

## Cisco MDS 9216i Multilayer Fabric Switch

### PRODUCT OVERVIEW

The Cisco MDS 9216i (Figure 1) brings new capability to the fabric switch market. Sharing a consistent architecture with the Cisco MDS 9500 Series, the Cisco MDS 9216i integrates both Fibre Channel and IP storage services in a single system to allow maximum flexibility in user configurations. With 14 2-Gbps Fibre Channel ports, two Gigabit Ethernet IP storage services ports, and a modular expansion slot, the Cisco MDS 9216i is ideally suited for enterprise storage networks that require high-performance SAN extension or cost-effective IP storage connectivity.

This high level of integration gives Cisco MDS 9216i users the benefits of a multiprotocol system without sacrificing Fibre Channel port density. The expansion slot on the Cisco MDS 9216i allows for the addition of any Cisco MDS 9000 Family switching module, so users can add additional Fibre Channel ports and/or additional IP ports. Alternatively, the expansion slot can be used for a variety of Cisco MDS 9000 Family services modules, thereby providing an unparalleled level of storage services in a single, highly available 3-rack unit (RU) system.

**Figure 1.** Cisco MDS 9216i Multilayer Fabric Switch



### KEY FEATURES AND BENEFITS

The Cisco® MDS 9216i Multilayer Fabric Switch is designed for building mission-critical enterprise storage networks that take advantage of the cost-effectiveness and ubiquity of IP for more robust business continuance services. Using both Fibre Channel and IP in a single module, the Cisco MDS 9216i offers the following important features:

- **Integrated Fibre Channel and IP storage services in an optimized form factor**—Supports 14 2-Gbps Fibre Channel interfaces for high-performance storage area network (SAN) connectivity and two Gigabit Ethernet ports for Fibre Channel over IP (FCIP) and Small Computer System Interface over IP (iSCSI) storage services.
- **Integrated hardware-based VSANs and Inter-VSAN Routing (IVR)**—Enables deployment of large-scale multisite and heterogeneous SAN topologies. Integration into port-level hardware allows any port within a system or fabric to be partitioned into any VSAN. Integrated hardware-based inter-VSAN routing provides line-rate routing between any ports within a system or fabric without the need for external routing appliances.
- **High-performance Inter-Switch Links (ISLs)**—Supports up to 16 Fibre Channel links in a single PortChannel. Links can span any port on any module within a chassis for added scalability and resilience. Up to 3500 buffer-to-buffer credits can be assigned to a single Fibre Channel port to extend storage networks over unprecedented distances.

- **Intelligent network services**—Uses virtual SAN (VSAN) technology for hardware-enforced, isolated environments within a single physical fabric; access control lists (ACLs) for hardware-based intelligent frame processing; and advanced traffic management features such as Fibre Channel Congestion Control (FCC) and fabric-wide quality of service (QoS) to facilitate migration from SAN islands to enterprise-wide storage networks.
- **Advanced FICON services**—Supports FICON environments, including cascaded FICON fabrics, VSAN-enabled intermix of mainframe and open systems environments, and N\_Port ID virtualization for mainframe Linux partitions. CUP (Control Unit Port) support enables in-band management of Cisco MDS 9200 Series switches from the mainframe management console.
- **Comprehensive network security framework**—Supports RADIUS and TACACS+, Fibre Channel Security Protocol (FC-SP), Secure File Transfer Protocol (SFTP), Secure Shell (SSH) Protocol, and Simple Network Management Protocol Version 3 (SNMPv3) implementing Advanced Encryption Standard (AES), VSANs, hardware-enforced zoning, ACLs, and per-VSAN role-based access control. Additionally, the Gigabit Ethernet ports offer IP security (IPSec) authentication, data integrity, and hardware-assisted data encryption for FCIP and iSCSI.
- **Sophisticated diagnostics**—Provides intelligent diagnostics, protocol decoding, and network analysis tools as well as integrated Call Home capability for added reliability, faster problem resolution, and reduced service costs.
- **Open platform for intelligent storage applications**—Provides the intelligent services necessary for hosting and/or accelerating storage applications such as network-hosted volume management, data migration and backup. Storage services modules can be installed in any Cisco MDS 9500 or MDS 9200 series chassis to provide application hosting and/or acceleration intelligence in the fabric.
- **FCIP for remote SAN extension**
  - Simplifies data-protection and business continuance strategies by enabling backup, remote replication, and other disaster recovery services over WAN distances using open-standard FCIP tunneling.
  - Optimizes utilization of WAN resources for backup and replication by tunneling up to three virtual ISLs on a single Gigabit Ethernet port and enabling hardware-based compression, hardware-based encryption, FCIP Write Acceleration, and FCIP Tape Acceleration.
  - Preserves Cisco MDS 9000 Family enhanced capabilities, including VSANs, advanced traffic management, and network security across remote connections.
- **iSCSI for extension of SAN to Ethernet-attached servers**
  - Extends the benefits of Fibre Channel SAN-based storage to Ethernet-attached servers at a lower cost than possible using Fibre Channel interconnect alone.
  - Increases storage utilization and availability through consolidation of IP and Fibre Channel block storage.
  - Transparent operation preserves the capability of existing storage management applications.

