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Chapter 1: Introduction to Storage Area Networks (SANs)

Storage area networks (SANs) are networks specifically dedicated to the task of transporting data for storage and retrieval. SAN architectures provide alternatives to storing data on disks directly attached to servers or storing data on network attached storage (NAS) devices which use general purpose networks. A SAN enables storage devices and servers to be interconnected using interconnect elements such as directors, switches, and routers. This allows one server or many heterogeneous servers to share storage resources.

The main benefit SANs provide is that storage devices can be centralized and shared among all networked servers as peer resources, similar to the way a LAN connects clients to servers. Concepts such as zoning and LUN (Logical Unit Number) masking are used to restrict access to disks and ensure data integrity. Zoning allows the SAN to be separated into units and to allocate those units to storage. LUN masking is an authorization process that makes a LUN available to some hosts and unavailable to other hosts.

Consolidating servers and storage greatly improves disk utilization because unused space can be allocated to other applications and servers. Consolidation also simplifies storage management and lowers total cost of ownership by helping to balance server and storage workloads to optimize performance. Another benefit of shared storage is that it simplifies data protection and backup activities which no longer need to be implemented on an individual server basis.

SANs are traditionally connected over Fibre Channel networks. Fibre Channel is a gigabit-speed network technology that was intended to replace SCSI (Small Computer System Interface), a standard parallel interface between computers and peripheral devices. Fibre Channel technology allows data to be transferred from one network node to another at very high speeds. While there are many products on the market that take advantage of Fibre Channel's high-speed and high-availability characteristics, alternative network protocols have also been developed for SANs, including Internet Small Computer Systems Interface (iSCSI), Fibre Channel over TCP/IP (FCIP), Internet Fibre Channel Protocol (iFCP), and Fiber Connectivity (FICON) for mainframe computers.

Today's data centers have at least two separate, but interdependent, physical networks. The Ethernet LAN provides server-network connectivity and the Fibre Channel SAN provides server-to-storage access. Ethernet and Fibre Channel networks are distinct technologies with different terminology, protocols, management tools, cabling, and interface cards. Multiple networks require unique equipment (cabling, switching infrastructure, adapters), and more people to manage and support two different technologies. The Connectrix NEX-5020 supports the Fibre Channel over Ethernet (FCoE) protocol, Data Center Ethernet as well as 10 Gigabit (GE) Ethernet. Customers can choose to deploy the NEX-5020 if they are interested in I/O consolidation. FCoE allows native Fibre Channel to travel unaltered over Ethernet. With this solution, customers can utilize Converged Network Adapters (CNAs) in place of traditional NICs and HBAs.

Why EMC for SANs?

Experience

EMC has nearly a decade of experience and industry-leading expertise designing, implementing, and managing the world's most critical SAN infrastructures. EMC has more than 10 years experience designing and deploying multi-vendor SANs.

Interoperability

EMC leads the industry in interoperability and multi-vendor support. EMC® E-Lab™ delivers the highest level of interoperability assurance, with no disclaimers, no excuses. EMC supports over 30 million combinations through interoperability testing.

Choice

EMC Connectrix® offers an extensive selection of networked storage connectivity products, with multiple protocols, ranging from entry-level switches to enterprise directors and distance extension products.

Chapter 2: Connectrix MDS-Series Solutions

The EMC Connectrix family represents the industry's most extensive selection of networked storage connectivity products. Connectrix integrates high-speed multi-protocol connectivity, highly resilient switching technology, and options for intelligent IP storage networking. This wide range of connectivity options allows you to configure Connectrix directors, switches, and routers to meet any business requirement. Combine that with EMC's industry-leading design, implementation, and support services and you have everything in one complete package.

Connectrix products provide more than just network connectivity. They offer:

- Simple, centralized, automated SAN management.
- Proven interoperability across your networked storage solution.
- The highest availability to meet escalating business continuity and service level requirements.
- Scalability with built-in investment protection.

