Cisco MDS 9250i Multiservice Fabric Switch for IBM System Storage

IBM Redbooks Product Guide

This IBM® Redbooks® Product Guide describes the Cisco MDS 9250i Multiservice Fabric Switch for IBM System Storage. The MDS 9250i, the next generation of the highly flexible, industry-leading, and proven Cisco MDS 9200 Series Multiservice Switches, is an optimized platform for deploying high performance SAN extension solutions, distributed intelligent fabric services, and cost-effective multiprotocol connectivity for both open systems and mainframe environments. With a compact form factor and advanced capabilities that are normally available only on director-class switches, the MDS 9250i is an ideal solution for departmental and remote branch-office SANs and in large-scale SANs with the Cisco MDS 9710 Multilayer Director for IBM System Storage.

The MDS 9250i switch offers up to 40 16-Gbps Fibre Channel ports, two 1/10-Gigabit Ethernet IP storage services ports, and eight 10-Gigabit Ethernet Fibre Channel over Ethernet (FCoE) ports in a fixed two-rack-unit (2RU) form factor. The MDS 9250i switch connects to existing native Fibre Channel networks, protecting current investments in storage networks.

The Cisco SAN Extension over IP application package license is enabled as standard on the two fixed, 1/10-Gigabit Ethernet IP storage services ports, enabling features such as Fibre Channel over IP (FCIP) and compression on the switch without the need for additional licenses. Also, by using the eight 10-Gigabit Ethernet FCoE ports, the MDS 9250i platform attaches to directly connected FCoE and Fibre Channel storage devices, and supports multitiered unified network fabric connectivity directly over FCoE.
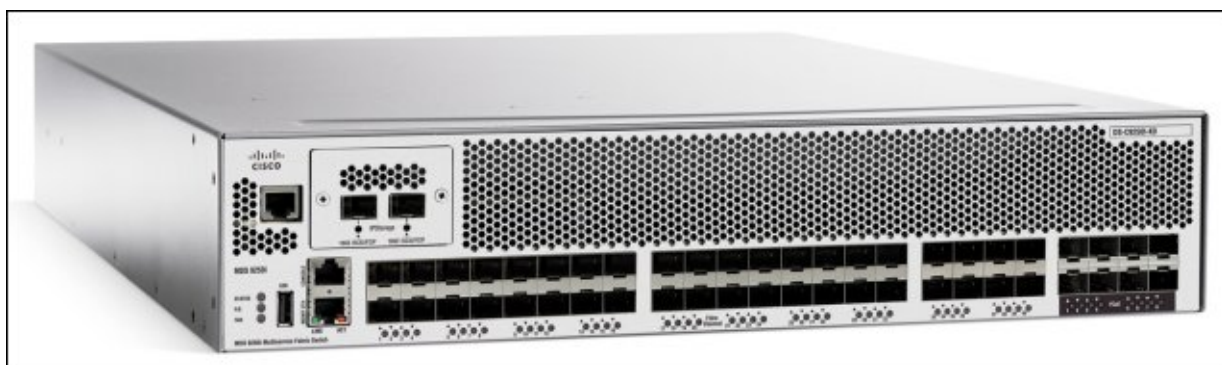
Figure 1 shows the MDS 9250i.

Figure 1. MDS 9250i

Did you know?

- Virtual SANs (VSANs) create hardware-based isolated environments with a single physical SAN fabric or switch.

- Fibre Channel routing with Inter-VSAN Routing (IVR) allows selective transfer of data between specific initiators and targets on different VSANs.

- The MDS 9250i switch scales up to 40 ports of 16-Gbps Fibre Channel in a fixed configuration switch.

Product highlights

The MDS 9250i switch provides unique multiservice and multiprotocol functions in a compact 2RU form factor:

- **SAN consolidation with integrated multiprotocol support :** The MDS 9250i switch is available in a base configuration of 20 ports of 16-Gbps Fibre Channel for high-performance SAN connectivity, 2 ports of 1/10-Gigabit Ethernet for FCIP and Small Computer System Interface over IP (iSCSI) storage services, and eight ports of 10-Gigabit Ethernet for FCoE connectivity.

- **High-density Fibre Channel switch with 16-Gbps connectivity:** The MDS 9250i switch scales up to 40 ports of 16-Gbps Fibre Channel in a fixed configuration switch. The base configuration comes with 20 ports of 16-Gbps Fibre Channel enabled for high-performance SAN connectivity. It can be upgraded onsite to enable additional 20 ports of 16-Gbps Fibre Channel by adding the MDS 9250i On-Demand Port Activation license. Additionally, the MDS 9250i cost-effectively scales up for IBM Fibre Connection (FICON) mainframe environments.

- **Intelligent application services engine :** The MDS 9250i switch includes as standard a single application services engine that enables the included Cisco SAN Extension over IP software solution package to run on the two fixed, 1/10-Gigabit Ethernet storage services ports. 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 various advanced features to optimize the performance and manageability of FCIP links.