## FCIP for Remote SAN Extension

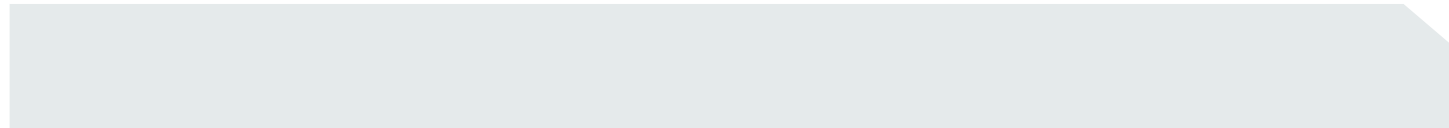
Data distribution, data protection, and business continuance services are significant components of today's information-centric businesses.

The ability to efficiently replicate critical data on a global scale not only ensures a higher level of data protection for valuable corporate information, but also increases utilization of backup resources and lowers total cost of storage ownership. The Cisco MDS 9216i uses open-standard FCIP to break the distance barrier of current Fibre Channel solutions and enable interconnection of SAN islands over extended distances.

## Advanced SAN Extension Features

The Cisco MDS 9216i supports FCIP compression to maximize the effective WAN bandwidth of SAN extension solutions. The Cisco MDS 9216i achieves up to a 30:1 compression ratio, with typical ratios of 2:1 over a wide variety of data sources. With the addition of hardware-based compression, the MDS 9216i is able to provide optimal levels of compressed throughput for implementations across both low-bandwidth and high-bandwidth links.

The Cisco MDS 9216i supports IPSec encryption for secure transmission of sensitive data over extended distances. Hardware enablement of IPSec ensures high throughput. Used together, hardware-based compression and hardware-based encryption provide high performance, highly secure SAN extension capability.



Additionally, the MDS 9216i supports FCIP Write Acceleration, a feature that can significantly improve application performance when storage traffic is extended across distance. When FCIP Write Acceleration is enabled, WAN throughput is optimized by reducing the latency of command acknowledgments. Similarly, the Cisco MDS 9216i supports FCIP Tape Acceleration, which significantly improves throughput over WAN links for remote tape backup operations.

### **Virtual SANs**

Ideal for efficient, secure SAN consolidation, VSANs allow more efficient storage network utilization by creating hardware-based isolated environments with a single physical SAN fabric or switch. Each VSAN can be zoned as a typical SAN and maintains its own fabric services for added scalability and resilience. VSANs allow the cost of SAN infrastructure to be shared among more users, while ensuring absolute segregation of traffic and retaining independent control of configuration on a VSAN-by-VSAN basis.

### **Integrated SAN Routing**

In another step toward deploying efficient, cost-effective, consolidated storage networks, the Cisco MDS 9216i multilayer fabric switch supports IVR, the industry's first routing functionality for Fibre Channel. IVR allows selective transfer of data between specific initiators and targets on different VSANs while maintaining isolation of control traffic within each VSAN. With IVR, data can transit VSAN boundaries while maintaining control plane isolation, thereby maintaining fabric stability and availability. Integrated IVR eliminates the need for external routing appliances, greatly increasing routing scalability while delivering line-rate routing performance, simplifying management, and eliminating the challenges associated with maintaining separate systems. Integrated IVR means lower total cost of SAN ownership.

### **Multiprotocol Intelligence**

The Cisco MDS 9216i architecture enables multilayer and multiprotocol functionality, allowing it to transparently integrate new transport technologies for maximum flexibility. Beginning with Fibre Channel, FICON, iSCSI, and FCIP, the Cisco MDS 9216i is a robust multiprotocol platform designed for deployment of cost-optimized storage networks. Users can implement up to 10-Gbps Fibre Channel or FICON for high-performance applications, iSCSI over Ethernet for cost-effective connectivity to shared storage pools, and FCIP for connectivity between data centers.

### **Open Platform for Intelligent Storage Applications**

The Cisco MDS 9216i multilayer fabric switch provides an open platform that delivers the intelligence and advanced features required to make multilayer intelligent SANs a reality, including hardware-enabled innovations to host or accelerate applications for data migration, data replication, serverless backup, network-hosted volume management and more. Hosting and/or accelerating these applications in the network can dramatically improve scalability, availability, security and manageability of the storage environment—resulting in increased utility and lower total cost of ownership (TCO).

## Integrated Mainframe Support

The Cisco MDS 9216i multilayer fabric switch is mainframe-ready, with full support for IBM zSeries FICON and Linux environments. Qualified by IBM for attachment to all FICON-enabled devices in an IBM zSeries operating environment, Cisco MDS 9216i multilayer fabric switches support transport of the FICON protocol in both cascaded and noncascaded fabrics, as well as an intermix of FICON and open systems Fibre Channel Protocol traffic on the same switch. VSANs simplify an intermix of SAN resources between z/OS, mainframe Linux, and open systems environments, allowing for increased SAN utilization and simplified SAN management. VSAN-based intermix mode eliminates the uncertainty and instability often associated with zoning-based intermix techniques. VSANs also eliminate the possibility of a misconfiguration or component failure in one VSAN affecting operation in other VSANs. VSAN-based management access controls simplify partitioning of SAN management responsibilities between mainframe and open systems environments, enhancing security. FICON VSANs can be managed using the integrated Cisco Fabric Manager; the Cisco CLI; or IBM CUP-enabled management tools, including SA/390, Resource Measurement Facility (RMF), or Dynamic Channel Path Management (DCM).

