalled), Configure-To-Order (See Note 4)	M9100ENT1K9
Cisco Data Center Network Manager (DCNM) for SAN Advanced Edition (Uninstalled), Configure-To-Order (See Note 5)	DCNM-SAN-M91-K9
<b>Spare License Options</b>	
Cisco MDS 9148 On-Demand Port Activation License wo/SFPs; activates increment of 8 ports, Spare	M9148PL8-8G=
Cisco MDS 9148 On-Demand Port Activation License to activate 8 incremental ports with 8 4-Gbps SW optics, Spare	M9148PL8-4G-SFP=
Cisco MDS 9148 On-Demand Port Activation License for electronic delivery; activates increment of 8 ports, Spare	L-M9148PL8-8G=
Cisco Data Center Network Manager (DCNM) for SAN Advanced Edition, Spare	DCNM-SAN-M91-K9=
Cisco DCNM for SAN Advanced Edition Configurable Pack for MDS 9000 Series, Spare (See Note 6)	DCNM-SAN-PAK=
Cisco E-delivery Data Center Network Manager (DCNM) for SAN Advanced Edition, Spare	L-DCNM-S-M91-K9=
Cisco E-Delivery DCNM for SAN Advanced Edition Configurable Pack for MDS 9000 Series, Spare (See Note 6)	L-DCNM-S-PAK=
<b>Accessory Kits (Spares)</b>	
Generic Cisco Accessory Kit for Cisco MDS 9148, Spare	DS-9148-KIT-CSCO=
EMC Accessory Kit for Cisco MDS 9148, Spare	DS-9148-KIT-EMC=
HDS Accessory Kit for Cisco MDS 9148, Spare	DS-9148-KIT-HDS=
HP Accessory Kit for Cisco MDS 9148, Spare	DS-9148-KIT-HP=
IBM Accessory Kit for Cisco MDS 9148, Spare	DS-9148-KIT-IBM=

**Note: 1** For detailed information about all supported transceivers, see [Cisco MDS 9000 Family pluggable transceivers](#).

**Note: 2** For detailed information about the optional Cisco MDS 9000 Family Enterprise Package Software and the Cisco DCNM software, see [http://www.cisco.com/en/US/prod/collateral/ps4159/ps6409/ps6029/product\\_data\\_sheet09186a00801ca6ac.html](http://www.cisco.com/en/US/prod/collateral/ps4159/ps6409/ps6029/product_data_sheet09186a00801ca6ac.html) and <http://www.cisco.com/go/dcnm>, respectively.

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**Note: 3** Bundled and configure-to-order optical transceivers are shipped in the box with the product unit, but are not installed in the port cages on the unit. Spares ship separately.

**Note: 4** License documentation ships with switch unit in Accessory Kit for customer installation on switch.

**Note: 5** License documentation ships with switch unit in Accessory Kit for customer installation on management server.

**Note: 6** Cisco DCNM for SAN Advanced Edition Configurable Packs have additional Configure-To-Order Part Numbers not shown here which are detailed in the Cisco Dynamic Configuration Tool.

## Service and Support

Cisco offers a wide range of services programs to accelerate customer success. These innovative services programs are delivered through a unique combination of people, processes, tools, and partners, resulting in high levels of customer satisfaction. Cisco Services offerings help you protect your network investment, optimize network operations, and prepare the network for new applications to extend network intelligence and the power of your business. For more information about Cisco Services, see [Cisco Technical Support Services](#) or [Cisco Advanced Services](#).

## For More Information

For more information about the Cisco MDS 9148 Multilayer Fabric Switch, visit <http://www.cisco.com/go/9148> or contact your local account representative.



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