- **Hardware-based virtual fabric isolation with virtual VSANs and Fibre Channel routing with IVR :** VSANs and IVR enable deployment of large-scale multisite and heterogeneous SAN topologies. Integration into port-level hardware allows any port in a system or in a fabric to be partitioned into any VSAN. Included in the optional MDS 9200 Enterprise advanced software package, IVR provides line-rate routing between any of the ports in a system or in a fabric without the need for external routing appliances.

- **Remote SAN extension with high -performance FCIP:**
  - Simplifies data protection and business-continuance strategies by enabling backup, remote replication, and other disaster-recovery services over WAN distances using open-standards FCIP tunneling.
  - Optimizes the usage of WAN resources for backup and replication by enabling hardware-based compression, hardware-based encryption, FCIP write acceleration, and FCIP tape read and write acceleration. Virtual inter-switch link (ISL) connections are provided on the two 1/10-Gigabit Ethernet ports through tunneling.
  - Preserves Cisco MDS 9000 Family enhanced capabilities, including VSANs, IVR, advanced traffic management, and network security across remote connections.

- **Cost-effective iSCSI connectivity to Ethernet -attached servers:**
  - o Extends the benefits of Fibre Channel SAN-based storage to Ethernet-attached servers at a lower cost than is possible by using Fibre Channel interconnect alone.
  - o Increases storage usage and availability through consolidation of IP and Fibre Channel block storage.
  - o Through transparent operation, it preserves the capability of existing storage management applications.
- **Advanced FICON services:** The MDS 9250i supports FICON environments, including cascaded FICON fabrics, VSAN-enabled intermix of mainframe and open systems environments, and N Port ID Virtualization (NPIV) for mainframe Linux partitions. IBM Control Unit Port (CUP) support enables in-band management of Cisco MDS 9200 Series switches from the mainframe management console. FICON tape acceleration reduces latency effects for FICON channel extension over FCIP for FICON tape read and write operations to mainframe physical or virtual tape. This feature is sometimes referred to as tape pipelining.
- **Cisco Data Mobility Manager (DMM) as a distributed fabric service:** DMM is a fabric-based data migration solution that transfers block data nondisruptively across heterogeneous storage volumes and across distances, whether the host is online or offline.
- **Platform for intelligent fabric applications:** The MDS 9250i switch provides an open platform that delivers the intelligence and advanced features that are required to make multilayer intelligent SANs a reality, including hardware-enabled innovations to host or accelerate applications for data migration, storage backup, and data replication. Hosting 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 TCO.
- **In Service Software Upgrade (ISSU) for Fibre Channel interfaces:** The MDS 9250i switch promotes high serviceability by allowing Cisco MDS 9000 NX-OS Software to be upgraded while the Fibre Channel ports are carrying traffic.
- **Intelligent network services:** The MDS 9250i switch uses 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 fabric-wide quality of service (QoS) to facilitate migration from SAN islands to enterprise-wide storage networks.
- **High-performance ISLs:** The MDS 9250i switch supports up to 16 Fibre Channel ISLs in a single PortChannel. Links can span any port on any module in a chassis for added scalability and resilience. Up to 253 buffer-to-buffer credits can be assigned to a single Fibre Channel port to extend storage networks over long distances.
- **Comprehensive network security framework:** The MDS 9250i switch supports RADIUS and TACACS+, Fibre Channel Security Protocol (FC-SP), Secure File Transfer Protocol (SFTP), Secure Shell (SSH) Protocol, Simple Network Management Protocol Version 3 (SNMPv3) implementing Advanced Encryption Standard (AES), VSANs, hardware-enforced zoning, ACLs, and per-VSAN role-based access control (RBAC). Additionally, the 10-Gigabit Ethernet ports offer IP Security (IPSec) authentication, data integrity, and hardware-assisted data encryption for FCIP and iSCSI.
- **IP Version 6 (IPv6) capable:** The MDS 9250i switch supports IPv6 as mandated by the US Department of Defense (DoD), Japan, and China. IPv6 support is provided for FCIP, iSCSI, and management traffic routed inband and out of band.
- **Sophisticated diagnostic tests:** The MDS 9250i switch provides intelligent diagnostic tests, protocol decoding, and network analysis tools, and integrated Cisco Call Home capability for added reliability, faster problem resolution, and reduced service costs.

Architecture and key components

This section describes the architecture and key components of the MDS 9250i.

VSANs

VSANs are ideal for efficient, secure SAN consolidation, enabling more efficient storage network usage 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 helping ensure complete segregation of traffic and retaining independent control of configuration on a VSAN-by-VSAN basis.

IVR

In another step toward deploying efficient, cost-effective, and consolidated storage networks, the MDS 9250i switch supports IVR, the industry's first routing function 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, maintaining fabric stability and availability. IVR is one of the feature enhancements that are provided with the MDS 9200 Enterprise advanced software package. It eliminates the need for external routing appliances, greatly increasing routing scalability while delivering line-rate routing performance, simplifying management, and eliminating the challenges that are associated with maintaining separate systems. Deploying IVR means lower total cost of SAN ownership.