## Advanced Traffic Management

The following advanced traffic-management capabilities are integrated into the Cisco MDS 9216i to simplify deployment and optimization of large-scale fabrics.

- **Virtual Output Queuing**—Helps ensure line-rate performance on each port, independent of traffic pattern, by eliminating head-of-line blocking.
- **255 buffer-to-buffer credits**—Are assigned to each port for optimal bandwidth utilization across distance. When extended distances are required, up to 3500 credits can be allocated to a single port within a group of four Fibre Channel ports.
- **PortChannels**—Allow users to aggregate up to 16 physical ISLs into a single logical bundle, providing optimized bandwidth utilization across all links. The bundle can consist of any speed-matched ports from any module in the chassis, ensuring that the bundle can remain active even in the event of a module 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.
- **Fibre Channel Congestion Control (FCC)**—Is an end-to-end, feedback-based congestion control mechanism that augments the Fibre Channel buffer-to-buffer credit mechanism to provide enhanced traffic management.

## Advanced Diagnostics and Troubleshooting Tools

Management of large-scale storage networks requires proactive diagnostics, tools to verify connectivity and route latency, and mechanisms for capturing and analyzing traffic. The Cisco MDS 9000 Family integrates the industry's most advanced analysis and diagnostic tools. Power-on self test (POST) and online diagnostics provide proactive health monitoring. The Cisco MDS 9216i implements diagnostic capabilities such as Fibre Channel Traceroute for detailing the exact path and timing of flows and Switched Port Analyzer (SPAN) to intelligently capture network traffic. After traffic has been captured, it can then be analyzed with the Cisco Fabric Analyzer, an embedded Fibre Channel analyzer. Comprehensive port-based and flow-based statistics facilitate sophisticated performance analysis and service-level agreement (SLA) accounting. With the Cisco MDS 9000 Family, Cisco Systems® delivers the most comprehensive toolset for troubleshooting and analysis of storage networks.

## Comprehensive Solution for Robust Network Security

Addressing the need for failproof security in storage networks, the Cisco MDS 9216i offers an extensive security framework to protect highly sensitive data crossing today's enterprise networks. The Cisco MDS 9216i employs intelligent packet inspection at the port level, including the application of ACLs for hardware enforcement of zones, VSANs, and advanced Port Security features.

Extended zoning capabilities are enabled to ensure that logical unit numbers (LUNs) are accessible only by specific hosts (LUN zoning), to limit SCSI read commands for a certain zone (read-only zoning), and to restrict broadcasts to only selected zones (broadcast zones). VSANs are used to achieve higher security and greater stability by providing complete isolation among devices that are connected to the same physical SAN. In addition, FC-SP provides switch-switch and host-switch Diffie-Hellman Challenge Handshake Authentication Protocol (DH-CHAP) authentication supporting RADIUS or TACACS+, to help ensure that only authorized devices access protected storage networks. Finally, for both FCIP and iSCSI deployments, the comprehensive IPSec protocol suite delivers secure authentication, data integrity, and hardware-based encryption.

## Ease of Management

To meet the needs of all users, the Cisco MDS 9216i provides three principal modes of management: the Cisco MDS 9000 Family command-line interface (CLI), Cisco Fabric Manager, and integration with third-party storage management tools.

The Cisco MDS9216i presents a 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 capability. It is an extremely efficient and direct interface designed to provide optimal functionality to administrators in enterprise environments.

Cisco Fabric Manager is a responsive, easy-to-use Java application that simplifies management across multiple switches and fabrics. Cisco Fabric Manager enables administrators to perform vital tasks such as topology discovery, fabric configuration and verification, provisioning, monitoring, and fault resolution. All functions are available through a secure interface, enabling remote management from any location.

Cisco Fabric Manager can be used independently or in conjunction with third-party management applications. Cisco provides an extensive API for integration with third-party and user-developed management tools.

## Advanced Software Packages

The Cisco MDS 9216i can be further enhanced through additional software packages that offer advanced intelligence and functionality. Currently available software packages include the following:

- **Cisco Enterprise Package**—The Cisco Enterprise Package includes a set of traffic engineering and advanced security features such as IVR, QoS, switch-switch and host-switch authentication, LUN zoning, and read-only zones that are recommended for enterprise SANs.
- **SAN Extension over IP Package**—The Cisco SAN Extension over IP Package provides an integrated, cost-effective, and reliable business continuance solution that uses IP infrastructure by offering FCIP for remote SAN extension, along with a variety of advanced features to optimize the performance and manageability of FCIP links.
- **Cisco Mainframe Package**—The Cisco Mainframe Package is a comprehensive collection of features required for using the Cisco MDS 9500 Series and MDS 9200 Series switches in mainframe storage networks, including the IBM Fiber Connection (FICON) protocol, Control Unit Port (CUP) management, switch cascading, fabric binding, and intermixing.
- **Cisco Fabric Manager Server Package**—The Cisco Fabric Manager Server (FMS) Package extends Cisco Fabric Manager by providing historical performance monitoring for network traffic hot-spot analysis, centralized management services, and advanced application integration.