EMC products are the fundamental building blocks in a variety of leading data management solutions. EMC products simplify data access and enable fast data movement across storage systems. The Connectrix MDS-Series provides the storage network backbone—including switches, directors, and routers—and provides the platform for applications such as EMC Invista® and EMC RecoverPoint™. All of these solutions provide the resilience needed for critical solutions such as business continuity, consolidation, data mobility, distance replication, and infrastructure simplification. The broad range of products in the Connectrix family supports EMC's approach of matching application requirements to high-performance storage devices.

This guide focuses on shared information management services to help you:

- Store intelligently
- Protect against loss
- Optimize infrastructure, management, and service levels
- Leverage information assets to create new value

EMC best-in-class solutions include hardware, software, and services designed to fully address key requirements from midrange (small and mid-tier) businesses to the largest enterprises. This guide also serves as a quick reference for EMC Connectrix MDS-Series products and SAN solutions, providing information on additional resources to make your research more effective and successful.

Product Portfolio at a Glance

EMC's Connectrix switches, directors, and management software represent a broad technology portfolio that covers the full range of business needs, from the entry level to the enterprise. The Connectrix MDS-Series portfolio provides the scalability, availability, and performance required to build flexible SANs that grow with the enterprise.

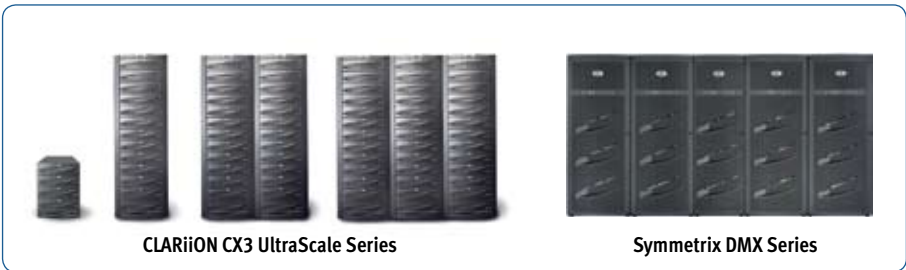
Switches and Routers



Enterprise Directors



Storage Systems



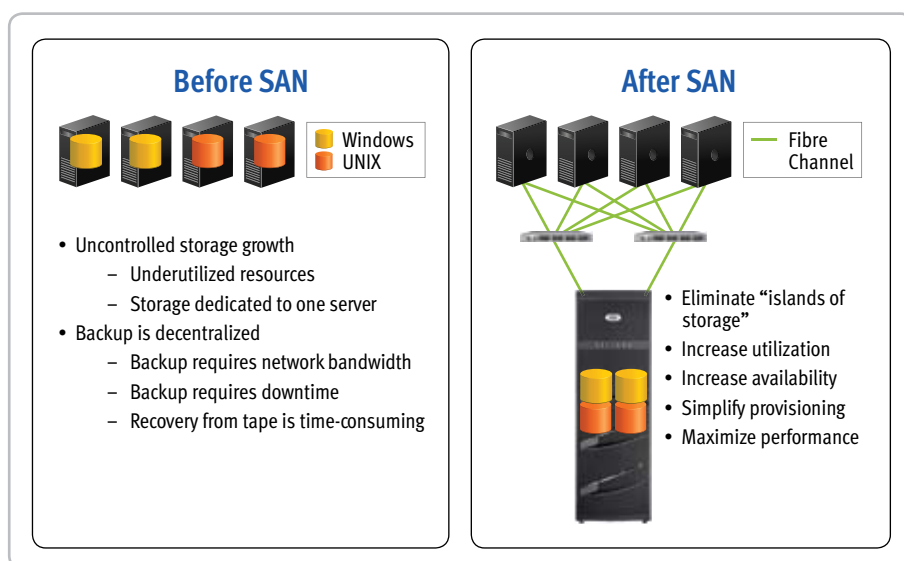
Chapter 3: EMC Solutions

Store More Efficiently

Server and Storage Consolidation

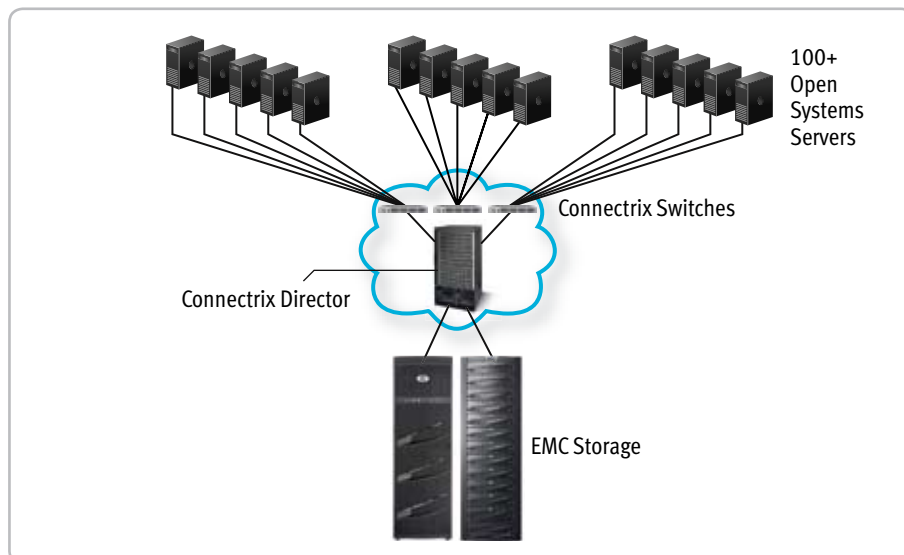
Storage resource requirements are growing exponentially, and organizations want to simplify storage management, enhance backup and recovery capabilities, and improve overall utilization. When first deploying SAN technology, companies are looking for cost-effective, yet robust solutions with future-proof features that provide for seamless growth over time.