FCIP for remote SAN extension

Data distribution, data protection, and business continuance services are significant components of today's information-centric businesses. The capability to efficiently replicate critical data on a global scale not only helps ensure a higher level of data protection for valuable corporate information, but also increases the usage of backup resources and lowers total cost of storage ownership.

- Building on expertise and knowledge of IP networks, the MDS 9250i switch uses open-standards FCIP to break the distance barrier of current Fibre Channel solutions, enabling the interconnection of SAN islands over extended distances.

- The MDS 9250i switch dramatically enhances hardware-based FCIP compression performance for both high-bandwidth and low-bandwidth links, providing immediate cost savings for expensive WAN infrastructure. The MDS 9250i achieves up to a 43:1 compression ratio, with typical ratios of 4:1 to 5:1 over a wide variety of data sources.

- The MDS 9250i switch supports hardware-based IPSec encryption for secure transmission of sensitive data over extended distances. Hardware enablement of IPSec helps ensure high throughput. Used together, hardware-based compression and hardware-based encryption provide high-performance, highly secure SAN extension capabilities.

I/O Acceleration services

The MDS 9250i switch supports Cisco MDS 9250i I/O Acceleration (IOA) services, an advanced software package that can significantly improve application performance when storage traffic is extended across long distances. When Fibre Channel and FCIP write acceleration are enabled, WAN throughput is optimized through reduced latency for command acknowledgments. Similarly, the MDS 9250i switch supports Fibre Channel and FCIP tape write acceleration, which allows operation at nearly full throughput over WAN links for remote tape backup and restore operations.

MDS 9250i IOA can be deployed with disk data replication solutions to extend the distance between data centers or reduce the effects of latency. MDS 9250i IOA can also be used to enable remote tape backup and restore operations without significant throughput degradation. Here are the main features of MDS 9250i IOA:

- Extension of the acceleration service as a fabric service to any port in the fabric, regardless of where it is attached

- Fibre Channel write acceleration (FC-WA) and Fibre Channel tape acceleration (FC-TA)

- FCIP write acceleration (FCIP-WA) and FCIP tape acceleration (FCIP-TA)

- Fibre Channel and FCIP compression

- High availability using PortChannels with acceleration over Fibre Channel and FCIP

- Unified solution for disk and tape I/O acceleration over metropolitan area networks (MANs) and WANs

- Speed-independent acceleration that accelerates 2/4/8/16-Gbps FC links and consolidates traffic over 8/16 Gigabit ISLs

Cisco DMM

Cisco DMM is an advanced software package that is composed of a fabric-based data migration solution that transfers block data nondisruptively across heterogeneous storage volumes and across distances, whether the host is online or offline. This data center-class solution helps mitigate the challenges that are experienced in migrating data, such as downtime, the need to add data migration software to servers, and the potential for data loss and corruption. By enabling the DMM feature on an MDS 9250i switch that is anywhere in the SAN, data migration can be configured without host agents, without rewiring, without affecting performance, and without downtime.

Mainframe support

The MDS 9250i is mainframe-ready and supports IBM zSeries FICON and Linux environments provided with the Cisco MDS 9200 Mainframe advanced software package. Qualified by IBM for attachment to all FICON-enabled devices in an IBM zSeries operating environment, MDS 9250i 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 intermixing of SAN resources among IBM z/OS, mainframe Linux, and open systems environments, enabling increased SAN utilization and simplified SAN management. VSAN-based intermix mode eliminates the uncertainty and instability that is often associated with zoning-based intermix techniques. VSANs also eliminate the possibility that a misconfiguration or component failure in one VSAN will affect 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 standard Cisco Data Center Network Manager (DCNM), the command-line interface (CLI), or IBM CUP-enabled management tools, including SA/390, Resource Measurement Facility (RMF), and Dynamic Channel Path Management (DCM).

The MDS 9200 Mainframe package is required for all MDS 9250i integrated FICON channel extension features. In combination with SAN extension capabilities, it enables FICON tape read and write acceleration.

Advanced traffic management

The following advanced traffic-management capabilities are integrated as standard on the MDS 9250i switch:

- Virtual output queue (VOQ): Helps ensure line-rate performance on each port, independent of traffic pattern, by eliminating head-of-line blocking.

- PortChannels: Allow users to aggregate up to 16 physical ISLs into a single logical bundle, providing optimized bandwidth usage across all links. The bundle can consist of any speed-matched ports from any module in the chassis, helping ensure that the bundle can remain active even during a module failure.

- Fabric Shortest Path First (FSPF)-based multipathing: Provides the intelligence to load-balance across up to 16 equal-cost paths and, during a switch failure, dynamically reroute traffic.

The following extra advanced traffic-management capabilities are available on the MDS 9250i switch with the optional MDS 9200 Enterprise advanced software package to simplify deployment and optimization of large-scale fabrics:

- Up to 256 buffer-to-buffer credits: Can be assigned to an individual port for optimal bandwidth usage across long distances.