## Versatile Expansion

The modular design of the Cisco MDS 9216i gives it the ability to support current and future Cisco MDS 9000 Family switching or services modules. Currently available modules include the following:

- 16-port and 32-port 2-Gbps Fibre Channel switching modules
- 12-port, 24-port, and 48-port 4-Gbps Fibre Channel switching modules
- 4-port 10-Gbps Fibre Channel switching module
- The IP Services Modules supporting iSCSI and FCIP over both four and eight ports of Gigabit Ethernet
- The multiprotocol services module supporting 14 ports of 2-Gbps Fibre Channel and two ports of Gigabit Ethernet
- The Storage Services Module supporting integrated network-hosted application services and 32 ports of 2-Gbps Fibre Channel

Optionally configurable, these modules give the Cisco MDS 9216i unparalleled functionality and versatility.

## PRODUCT SPECIFICATIONS

Table 1 lists the product specifications for the Cisco MDS 9216i.

**Table 1.** Product Specifications

Feature	Description
Product Compatibility	<ul style="list-style-type: none"><li>• Cisco MDS 9000 Family</li></ul>
Software Compatibility	<ul style="list-style-type: none"><li>• Cisco MDS SAN-OS Release 2.0(1) or later</li></ul>
Protocols	<ul style="list-style-type: none"><li>• Fibre Channel standards<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>– 10GFC, Revision 4.0 (ANSI/INCITS 364:2003)</li><li>– FC-FS, Revision 1.9 (ANSI/INCITS 373-2003)</li><li>– FC-FS-2, Revision 0.92</li><li>– FC-LS, Revision 1.2</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-GS-3, Revision 7.01 (ANSI/INCITS 348-2001)</li></ul></li></ul>

Feature	Description
	<ul style="list-style-type: none"> <li>– FC-GS-4, Revision 7.91 (ANSI/INCITS 387-2004)</li> <li>– FC-GS-5, Revision 8.2</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>– 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 1.74</li> <li>– FC-DA, Revision 3.1 (INCITS TR-36-2004)</li> <li>– FAIS, Revision 0.7</li> <li>• IP over Fibre Channel (RFC 2625)</li> <li>• IPv6, IPv4 and ARP over FC (RFC 4338)</li> <li>• Extensive IETF-standards based TCP/IP, SNMPv3, and remote monitoring (RMON) MIBs</li> <li>• Class of Service: Class 2, Class 3, Class F</li> <li>• Fibre Channel standard port types: E, F, FL, B</li> <li>• Fibre Channel enhanced port types: SD, ST, TE</li> <li>• IP standards <ul style="list-style-type: none"> <li>– RFC 791 IPv4</li> <li>– RFC 793, 1323 TCP</li> <li>– RFC 894 IP/Ethernet</li> <li>– RFC 1041 IP/802</li> <li>– RFC 792, 950, 1256 ICMP</li> <li>– RFC 1323 TCP performance enhancements</li> <li>– RFC 2338 VRRP</li> <li>– RFC 2460, 4291 IPv6</li> <li>– RFC 2463 ICMPv6</li> <li>– RFC 2461, 2462 IPv6 neighbor discovery and stateless auto-configuration</li> <li>– RFC 2464 IPv6/Ethernet</li> <li>– RFC 3270 iSCSI</li> </ul> </li> </ul>

Feature	Description
	<ul style="list-style-type: none"> <li>– RFC 3643, 3821 FCIP</li> <li>• Ethernet standards <ul style="list-style-type: none"> <li>– IEEE 802.3z Gigabit Ethernet</li> <li>– IEEE 802.1Q VLAN</li> </ul> </li> <li>• IPSec <ul style="list-style-type: none"> <li>– RFC 2401 security architecture for IP</li> <li>– RFC 2403, 2404 HMAC</li> <li>– RFC 2405, 2406, 2451 IP ESP</li> <li>– RFC 2407, 2408 ISAKMP</li> <li>– RFC 2412 OAKLEY Key Determination Protocol</li> <li>– RFC 3566, 3602, 3686 AES</li> </ul> </li> <li>• Internet Key Exchange (IKE) <ul style="list-style-type: none"> <li>– RFC 2409 IKEv1</li> <li>– IKEv2, draft</li> </ul> </li> </ul>
<b>Cards, Ports, Slots</b>	<ul style="list-style-type: none"> <li>• Base: 14 fixed autosensing 1/2-Gbps Fibre Channel ports and 2 fixed 1-Gbps Ethernet ports</li> <li>• Expansion: 1 empty expansion slot</li> </ul>
<b>Features and Functions</b>	
Fabric Services	<ul style="list-style-type: none"> <li>• Name server</li> <li>• Internet Storage Name Server (iSNS)</li> <li>• Registered State Change Notification (RSCN)</li> <li>• Login services</li> <li>• Fabric Configuration Server (FCS)</li> <li>• Private loop</li> <li>• Public loop</li> <li>• Translative loop</li> <li>• Broadcast</li> <li>• In-order delivery</li> </ul>
Advanced Functionality	<ul style="list-style-type: none"> <li>• VSAN</li> <li>• IVR</li> <li>• PortChannel with Multipath Load Balancing</li> <li>• QoS-flow-based, zone-based</li> <li>• Fibre Channel Congestion Control</li> <li>• Extended Buffer-To-Buffer Credits</li> <li>• FCIP Write Acceleration</li> <li>• FCIP Tape Acceleration</li> </ul>