Consolidating the management and connectivity of storage resources into a SAN delivers huge benefits. Beyond centralizing and simplifying management functionality, the additional connectivity can help maximize storage resource utilization and improve reliability for simplifying management functionality. The additional connectivity can help maximize storage resource utilization, improve reliability for backups and ensure 24/7 availability. EMC Symmetrix® and EMC CLARiiON® storage platforms provide a solid foundation for large enterprise and small/medium-size businesses. EMC plays a major role in implementing SAN solutions with a broad range of switches and directors that meet the needs of small, midsize, and enterprise-level organizations.



The following represents an example of an environment with hundreds of open systems servers with direct-attached storage (DAS). Management costs and backup windows in this type of environment grow quickly and storage is underutilized.

With a SAN configuration, open system servers are consolidated onto a highly available SAN. With a consolidated SAN, management costs are reduced by 35 percent and backup windows are reduced by 60 percent.



Consolidation for SAN Islands

Customers who are firmly onboard for SANs and have deployed them around specific applications or departments may start to lose some of the benefits as the number of isolated SAN islands increases. Typical concerns include growing management requirements and poor resource sharing. SAN islands can become a barrier to application storage optimization.

The approach to consolidating SAN islands varies based on several factors, including the physical location of the SANs (local or geographically dispersed). One option is to consolidate individual SAN islands into a single, very large director-based SAN or interconnect existing directors and switches into a true core-edge SAN and consolidate all storage using the EMC Symmetrix storage platform or the CLARiiON storage platform. Connectrix directors are an ideal solution for consolidation of SAN islands because they are highly scalable and provide a high port count. The MDS-9513, MDS-9509, and MDS-9506 directors support up to 528 Fibre Channel ports. You can insert blades to support routing and extension or iSCSI. The routing and extension capability also facilitates consolidation of fabrics into virtual SANs (VSANs) enabling communication between selected ports in the fabrics without merging the fabrics and ensuring a level of security for those ports not in the VSAN.

Consolidation with Fibre Channel over Ethernet

The Connectrix NEX-5020 can expand Fibre Channel into the Ethernet environments. The NEX-5020 can also reduce the number of interface cards required to connect into Fibre Channel storage. Converged Network Adapters (CNAs) run multiple protocols from a single adapter. As a result, savings can be realized in power and cooling and the cabling infrastructure. EMC offers CNAs from Emulex and Qlogic through our EMC Select program.

