



Overview

IBM mainframes have been the workhorses of the computing world for more than four decades, and many large organizations still entrust IBM System z servers with their most mission-critical and demanding applications.

Cisco® MDS 9000 Family directors and SAN switches deliver many of the same benefits that long-time IBM mainframe customers have come to expect from their mainframe systems.

Figure 1. Cisco MDS 9513 FICON Director



Infrastructure Simplification

One notable characteristic of the IBM System z architecture is its ability to scale by assembling a large pool of computing resources capable of supporting the most demanding application workloads and then partitioning these resources in a flexible, dynamic manner.

The Cisco MDS 9000 Family FICON (IBM Fiber Connection) product line spans the full range of sizes and form factors to meet mainframe data center needs. Modular, bladed, fully redundant directors are available with 6, 9, or 13 blades. The flagship Cisco MDS 9513 Multilayer Director scales up to provide 528 ports of FICON connectivity. Smaller fixed-configuration and

semimodular switches are also available for more specialized needs and applications.

Just as the resources of an IBM System z can be divided into Logical Partitions (LPARs), you can create FICON VSANs on Cisco MDS 9000 Family directors and switches. Each FICON VSAN is a completely distinct, protected set of switch resources, providing isolation from other workloads. Each FICON VSAN has its own set of fabric services: its own instance of the FICON Control Unit Port (CUP), a unique domain ID for each VSAN and director combination, Fabric Shortest Path First (FSPF) routing, and security profile. No special hardware is required to create FICON VSANs or to enforce the isolation of their resources.

A FICON VSAN can include ports from one or more line cards on a single director, or it can include ports from line cards on multiple directors to support cascaded configurations. FICON VSANs are dynamic in size, and addition of ports to a FICON VSAN is a nondisruptive process. The maximum number of ports for a FICON VSAN domain ID is 250 due to FICONs addressing structure, so a single Cisco MDS 9513 can provision several FICON director VSANs.

Business Resiliency

All Cisco MDS 9000 Family directors are engineered to meet the reliability, availability, and serviceability (RAS) requirements of the most demanding workloads. They provide nondisruptive software upgrades, stateful process restart and failover, in-order delivery, and full redundancy of all components. Recent analyses by Miercom have shown the superiority of the Cisco MDS 9500 Family in terms of high availability and consistency and predictability of performance under load.

This redundancy makes the Cisco MDS 9000 Family ideally suited for business-continuity and disaster-recovery applications, supporting both array and mainframe-based solutions such as Geographically Dispersed

Parallel Sysplex (GDPS), IBM Metro Mirror (formerly Peer-to-Peer Remote Copy [PPRC]), real and virtual tape, and IBM z/OS Global Mirror (formerly Extended Remote Copy [XRC]). The Cisco MDS 9000 Family provides a broad range of features for these environments:

- FICON cascading allows extension over greater metropolitan area network (MAN) distances and connection across WAN links with Fibre Channel over IP (FCIP).
- A new feature, XRC Acceleration, improves performance and bandwidth utilization over WAN links for IBM z/OS Global Mirror dynamic updates.
- Support for GDPS.
- Tape and virtual tape products from IBM and Sun/StorageTek (STK) are supported, as are storage arrays from IBM, EMC, Sun/STK, and HDS. FICON tape acceleration improves performance and bandwidth utilization over FCIP links.
- Dense Wavelength-Division Multiplexing (DWDM) and Coarse Wavelength-Division Multiplexing (CWDM) optics are available for every line card, integrating directly into the director or switch, enabling a simple and cost-effective solution. The integration of DWDM optics into the Cisco MDS 9500 line cards lets the cards communicate directly with reconfigurable optical add-drop multiplexer (ROADM) optical multiplexers, avoiding the need for transponder equipment.
- Up to 5880 buffer-to-buffer credits can be assigned to a single port, maintaining performance over MAN distances.
- Integrated FCIP is provided, with hardware-based compression, IP Security (IPsec) encryption, and TCP stacks tuned for storage traffic.
- No-cost PortChannels are supported to provide additional resiliency and performance by combining ports into a single logical port. The ability to create PortChannels from ports on different line



cards provides outstanding availability and resiliency.

- Multiple FICON and open systems VSANs can be provided over the same Inter-Switch Links (ISLs), and a quality of service (QoS) can be assigned to give priority to critical workloads.
- Port tracking accelerates error recovery when problems are detected on ISLs.