Feature	Description
Diagnostics and Troubleshooting Tools	<ul style="list-style-type: none"> <li>• POST diagnostics</li> <li>• Online diagnostics</li> <li>• Internal port loopbacks</li> <li>• SPAN and Remote SPAN</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>• Online system health</li> <li>• Port-level statistics</li> <li>• Real-Time Protocol Debug</li> </ul>
Network Security	<ul style="list-style-type: none"> <li>• VSANs</li> <li>• ACLs</li> <li>• Per-VSAN role-based access control</li> <li>• Fibre Channel Zoning <ul style="list-style-type: none"> <li>– N_Port WWN</li> <li>– N_Port FC-ID</li> <li>– Fx_Port WWN</li> <li>– Fx_Port WWN and interface index</li> <li>– Fx_Port domain ID and interface index</li> <li>– Fx_Port domain ID and port number</li> <li>– LUN</li> <li>– Read-only</li> <li>– Broadcast</li> </ul> </li> <li>• iSCSI zoning <ul style="list-style-type: none"> <li>– iSCSI name</li> <li>– IP address</li> </ul> </li> <li>• FC-SP <ul style="list-style-type: none"> <li>– DH-CHAP switch-switch authentication</li> <li>– DH-CHAP host-switch authentication</li> </ul> </li> <li>• Port Security and Fabric Binding</li> <li>• IPSec for FCIP and iSCSI</li> <li>• IKEv1 and IKEv2</li> <li>• Management access <ul style="list-style-type: none"> <li>– SSHv2 implementing AES</li> <li>– SNMPv3 implementing AES</li> </ul> </li> <li>• SFTP</li> </ul>

Feature	Description																																				
FICON	<ul style="list-style-type: none"><li>FC-SB-3 compliant</li><li>Cascaded FICON fabrics</li><li>Intermix of FICON and Fibre Channel FCP traffic</li><li>CUP management interface</li></ul>																																				
Serviceability	<ul style="list-style-type: none"><li>Configuration file management</li><li>Call Home</li><li>Power-management LEDs</li><li>Port beaconing</li><li>System LED</li><li>SNMP traps for alerts</li><li>Network boot</li></ul>																																				
Performance	<ul style="list-style-type: none"><li>Port speed: 1/2-Gbps autosensing, optionally configurable</li><li>Buffer credits: up to 3500 per port</li><li>Ports per chassis: 14 to 62 Fibre Channel ports, up to 10 1-Gbps Ethernet ports</li><li>Ports per rack: up to 896</li><li>PortChannel: up to 16 physical links</li><li>Supported optics, media, and transmission distances:<table><tr><th>Optics</th><th>Media</th><th>Distance</th></tr><tr><td>1-Gbps-SW, LC SFP</td><td>50/125 micron multimode</td><td>500 m</td></tr><tr><td>1-Gbps-SX, LC SFP</td><td>50/125 micron multimode</td><td>550 m</td></tr><tr><td>1-Gbps-SW, LC SFP</td><td>62.5/125 micron multimode</td><td>300 m</td></tr><tr><td>1-Gbps-SX, LC SFP</td><td>62.5/125 micron multimode</td><td>275 m</td></tr><tr><td>1-Gbps-LW, LC SFP</td><td>9/125 micron single-mode</td><td>10 km</td></tr><tr><td>1-Gbps-LX/LH, LC SFP</td><td>9/125 or 10/125 micron single-mode</td><td>10 km</td></tr><tr><td>1-Gbps-CWDM, LC SFP</td><td>9/125 micron single-mode</td><td>100 km</td></tr><tr><td>2-Gbps-SW, LC SFP</td><td>50/125 micron multimode</td><td>300 m</td></tr><tr><td>2-Gbps-SW, LC SFP</td><td>62.5/125 micron multimode</td><td>150 m</td></tr><tr><td>2-Gbps-LW, LC SFP</td><td>9/125 micron single-mode</td><td>10 km</td></tr><tr><td>2-Gbps-CWDM, LC SFP</td><td>9/125 micron single-mode</td><td>100 km</td></tr></table></li></ul>	Optics	Media	Distance	1-Gbps-SW, LC SFP	50/125 micron multimode	500 m	1-Gbps-SX, LC SFP	50/125 micron multimode	550 m	1-Gbps-SW, LC SFP	62.5/125 micron multimode	300 m	1-Gbps-SX, LC SFP	62.5/125 micron multimode	275 m	1-Gbps-LW, LC SFP	9/125 micron single-mode	10 km	1-Gbps-LX/LH, LC SFP	9/125 or 10/125 micron single-mode	10 km	1-Gbps-CWDM, LC SFP	9/125 micron single-mode	100 km	2-Gbps-SW, LC SFP	50/125 micron multimode	300 m	2-Gbps-SW, LC SFP	62.5/125 micron multimode	150 m	2-Gbps-LW, LC SFP	9/125 micron single-mode	10 km	2-Gbps-CWDM, LC SFP	9/125 micron single-mode	100 km
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Reliability and Availability	<ul style="list-style-type: none"><li>Hot-swappable, 1+1 redundant power supplies</li><li>Hot-swappable fan tray with integrated temperature and power management</li><li>Hot-swappable SFP optics</li><li>Hot-swappable switching module</li><li>Passive backplane</li><li>Stateful process restart</li><li>Any module, any port configuration for PortChannels</li><li>Fabric-based multipathing</li></ul>																																				