- QoS: Can be used to manage bandwidth and control latency to prioritize critical traffic for specific applications.

- IVR: Eliminates the need for external routing appliances, greatly increasing routing scalability while delivering line-rate routing performance, simplifying management, and eliminating the challenges that are associated with maintaining separate systems.

- SCSI flow statistics: Collects logical unit number (LUN)-level SCSI flow statistics, including read, write, and error statistics, for any combination of initiators and targets.

Comprehensive solution for robust network security

To address the need for failure-proof security in storage networks, the MDS 9250i switch includes as standard an extensive security framework to protect highly sensitive data crossing today's enterprise networks:

- When the Smart Zoning feature is enabled, Cisco MDS 9000 Family fabrics provision the hardware access control entries that are specified by the zone set more efficiently. Doing so avoids the superfluous entries that 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.

- Intelligent packet inspection is provided at the port level, including the application of ACLs for hardware enforcement of zones, VSANs, and advanced port-security features.

- Extended zoning capabilities are provided to help ensure that LUNs can be accessed 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).

The following additional advanced security-management capabilities are available on the MDS 9250i switch with the MDS 9200 Enterprise advanced software package to further help ensure the security of large-scale fabrics:

- Switch-to-switch and host-to-switch authentication helps eliminate disruptions that might occur because of unauthorized devices connecting to a large enterprise fabric.

- Port security locks down the mapping of an entity to a switch port to help ensure that SAN security is not compromised by connection of unauthorized devices to a switch port.

- VSAN-based access control allows customers to define roles in which the scope of the roles is limited to certain VSANs.

- FC-SP provides switch-switch and host-switch Diffie-Hellman Challenge Handshake Authentication Protocol (DH-CHAP) authentication that supports RADIUS and TACACS+ to help ensure that only authorized devices access protected storage networks.

- Comprehensive IPSec protocol suite delivers secure authentication, data integrity, and hardware-based encryption for both FCIP and iSCSI deployments.

- Digital certificates are issued by a trusted third party and are used as electronic passports to prove the identity of certificate owners.

- Fabric binding for open systems helps ensure that the ISLs are enabled only between switches that are authorized in the fabric binding configuration.

Advanced diagnostic and troubleshooting tools

Management of large-scale storage networks requires proactive diagnostic 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, which are included as standard on the MDS 9250i switch. The power-on self-test (POST) and Cisco Generic Online Diagnostics (GOLD) provide proactive health monitoring. The MDS 9250i switch implements diagnostic capabilities such as Fibre Channel traceroute to identify the exact path and timing of flows, and Switched Port Analyzer (SPAN) to intelligently capture network traffic. After traffic is captured, it can be analyzed with Cisco Fabric Analyzer, which is 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 delivers a comprehensive tool set for troubleshooting and analysis of storage networks.

Ease of management

To meet the needs of all users, the MDS 9250i switch provides three principal modes of management: The Cisco MDS 9000 Family CLI, Cisco DCNM, and integration with third-party storage management tools.

The MDS 9250i switch 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 capabilities. The Cisco MDS 9000 Family CLI is an efficient and direct interface that provides optimal capabilities to administrators in enterprise environments.

Data Center Network Manager (DCNM) for SAN is an application that simplifies management across multiple switches and converged fabrics. It provides robust features to meet the routing, switching, and storage administration needs of present and future virtualized data centers, streamlines provisioning of the unified fabric, and proactively monitors SAN components. DCNM SAN can be used independently or with third-party management applications.

The solution is designed to scale to large enterprise deployments through a scale-out server architecture with automated failover capability. These capabilities provide a resilient management system that

centralizes infrastructure and path monitoring across geographically dispersed data centers. DCNM SAN base management functions are available at no additional charge, whereas advanced features are unlocked with the DCNM SAN Advanced license.

The Cisco DCNM SAN application can be installed on Linux and Microsoft Windows operating systems and supports both PostgreSQL and Oracle databases.

Advanced software packages

The MDS 9250i switch can be further enhanced through additional optional licensed software packages that offer advanced intelligence and functions (summarized in Tables 1 and 2). The following software packages are available:

- MDS 9200 Enterprise package: This package includes a set of traffic engineering and advanced security features, such as extended-distance buffer-to-buffer (B2B) credits, IVR, QoS, switch-to-switch and host-to-switch authentication, LUN zoning, and read-only zones, which are recommended for enterprise SANs.

- MDS 9200 DCNM SAN Advanced: DCNM is an easy-to-use application that simplifies management across multiple switches and fabrics. Focused on supporting efficient operations and management of virtual machine-aware fabrics, it provides a robust framework and rich feature set that meets the routing, switching, and storage administration needs of present and future virtualized data centers. MDS 9200 DCNM streamlines provisioning of the unified fabric and proactively monitors the SAN components.

- MDS 9250i IOA Services package: The MDS 9250i switch supports IOA services, which is an advanced software package that can significantly improve application performance when storage traffic is extended across long distances. When Fibre Channel and FCIP write acceleration is enabled, WAN throughput is optimized through reduced latency for command acknowledgments.