Security

A new feature, Cisco TrustSec Fibre Channel Link Encryption, can encrypt data in flight between any two 8-Gbps-capable Cisco MDS 9500 Family line cards. This feature provides security across a MAN or campus dark fiber link between data centers, or within a data center for IBM System z users with extreme security requirements.

FICON VSANs provide hardware-based traffic isolation, separating traffic of various FICON workloads and enabling safe sharing (if desired) of infrastructure between mainframe and open systems storage when intermix mode is deployed. Access controls protect data from unauthorized hosts, while the fabric binding feature protects the fabric from the addition of unauthorized directors. Role-based management helps ensure that the security of the infrastructure is not compromised by uncontrolled management access.

Workload and Systems Management

IBM System z customers are accustomed to enabling hardware features and software licenses to provide the right amount of capacity to process their workloads. The Cisco MDS 9000 Family extends this concept to the FICON environment. A variety of blades can be added non-disruptively to directors and semimodular switches such as the Cisco MDS 9222i Multiservice Modular Switch to match capacity to demand. Even fixed-configuration switches, such as the MDS 9134 Multilayer Fabric Switch, can enable additional ports with Cisco's on-demand port activation feature.

The prerequisite for matching capacity to demand is performance measurement, and the Cisco MDS 9000 Family provides a comprehensive set of capabilities in this area. Support for FICON CUP enables in-band management from the System z and the accumulation of performance and error statistics in the SA/390 Resource Measurement Facility (RMF). Direct administration is provided through a traditional command-line interface (CLI) and the Java-based Cisco Fabric Manager GUI. Cisco Fabric Manager can be extended with the optional Cisco Fabric Manager Server license to enable concurrent management of multiple independent fabrics and extensive accumulation, monitoring and analysis of performance statistics.

Performance

The business-critical nature of many IBM System z workloads demands the highest performance from its I/O infrastructure as well. The Cisco MDS 9000 Family delivers up to 2.2 Tbps of I/O bandwidth through its fully redundant crossbars. A choice of line cards lets you mix and match high fan-out for older 1-, 2-, and 4-Gbps control units and channels with dedicated performance for today's 8-Gbps connections. Further, 10-Gbps ISLs are available to increase bandwidth between cascaded directors. PortChannels can pool ports across line cards to distribute workloads for smooth performance scaling.

Raw performance is not enough, however. It must also be predictable and manageable. The Cisco MDS 9000 Family crossbar architecture helps ensure fairness; all ports get their fair share of bandwidth when workload peaks occur. Port bandwidth reservation gives administrators even more granular control, helping ensure that specific workloads get defined amounts of I/O bandwidth within a specific group of FICON ports.

From the Past to the Future

Mainframes have been evolving for more than 40 years, and because of their importance to IT infrastructures, individual installations often have equipment that dates

back many generations of technology. Older IBM ESCON control units can be connected to a Cisco FICON infrastructure with the Optica PRIZM FICON-to-ESCON converter. This capability makes Cisco a desirable target for infrastructure migration, especially from other vendors' product lines that have been declared at end of life by reason of acquisition. The rich FICON feature set of the Cisco MDS 9500 Series Multilayer Directors enables a methodology for migrating from other directors to Cisco without requiring changes to the IBM System z I/O configuration.

The Cisco MDS 9000 Family is the only family of directors in the SAN industry that consistently provides the capability to upgrade installed chassis from one generation of FICON technology to the next. From 1 Gbps to 2 to 4 to 8 to 10 Gbps, component-level replacement of line cards and, in some cases, supervisor cards, has been all that is needed to move a Cisco director to the next level of performance. This level of investment protection is not available anywhere else in the SAN industry.

Conclusion

The Cisco MDS 9000 family incorporates many of the same design values as the IBM System z itself: scalability, secure logical partitioning of physical and software resources, infrastructure consolidation, and extremely high availability to enable business resiliency, security, consistent performance, and investment protection. These characteristics make the Cisco MDS 9000 Family the clear choice for extending, enhancing and accelerating IBM System z deployments.

For more information about the deploying the Cisco MDS 9000 Family in your mainframe environment, contact your local account representative or contact Cisco at <http://www.cisco.com/go/storage>.