Feature	Description
	<ul style="list-style-type: none"> <li>• Per-VSAN fabric services</li> <li>• Port tracking</li> <li>• Virtual Routing Redundancy Protocol (VRRP) for management and FCIP or iSCSI connections</li> <li>• Online diagnostics</li> </ul>
<b>Network Management</b>	<ul style="list-style-type: none"> <li>• Access methods <ul style="list-style-type: none"> <li>– Out-of-band 10/100 Ethernet port</li> <li>– RS-232 serial console port</li> <li>– In-band IP over Fibre Channel</li> <li>– DB-9 COM port</li> <li>– In-band FICON CUP over Fibre Channel</li> </ul> </li> <li>• Access protocols <ul style="list-style-type: none"> <li>– CLI via console and Ethernet ports</li> <li>– SNMPv3 via Ethernet port and in-band IP over Fibre Channel access</li> <li>– Storage Networking Industry Association (SNIA) Storage Management Initiative Specification (SMI-S)</li> <li>– FICON CUP</li> </ul> </li> <li>• Distributed Device Alias service</li> <li>• Network security <ul style="list-style-type: none"> <li>– Per-VSAN role-based access control using RADIUS and TACACS+-based authentication, authorization, and accounting (AAA) functions</li> <li>– SFTP</li> <li>– SSHv2 implementing AES</li> <li>– SNMPv3 implementing AES</li> </ul> </li> <li>• Management applications <ul style="list-style-type: none"> <li>– Cisco MDS 9000 Family CLI</li> <li>– Cisco Fabric Manager</li> <li>– Cisco Device Manager</li> <li>– CiscoWorks Resource Manager Essentials (RME) and Device Fault Manager (DFM)</li> </ul> </li> </ul>
<b>Programming Interfaces</b>	<ul style="list-style-type: none"> <li>• Scriptable CLI</li> <li>• Fabric Manager GUI</li> <li>• Device Manager GUI</li> </ul>
<b>Environmental</b>	<ul style="list-style-type: none"> <li>• Temperature, ambient operating: 32 to 104°F (0 to 40°C)</li> <li>• Temperature, ambient nonoperating and storage: 40 to 158°F (–40 to 75°C)</li> <li>• Relative humidity, ambient (noncondensing) operating: 10 to 90%</li> <li>• Relative humidity, ambient (noncondensing) nonoperating and storage: 10 to 95%</li> <li>• Altitude, operating: –197 to 6500 feet (–60 to 2000 m)</li> </ul>

Feature	Description
Physical Dimensions	<ul style="list-style-type: none"> <li>Dimensions (H x W x D): 5.25 x 17.32 x 22.66 in. (13.34 x 43.99 x 57.56 cm), 3 rack units (RUs) <ul style="list-style-type: none"> <li>All units rack mountable in standard 19-inch EIA rack</li> </ul> </li> <li>Weight <ul style="list-style-type: none"> <li>Fully configured chassis with optional switching module: 70 lb (32 kg)</li> </ul> </li> </ul>
Power and Cooling	<p>Power supply (845W AC)</p> <ul style="list-style-type: none"> <li>AC input characteristics <ul style="list-style-type: none"> <li>100 to 240V AC (10% range)</li> <li>50–60 Hz (nominal)</li> </ul> </li> <li>Airflow <ul style="list-style-type: none"> <li>200 linear feet per minute (lfm) through system fan assembly</li> <li>Cisco recommends that you maintain a minimum air space of 2.5 in. (6.4 cm) between walls and chassis air vents and a minimum horizontal separation of 6 in. (15.2 cm) between two chassis to prevent overheating.</li> </ul> </li> </ul>
Approvals and Compliance	<ul style="list-style-type: none"> <li>Safety compliance <ul style="list-style-type: none"> <li>CE Marking</li> <li>UL 60950</li> <li>CAN/CSA-C22.2 No. 60950</li> <li>EN 60950</li> <li>IEC 60950</li> <li>TS 001</li> <li>AS/NZS 3260</li> <li>IEC60825</li> <li>EN60825</li> <li>21 CFR 1040</li> </ul> </li> <li>EMC compliance <ul style="list-style-type: none"> <li>FCC Part 15 (CFR 47) Class A</li> <li>ICES-003 Class A</li> <li>EN 55022 Class A</li> <li>CISPR 22 Class A</li> <li>AS/NZS 3548 Class A</li> <li>VCCI Class A</li> <li>EN 55024</li> <li>EN 50082-1</li> <li>EN 61000-6-1</li> <li>EN 61000-3-2</li> <li>EN 61000-3-3</li> </ul> </li> </ul>

## ORDERING INFORMATION

Table 2 lists ordering information for the Cisco MDS 9216i.