- MDS 9000 DMM package: This package on the MDS 9250i switch enables DMM to perform fabric-based data migration that transfers block data nondisruptively across heterogeneous storage volumes and across distances, regardless of whether the host is online or offline. This license is available through RPQ 8S1390.

- MDS 9200 Mainframe package: This package is a comprehensive collection of features required for using the Cisco MDS 9200 Series switches in mainframe storage networks. These features include FICON protocol, FICON tape acceleration (read and write), CUP management, switch cascading, fabric binding, and intermixing.

Table 1 lists the advanced software packages that do not require Application Services Engine.

Table 1. Advanced software packages that do not require Application Services Engine

Advanced software packages that do not require Application Services Engine	Included or optional
DCNM SAN base version	Included
DCNM SAN Advanced	Optional
MDS 9200 Enterprise	Optional
MDS 9250i On-Demand Port Activation	Optional
MDS 9200 Mainframe	Optional

Table 2 lists the advanced software packages that require Application Services Engine.

Table 2. Advanced software packages that require Application Services Engine

Advanced software packages that require Application Services Engine	Included or optional
SAN Extension over IP	Included
MDS 9250i IOA Services	Optional
MDS 9000 DMM package	Optional

MDS 9250i product specifications

This section describes the product specifications for the 9250i switch. The MDS 9250i switch offers distributed intelligent fabric services, cost-effective and high-performing FC and FCIP connectivity for open systems, remote SAN extension, and fast disaster recovery.

For a detailed, three-dimensional view of the MDS 9250i switch, see the following website:
http://bit.ly/1is5Ek8

All of the features that are shown in this view are included in the IBM offering.

Table 3 lists the specifications for the MDS 9250i switch.

Table 3. Specifications for the MDS 9250i switch (part 1 of 5)

Feature	Description
Product compatibility	● Cisco MDS 9000 Family
Software compatibility	● Cisco MDS 9000 NX-OS Release 6.2.11c or later

Protocols	● Fibre Channel standards
	  o FC-PH, Revision 4.3 (ANSI INCITS 230-1994)
	  o FC-PH, Amendment 1 (ANSI INCITS 230-1994/AM1-1996)
	  o FC-PH, Amendment 2 (ANSI INCITS 230-1994/AM2-1999)
	  o FC-PH-2, Revision 7.4 (ANSI INCITS 297-1997)
	  o FC-PH-3, Revision 9.4 (ANSI INCITS 303-1998)
	  o FC-PI, Revision 13 (ANSI INCITS 352-2002)
	  o FC-PI-2, Revision 10 (ANSI INCITS 404-2006)
	  o FC-PI-3, Revision 4 (ANSI INCITS 460-2011)
	  o FC-PI-4, Revision 8 (ANSI INCITS 450-2008)
	  o FC-PI-5, Revision 6 (ANSI INCITS 479-2011)
	  o FC-FS, Revision 1.9 (ANSI INCITS 373-2003)
	  o FC-FS-2, Revision 1.01 (ANSI INCITS 424-2007)
	  o FC-FS-2, Amendment 1 (ANSI INCITS 424-2007/AM1-2007)
	  o FC-FS-3, Revision 1.11 (ANSI INCITS 470-2011)
	  o FC-LS, Revision 1.62 (ANSI INCITS 433-2007)
	  o FC-LS-2, Revision 2.21 (ANSI INCITS 477-2011)
	  o FC-SW-2, Revision 5.3 (ANSI INCITS 355-2001)
	  o FC-SW-3, Revision 6.6 (ANSI INCITS 384-2004)
	  o FC-SW-4, Revision 7.5 (ANSI INCITS 418-2006)
	  o FC-SW-5, Revision 8.5 (ANSI INCITS 461-2010)
	  o FC-GS-3, Revision 7.01 (ANSI INCITS 348-2001)
	  o FC-GS-4, Revision 7.91 (ANSI INCITS 387-2004)
	  o FC-GS-5, Revision 8.51 (ANSI INCITS 427-2007)
	  o FC-GS-6, Revision 9.4 (ANSI INCITS 463-2010)
	  o FCP, Revision 12 (ANSI INCITS 269-1996)
	  o FCP-2, Revision 8 (ANSI INCITS 350-2003)
	  o FCP-3, Revision 4 (ANSI INCITS 416-2006)
	  o FCP-4, Revision 2b (ANSI INCITS 481-2011)
	  o FC-SB-2, Revision 2.1 (ANSI INCITS 349-2001)
	  o FC-SB-3, Revision 1.6 (ANSI INCITS 374-2003)
	  o FC-SB-3, Amendment 1 (ANSI INCITS 374-2003/AM1-2007)
	  o FC-SB-4, Revision 3.0 (ANSI INCITS 466-2011)
	  o FC-BB-2, Revision 6.0 (ANSI INCITS 372-2003)
	  o FC-BB-3, Revision 6.8 (ANSI INCITS 414-2006)
	  o FC-BB-4, Revision 2.7 (ANSI INCITS 419-2008)
	  o FC-BB-5, Revision 2.0 (ANSI INCITS 462-2010)
	  o FC-VI, Revision 1.84 (ANSI INCITS 357-2002)
	  o FC-SP, Revision 1.8 (ANSI INCITS 426-2007)
	  o FC-SP-2, Revision 2.71 (ANSI INCITS 496-2012)
	  o FAIS, Revision 1.03 (ANSI INCITS 432-2007)
	  o FAIS-2, Revision 2.23 (ANSI INCITS 449-2008)
	  o FC-IFR, Revision 1.06 (ANSI INCITS 475-2011)
	  o FC-FLA, Revision 2.7 (INCITS TR-20-1998)
	  o FC-PLDA, Revision 2.1 (INCITS TR-19-1998)
	  o FC-Tape, Revision 1.17 (INCITS TR-24-1999)
	  o FC-MI, Revision 1.92 (INCITS TR-30-2002)
	  o FC-MI-2, Revision 2.6 (INCITS TR-39-2005)
	  o FC-MI-3, Revision 1.03 (INCITS TR-48-2012)