Interoperability

Over the years, enterprise SANs have proliferated, both in size and numbers. Initiatives such as consolidation, mergers/acquisitions, BC/DR, and technology refreshes have driven the need for new connectivity and interoperability requirements. These connectivity requirements need to be addressed in a way that provides flexibility, scalability, and investment protection.

The approach and solution to enabling interoperability across a multi-fabric or multi-vendor environment depends upon the specific objective. As an industry leader in storage networking, EMC addresses a wide variety of connectivity and interoperability requirements.

For increased SAN scalability, distance support, and multi-vendor interoperability, the MDS-9000 family provides connectivity between fabrics without merging them with Virtual SAN (VSAN) and Inter-VSAN Routing (IVR). Using these technologies, customers can route and selectively share devices across remote fabrics, while maintaining fabric and fault isolation to improve SAN stability. For blade server connectivity to heterogeneous SAN fabrics, EMC supports NPIV technology to provide transparent server connectivity to the SAN fabric, regardless of switch vendor.

The EMC Interoperability Difference

- **True interoperability:** While other manufacturers claim interoperability, only EMC offers solutions that are designed and tested for true and sustained interoperability, eliminating the guesswork of reverse engineering. This ensures customers get innovative SAN solutions that deliver the highest performance, best scalability, and highest reliability, rather than compatibility problems with every release of new firmware.
- **Investment protection:** EMC is committed to providing our customers investment protection for existing investments as well as delivering new capabilities for installed investments, creating new business value and increasing leverage.

EMC's interoperability solutions ensure true interoperability, eliminating the guesswork of reverse engineering and the resulting bugs and interoperability problems with each new firmware release. EMC delivers maximum investment protection and enables new solutions for customers' existing investments, helping them grow their businesses and meet new business objectives.

Power Efficiency and Consumption

Electricity prices are rising, available supply is limited in some major metropolitan areas, and rack density is increasing requiring HVAC systems to work harder to remove excess heat. As a result, power and cooling are becoming critical concerns in data centers. Many data centers are simply out of power, to the point where organizations can only bring in new equipment by replacing older, less-efficient equipment.

EMC understands the importance of power and cooling efficiency and today offers the industry's most power-efficient solutions on the market. EMC addresses power efficiency through scalable tiered storage solutions, advanced software and tools, and innovative new services. EMC storage platforms are designed to consume less energy per terabyte than alternative solutions. For example, in consolidated and tiered storage environments, the EMC Symmetrix DMX-4 950 reduces energy use by as much as 70 percent compared to alternatives. Using advanced tools like the EMC power calculator, EMC experts help you manage more data more efficiently—while significantly reducing power and cooling costs. EMC Energy Efficiency Services can help you make your data center as power efficient as possible.

The Connectrix MDS 9000 family supports features that can reduce the costs associated with power and cooling.

Virtual SANs (VSANs) allow for more efficient SAN usage by creating hardware-based isolated environments within a single SAN fabric. Each VSAN can be zoned as a typical SAN and maintains its own fabric services for added scalability and resilience. VSANs allow you to share the cost of the SAN infrastructure among additional users, while assuring segregation and security of SAN traffic. VSANs can reduce the number of directors or switches required in a data center which decreases the amount of power consumed.

In addition to VSANs, Inter-VSAN Routing (IVR) allows centralized storage services, such as tape libraries and disks, to be shared across VSANs without merging fabrics. IVR consolidation can also reduce the costs of power and cooling. In addition, IVR works across WANs over FCIP for business continuity solutions which extends the power benefit and it also eliminates the need for external routing appliances.

The Connectrix MDS family also supports FICON and Fibre Channel Intermix so you can deploy mainframe and open systems applications on the same MDS director, which reduces the number of directors required in a data center.

When building out your SAN, choose the most power-efficient building block available. This will leave more power for storage and bladed servers, minimize the carbon footprint of your SAN, and significantly lower your power bill over time.

To learn more about reducing power and cooling costs, as well as EMC's energy-efficiency services, refer to EMC's energy and efficiency page at www.EMC.com/products/systems/energy_efficiencies.