**Table 2.** Ordering Information

Part Number	Product Name
DS-C9216i-K9	Cisco MDS 9216i Multilayer Fabric Switch
<b>Optional Switching Modules, SFPs</b>	
DS-X9016	Cisco MDS 9000 Family 16-Port 1/2-Gbps Fibre Channel Module, SFP/LC
DS-X9032	Cisco MDS 9000 Family 32-Port 1/2-Gbps Fibre Channel Module, SFP/LC
DS-X9032SSM	Cisco MDS 9000 Family 32-Port Storage Services Module
DS-X9112	Cisco MDS 9000 Family 1/2/4-Gbps 12-Port Fibre Channel Switching Module
DS-X9124	Cisco MDS 9000 Family 1/2/4-Gbps 24-Port Fibre Channel Switching Module
DS-X9148	Cisco MDS 9000 Family 1/2/4-Gbps 48-Port Fibre Channel Switching Module
DS-X9302-14K9	Cisco MDS 9000 Family 14/2-Port Multiprotocol Services Module
DS-X9304-SMIP	Cisco MDS 9000 Family 4-Port 1-GE IP Storage Services Module
DS-X9308-SMIP	Cisco MDS 9000 Family 8-Port 1-GE IP Storage Services Module
DS-X9704	Cisco MDS 9000 Family 10-Gbps 4-Port Fibre Channel Switching Module
DS-SFP-FC-2G-SW	Cisco MDS 9000 Family 1/2-Gbps Fibre Channel—Shortwave, SFP, LC (Supported only with 1/2-Gbps FC ports)
DS-SFP-FC-2G-LW	Cisco MDS 9000 Family 1/2-Gbps Fibre Channel—Longwave, SFP, LC (Supported only with 1/2-Gbps FC ports)
DS-SFP-FCGE-SW	Cisco MDS 9000 Family Gigabit Ethernet, 1/2-Gbps Fibre Channel—Shortwave, SFP, LC (Supported only with 1/2-Gbps FC ports and IP Services ports)
DS-SFP-FCGE-LW	Cisco MDS 9000 Family Gigabit Ethernet, 1/2-Gbps Fibre Channel—Longwave, SFP, LC (Supported only with 1/2-Gbps FC ports and IP Services ports)
DS-SFP-GE-T	Gigabit Ethernet Copper SFP, RJ-45 (Supported only with IP Services ports)
DS-SFP-FC4G-SW	Cisco MDS 9000 Family 1/2/4-Gbps Fibre Channel—Shortwave, SFP, LC (Supported only with 1/2/4-Gbps FC ports)
DS-SFP-FC4G-MR	Cisco MDS 9000 Family 1/2/4-Gbps Fibre Channel—Longwave, SFP, LC (4-km reach) (Supported only with 1/2/4-Gbps FC ports)
DS-SFP-FC4G-LW	Cisco MDS 9000 Family 1/2/4-Gbps Fibre Channel—Longwave, SFP, LC (10-km reach) (Supported only with 1/2/4-Gbps FC ports)
DS-X2-FC10G-SR	10-Gbps Fibre Channel—SR X2 Transceiver (Supported only with 10-Gbps FC ports)
DS-X2-FC10G-LR	10-Gbps Fibre Channel—LR X2 Transceiver (Supported only with 10-Gbps FC ports)
<b>Advanced Software Packages</b>	
M9200EXT12K9	Cisco MDS 9200 SAN Extension over IP Package for Cisco MDS 9000 Family 14/2-Port Multiprotocol Services Module
M9200EXT1K9	Cisco MDS 9200 SAN Extension over IP Package for Cisco MDS 9000 Family 8-Port 1-GE IP Storage Services Module
M9200EXT14K9	Cisco MDS 9200 SAN Extension over IP Package for Cisco MDS 9000 Family 4-Port 1-GE IP Storage Services Module
M9200ENT1K9	Cisco MDS 9200 Series Enterprise Package
M9200FMS1K9	Cisco MDS 9200 Series Fabric Manager Server Package
M9200FIC1K9	Cisco MDS 9200 Series Mainframe Package