Table 3. Specifications for the MDS 9250i switch (part 2 of 5)

Feature	Description
Protocols (continued)	- o FC-DA, Revision 3.1 (INCITS TR-36-2004) - o FC-DA-2, Revision 1.06 (INCITS TR-49-2012) - o FC-MSQS, Revision 3.2 (INCITS TR-46-2011) - Fibre Channel classes of service: Class 2, Class 3, and Class F - Fibre Channel standard port types: E, F, FL, and B - Fibre Channel enhanced port types: SD, ST, and TE - IP over Fibre Channel (RFC 2625) - IPv6, IPv4, and Address Resolution Protocol (ARP) over Fibre Channel (RFC 4338) - Extensive IETF-standards based TCP/IP, SNMPv3, and remote monitoring (RMON) MIBs - IP standards - o RFC 791 IPv4 - o RFC 793 and 1323 TCP - o RFC 894 IP/Ethernet - o RFC 1041 IP/802 - o RFC 792, 950, and 1256 ICMP - o RFC 1323 TCP performance enhancements - o RFC 2338 VRRP - o RFC 2460 and 4291 IPv6 - o RFC 2463 and 4443 ICMPv6 - o RFC 2461 and 2462 IPv6 neighbor discovery and stateless autoconfiguration - o RFC 2464 IPv6/Ethernet - o RFC 3270 and 3980 iSCSI - o RFC 3643 and 3821 FCIP - Ethernet standards - o IEEE Std 802.3-2005 Ethernet - o IEEE Std 802.1Q-2005 VLAN - o IPSec - o RFC 2401 and 4301 security architecture for IP - o RFC 2403 and 2404 HMAC - o RFC 2405, 2406, 2451, and 4303 IP ESP - o RFC 2407 and 2408 ISAKMP - o RFC 2412 OAKLEY Key Determination Protocol - o RFC 3566, 3602, and 3686 AES - Internet Key Exchange (IKE) - o RFC 2409 IKEv1 - o RFC 4306 IKEv2
Cards, ports, and slots	Fixed configuration with 40 ports of 16-Gbps Fibre Channel and 10 ports of 10-Gigabit Ethernet
Fabric services	- Name server - Internet Storage Name Server (iSNS) - Registered State Change Notification (RSCN) - Login services - Fabric Configuration Server (FCS) - Public loop - Broadcast - In-order delivery
Advanced functions	- VSAN - IVR - PortChannel with multipath load balancing - Flow-based and zone-based QoS - FCIP tape read and write acceleration

Table 3. Specifications for the MDS 9250i switch (part 3 of 5)

Feature	Description
Diagnostic and troubleshooting tools	• POST diagnostic tests • Cisco Generic Online Diagnostics (GOLD) • Internal port loopbacks • SPAN and Remote SPAN (RSPAN) • Fibre Channel traceroute • Fibre Channel ping • Fibre Channel debug • Cisco Fabric Analyzer • Syslog • Online system health • Port-level statistics • Real-Time Protocol (RTP) debug
Network security	• VSANs • ACLs • Per-VSAN RBAC • Fibre Channel zoning • N-port Worldwide Name (WWN) • N-port FC-ID • Fx-port WWN • Fx-port WWN and interface index • Fx-port domain ID and interface index • Fx-port domain ID and port number • iSCSI zoning • iSCSI name • IP address • FC-SP • DH-CHAP switch-to-switch authentication • DH-CHAP host-to-switch authentication • Port security and fabric binding • IPSec for FCIP and iSCSI • IKEv1 and IKEv2 • Management access • SSHv2 implementing AES • SNMPv3 implementing AES • SFTP
FICON	• FC-SB-3 compliant • Cascaded FICON fabrics • Intermix of FICON and Fibre Channel Protocol traffic • CUP management interface
Serviceability	• Configuration file management • ISSU for Fibre Channel interfaces • Cisco Call Home • Power-management LEDs • Port beaconing • System LED • SNMP traps for alerts • Network boot
Performance	• Port speed: 4/8/16-Gbps autosensing, optionally configurable • Buffer credits: 64 per port (shared-mode ports) and up to 253 on an individual port (dedicated-mode ports with optional Cisco MDS 9000 Enterprise package license activated) • Ports per chassis: 40 ports of 16-Gbps Fibre Channel, 8 ports of 10-Gigabit Ethernet FCoE and 2 ports of 1/10-Gigabit Ethernet • Ports per rack: Up to 1050 • PortChannel: Up to 16 physical links • FCIP tunnels: Up to 6 per port