Making Protection Effective and Affordable

EMC RecoverPoint

Every organization has unique business continuity requirements that are directly tied to their business goals. Because of these requirements, many organizations need to implement broad disaster recovery solutions (DR) for their business-critical applications in which applications and the associated data can be replicated, protected, and backed up, not only locally but across secondary or multiple remote locations.

EMC RecoverPoint protects data at a local site and/or at a remote site without impact to production application processing. RecoverPoint provides local Continuous Data Protection (CDP) and Continuous Remote Replication (CRR), as well as Concurrent Local and Remote (CLR) data protection. RecoverPoint CDP provides local replication enabling customers to roll back to any point in time for effective operational recovery from events such as database corruption. RecoverPoint CRR complements EMC's existing portfolio of replication products by adding heterogeneous replication (with bandwidth reduction) in asynchronous-replication environments, which lowers multi-year total cost of ownership. RecoverPoint CLR combines CDP and CRR features providing both operational recovery and disaster recovery of the same data.

EMC RecoverPoint appliances can be configured with the Connectrix MDS-9200 and MDS-9500. The SAN fabric and the primary data center is connected to the secondary remote data center across a WAN using the RecoverPoint appliance. The solution provides a point-in-time application recovery using the CDP technology. RecoverPoint's CDP technology creates a running journal of each write activity, with updates getting logged every time a change occurs to the application and its associated data. When a problem occurs, data administrators can use a time-based snapshot of an application server created just before the problem occurred and provision back the application services locally to a known, stable point in time.

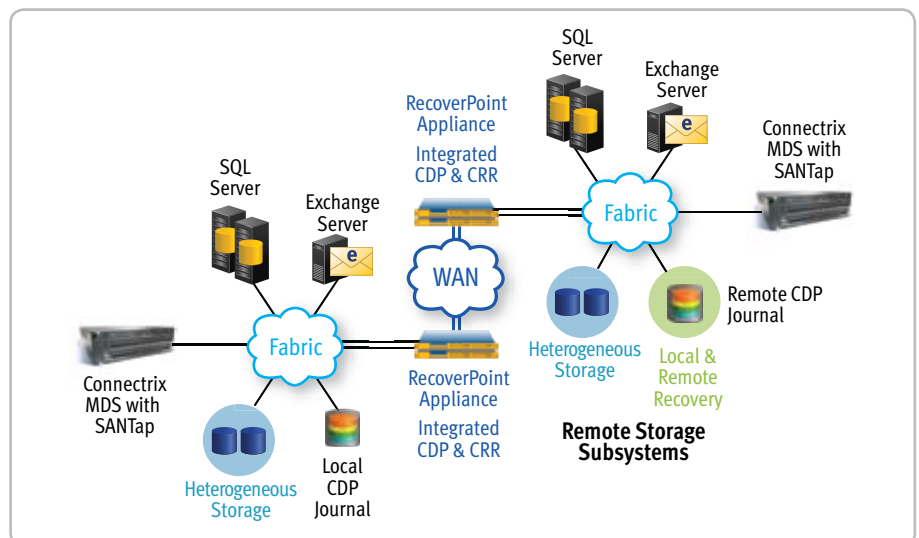
If the entire primary data center goes down, using RecoverPoint's CRR technology between the primary and the secondary data center, applications can be recovered to a stable point in time at the secondary data center. With CRR, each write from the primary data center is mirrored at the secondary data center, across the WAN.

The EMC RecoverPoint Difference

- By running the RecoverPoint appliance in the SAN fabric rather than on every host dramatically simplifies installation, upgrades, configuration changes, and operating system dependencies, and reduces other risk-areas.
- The Connectrix MDS-9200 and MDS-9500 blades feature high-performance architecture with hardware acceleration on every Fibre Channel port so that the RecoverPoint solution meets application performance requirements. The MDS split-path feature is called "SANTap."
- The RecoverPoint solution has a high-availability design with failover capable Data Path Controllers (DPCs) at every Fibre Channel port as well as dual-redundant power and cooling.
- Unique RecoverPoint bandwidth reduction and compression technology optimizes network resource utilization over the WAN by up to 10x.
- E-Port connectivity provides a switch-like model for connectivity and scalability into an existing SAN fabric with line-rate application and data-handling performance for RecoverPoint.
- Application and server independent deployment enables broader and faster DR coverage.