Part Number	Product Name
M9200SSE1K9	Cisco MDS 9200 Storage Services Enabler Package for the Cisco MDS 9000 Family Advanced Services Module or the Cisco MDS 9000 Family Storage Services Module
<b>Spare Components</b>	
DS-2SLOT-FAN=	Cisco MDS 9200 Fan Module, spare
DS-CAC-845W=	Cisco MDS 9200 AC power supply—845W, spare
DS-X9016=	Cisco MDS 9000 Family 16-Port 1/2 -Gbps Fibre Channel Module, SFP/LC, spare
DS-X9032=	Cisco MDS 9000 Family 32-Port 1/2-Gbps Fibre Channel Module, SFP/LC
DS-X9032-SSM=	Cisco MDS 9000 Family 32-Port Storage Services Module, spare
DS-X9112=	Cisco MDS 9000 Family 1/2/4-Gbps 12-Port Fibre Channel Switching Module, spare
DS-X9124=	Cisco MDS 9000 Family 1/2/4-Gbps 24-Port Fibre Channel Switching Module, spare
DS-X9148=	Cisco MDS 9000 Family 1/2/4-Gbps 48-Port Fibre Channel Switching Module, spare
DS-X9302-14K9=	Cisco MDS 9000 Family 14/2-Port Multiprotocol Services Module, spare
DS-X9304-SMIP=	Cisco MDS 9000 Family 4-Port 1-GE IP Storage Services Module, spare
DS-X9308-SMIP=	Cisco MDS 9000 Family 8-Port 1-GE IP Storage Services Module, spare
DS-X9704=	Cisco MDS 9000 Family 10-Gbps 4-Port Fibre Channel Switching Module, spare
DS-SFP-FC-2G-SW=	Cisco MDS 9000 Family 1/2-Gbps Fibre Channel—Shortwave, SFP, LC, spare (Supported only with 1/2/4-Gbps FC ports)
DS-SFP-FC-2G-LW=	Cisco MDS 9000 Family 1/2-Gbps Fibre Channel—Longwave, SFP, LC, spare (Supported only with 1/2/4-Gbps FC ports)
DS-SFP-FCGE-SW=	Cisco MDS 9000 Family 1-Gbps Ethernet, 1/2-Gbps Fibre Channel—Shortwave, SFP, LC, spare (Supported only with 1/2-Gbps FC ports and IP Services ports)
DS-SFP-FCGE-LW=	Cisco MDS 9000 Family 1-Gbps Ethernet, 1/2-Gbps Fibre Channel—Longwave, SFP, LC, spare (Supported only with 1/2-Gbps FC ports and IP Services ports)
DS-SFP-FC4G-SW=	Cisco MDS 9000 Family 1/2/4-Gbps Fibre Channel—Shortwave, SFP, LC, spare (Supported only with 1/2/4-Gbps FC ports)
DS-SFP-FC4G-MR=	Cisco MDS 9000 Family 1/2/4-Gbps Fibre Channel—Longwave, SFP, LC (4-km reach), spare (Supported only with 1/2/4-Gbps FC ports)
DS-SFP-FC4G-LW=	Cisco MDS 9000 Family 1/2/4-Gbps Fibre Channel—Longwave, SFP, LC (10-km reach), spare (Supported only with 1/2-Gbps FC ports)
DS-X2-FC10G-SR=	10-Gbps Fibre Channel—SR X2, spare (Supported only with 10-Gbps FC ports)
DS-X2-FC10G-LR=	10-Gbps Fibre Channel—LR X2, spare (Supported only with 10-Gbps FC ports)
DS-SFP-GE-T=	Gigabit Ethernet Copper SFP, RJ-45, spare (Supported only with Gigabit Ethernet ports)
M9200EXT12K9=	Cisco MDS 9200 SAN Extension over IP Package for Cisco MDS 9000 Family 14/2-Port Multiprotocol Services Module, spare
M9200EXT1K9 =	Cisco MDS 9200 SAN Extension over IP Package for Cisco MDS 9000 Family 8-Port 1-GE IP Storage Services Module, spare
M9200EXT14K9=	Cisco MDS 9200 SAN Extension over IP Package for Cisco MDS 9000 Family 4-Port 1-GE IP Storage Services Module, spare
M9200ENT1K9=	Cisco MDS 9200 Series Enterprise Package, spare
M9200FMS1K9=	Cisco MDS 9200 Series Fabric Manager Server Package, spare

Part Number	Product Name
M9200FIC1K9=	Cisco MDS 9200 Series Mainframe Package, spare
M9200SSE1K9=	Cisco MDS 9200 Storage Services Enabler Package for the Cisco MDS 9000 Family Advanced Services Module or the Cisco MDS 9000 Family Storage Services Module, spare
DS-CWDM-1470=	Cisco 1470 NM CWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DS-CWDM-1490=	Cisco 1490 NM CWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DS-CWDM-1510=	Cisco 1510 NM CWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DS-CWDM-1530=	Cisco 1530 NM CWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DS-CWDM-1550=	Cisco 1550 NM CWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DS-CWDM-1570=	Cisco 1570 NM CWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DS-CWDM-1590=	Cisco 1590 NM CWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare
DS-CWDM-1610=	Cisco 1610 NM CWDM Gigabit Ethernet and 1/2-Gbps Fibre Channel SFP, spare

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## FOR MORE INFORMATION

For more information about the Cisco MDS 9216i, visit <http://www.cisco.com/en/US/products/hw/ps4159/ps4358/index.html> or contact your local account representative.

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