Table 3. Specifications for the MDS 9250i switch (part 4 of 5)

Feature	Description
Reliability and availability	- ISSU - Hot-swappable, 2+1 redundant power supplies - Hot-swappable fan tray with integrated temperature and power management - Hot-swappable SFP+ optics - Passive backplane - Stateful process restart - Any port configuration for PortChannels - Fabric-based multipathing - Per-VSAN fabric services - Port tracking - VRRP for management and FCIP or iSCSI connections - Online diagnostic tests
Network management	- Access methods - Out-of-band 10/100 Gigabit Ethernet port - RS-232 serial console port - In-band IP over Fibre Channel - In-band FICON CUP over Fibre Channel - Access protocols - CLI using the console and Ethernet ports - SNMPv3 using the Ethernet port and in-band IP over Fibre Channel access - Storage Networking Industry Association (SNIA) Storage Management Initiative Specification (SMI-S) - FICON CUP - Distributed device alias service - Network security - Per-VSAN RBAC using RADIUS and TACACS+-based authentication, authorization, and accounting (AAA) functions - SFTP - SSHv2 implementing AES - SNMPv3 implementing AES - Management applications - Cisco MDS 9000 Family CLI - Cisco DCNM SAN Advanced Edition - Cisco Device Manager
Programming interfaces	- Scriptable CLI - Cisco DCNM web services API - Cisco Device Manager GUI
Approvals and compliance	- Safety compliance - CE Marking - UL 60950 - CAN/CSA-C22.2 No. 60950 - EN 60950 - IEC 60950 - TS 001 - AS/NZS 3260 - IEC60825 - EN60825 21 CFR 1040 - EMC compliance - FCC Part 15 (CFR 47) Class A - ICES-003 Class A - EN 55022 Class A - CISPR 22 Class A - AS/NZS 3548 Class A - VCCI Class A

Table 3. Specifications for the MDS 9250i switch (part 5 of 5)

Feature	Description
Approvals and compliance (continued)	- EN 55024 - EN 50082-1 - EN 61000-6-1 - EN 61000-3-2 - EN 61000-3-3

Supported Cisco optics, media, and transmission distances for the MDS 9250i switch

Table 4 lists the supported Cisco optics, media, and transmission distances for the MDS 9250i switch.

Table 4. Supported Cisco optics, media, and transmission distances for the MDS 9250i switch (part 1 of 2)

Speed	Media	Distance
8-Gbps SW, LC Enhanced Small Form-Factor Pluggable (SFP+)	50-micron multimode (OM3)	150 m
8-Gbps SW, LC SFP+	50-micron multimode (OM2)	50 m
8-Gbps SW, LC SFP+	62.5-micron multimode	21 m
8-Gbps LW, LC SFP+	9-micron single mode	10 km
16-Gbps SW, LC SFP+	50-micron multimode (OM4)	125 m
16-Gbps SW, LC SFP+	50-micron multimode (OM3)	100 m
16-Gbps SW, LC SFP+	50-micron multimode (OM2)	35 m
16-Gbps SW, LC SFP+	62.5-micron multimode (OM1)	15 m
16-Gbps LW, LC SFP+	9-micron single mode	10 km
10GBASE-SR SFP+	50-micron multimode / 2000 MHz km	300 m
10GBASE-SR SFP+	50-micron multimode / 500 MHz km	82 m
10GBASE-SR SFP+	50-micron multimode / 400 MHz km	66 m

Table 4. Supported Cisco optics, media, and transmission distances for the MDS 9250i switch (part 2 of 2)

Speed	Media	Distance
10GBASE-SR SFP+	62.5-micron multimode / 200 MHz km	33 m
10GBASE-SR SFP+	62.5-micron multimode / 160 MHz km	26 m
10GBASE- LR 10km SFP+	9-micron single mode	10 km
Tri-Rate SW SFP	62.5-micron multimode/1Gbps	300 m
Tri-Rate SW SFP	62.5-micron multimode/2Gbps	150 m
Tri-Rate SW SFP	50.0-micron multimode/1Gbps	500 m
Tri-Rate SW SFP	50.0-micron multimode/2Gbps	300 m
Tri-Rate SW SFP	9-micron single mode/1 Gbps	10 km
Tri-Rate LW SFP	9-micron single mode/2 Gbps	10 km

Note: For more information about all the supported transceivers, see the Cisco MDS 9000 Family pluggable transceivers data sheet: at
http://bit.ly/1ma0ql7

Physical and environmental specifications for the MDS 9250i switch

Table 5 lists the physical and environmental specifications for the MDS 9250i switch.

Table 5. Physical and environmental specifications for the MDS 9250i switch

Feature	Description
Environmental	● Temperature, ambient operating: 0 to 40°C (32 to 104°F) ● Temperature, ambient nonoperating and storage: -40 to 70°C (40 to 158°F) ● Relative humidity, ambient (noncondensing) operating: 10 - 90% ● Relative humidity, ambient (noncondensing) nonoperating and storage: 10 - 95% ● Altitude, operating: -60 to 2000 m (-197 to 6500 ft)
Physical dimensions	● Dimensions (H x W x D): 9.75 cm x 43.74 cm x 54.36 cm (3.84 in. x 17.22 in. x 21.4 in.), 2RUs; all units rack mountable in standard 19-inch Electronic Industries Alliance (EIA) rack) ● Weight of fully configured chassis: 10.2 kg (22.4 lb)
Power and cooling	● Power supply: 300W AC ● Power cord: Notched C15 socket connector connecting to C16 plug on power supply ● AC input characteristics ● 100 - 240 V AC (10% range) ● 50 - 60 Hz (nominal) ● Airflow (front to back) ● 200 linear feet per minute (LFM) through system fan assembly ● Cisco recommends maintaining a minimum air space of 6.4 cm (2.5 in.) between walls and chassis air vents and a minimum horizontal separation of 15.2 cm (6 in.) between two chassis to prevent overheating.

Ordering information

Table 6 lists the ordering information.

Table 6. Part numbers or feature codes and descriptions

IBM Part Number/Feature Code	Description
9710-E01	Base Machine with 20x 16 Gbps FC Ports, 8x FCoE and 2x FCIP Ports
5210	Tri-Rate SW SFP
5220	Tri-Rate LW SFP
5410	10GBASE-SR SFP+
5420	10GBASE- LR 10km SFP+
5602	FC 16Gb SW SFP+
5604	FC 16Gb SW SFP+ - 4 Pack
5611	FC 16Gb 10km LW SFP+
5614	FC 16Gb 10km LW SFP+ - 4 Pack
5830	FC 8Gb SW SFP+
5834	FC 8Gb SW SFP+ - 4 Pack
5850	FC 8Gb 10km LW SFP+
5854	FC 8Gb 10km LW SFP+ - 4 Pack
5855	FC 8 Gb LC 40 Km SFP+
5605	5m 50u LC/LC Fiber Cable
5625	25m 50u LC/LC Fiber Cable
9110	Power Cord, 125VAC 15A NEMA 5-15 Plug, North America
9111	Power Cord, 250VAC 10A 3112 Plug, Australia
9112	Power Cord, 250VAC 10A CEE 7/7 Plug, EU
9113	Power Cord, 250VAC 10A CEI 23-16/VII Plug, Italy
9114	Power Cord, 250VAC 13A BS1363 Plug (13 A fuse), UK
9115	Power Cord, 250VAC 10A IRAM 2073 Plug, Argentina
9116	Power Cord, 250VAC 10A SABS 164/1 Plug, South Africa
9117	Power Cord, 250VAC 10A, Straight C15, MP232 Plug, SWITZ
9118	Power Cord, 250VAC 10A GB1002 Plug, China
9119	Power Cord, 250VAC 10A SI16S3 Plug, Israel
9120	Cabinet Jumper Power Cord, 250 VAC16A, C14-C15 Connector
9121	Power Cord, 125VAC 13A KSC8305 Plug, Korea
9122	Power Cord, 125VAC 15A CNS10917-2, Taiwan
9555	Bulk Order MES Feature

Table 7 lists the feature codes for licensed software.

Table 7. Licensed software

Feature Code	Description
7011	MDS 9200 Enterprise Pkg
7012	MDS 9250i IO Accelerator
7031	MDS 9200 Mainframe Pkg
7050	MDS 9200 DCNM SAN Advanced Edition
7065	MDS 9250i 20-port FC Port-On-Demand

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Related publications

For more information about the Cisco MDS 9250i, see the following documents:

● Cisco MDS 9000 Family Pluggable Transceivers
  http://bit.ly/1dbyDXs

● Cisco MDS 9000 Series Multilayer Switches
  http://www.cisco.com/en/US/products/hw/ps4159/ps4358/index.html

● Cisco MDS 9250i Multiservice Fabric Switch for IBM System Storage
  http://www.ibm.com/systems/storage/san/ctype/9250i/index.html

● IBM System Storage Interoperation Center (SSIC)
  http://www.ibm.com/systems/support/storage/ssic/interoperability.wss

● IBM Support Fix Central support site (select a product from drop-down menus)
  http://www.ibm.com/support/fixcentral/

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