With the Connectrix MDS platforms integrated with EMC RecoverPoint in the SAN fabric, customers can now confidently deploy an industry-leading end-to-end solution for continuous data protection and continuous remote replication across heterogeneous server and storage platforms, providing complete data protection for the entire organization.

EMC RecoverPoint with the Connectrix MDS platforms provides a comprehensive CDP or remote replication solution for the Microsoft Exchange Server. To meet real customers' challenges for highly available e-mail solutions, either RecoverPoint CDP or CRR can be deployed. With the added value of a fabric-based Connectrix-based solution, customers can confidently deploy a data replication and data recovery configuration within their Exchange environments. The combined solution can provide various high levels of protection and can offer virtually any-point-in-time recovery of mailboxes and messages while greatly expediting the recovery time for Exchange so as not to impact the business.



Distance Replication Solutions using EMC SRDF, SAN Copy, and MirrorView

Customers have always had some level of disaster recovery and business continuity plans in place. However, post-9/11 emergency plans and government regulations are forcing most companies to put more resources into their plans. Some companies, by the nature of their businesses, are seeking to create “out-of-region” disaster recovery facilities with replicated copies of data at a specified distance from their primary computing sites. The challenge is how to get the data there and maintain it in the most manageable and cost-effective way. Data must have integrity for both primary and remote systems at any distance, without impacting system performance and without data loss at any distance.

EMC storage systems are an integral part of the solution with a wide range of options to support customers’ specific business goals. With array replication applications (EMC SRDF®, SAN Copy™, and/or MirrorView™) and Connectrix Fibre Channel (FC) distance extension products, an efficient and cost-effective solution can be deployed.

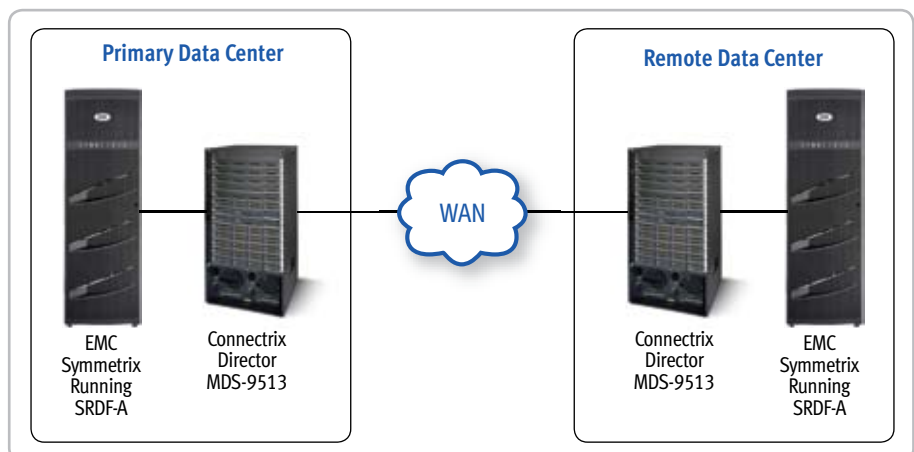
These products can be deployed in many different configurations and costs depending on the Recovery Point Objective/Recovery Time Objective that the customer is trying to achieve.

EMC has extensive, proven experience in long-distance FC routing over IP for SAN solutions. EMC FC routing solutions were the first to be used in coast-to-coast replication and have been proven for distances of more than 7,000 miles. EMC FC routers can support disk-based replication over leased IP lines, providing a fast and cost-effective solution for long-distance storage management.

With features like FastWrite, compression and rate limiting IP ports, Connectrix distance extension solutions help customers utilize their WAN bandwidth more efficiently. These features allow customers to cost justify a distance replication solution. As the market leader in array distance replication solutions, EMC can help customers find the right solution to meet business objectives.

Solutions	Storage Networking Hardware	Software
Continuous Data Protection and Distance Replication	MDS-9200 MDS-9500	RecoverPoint
Distance Replication and Fibre Channel Routing	MDS-9200 MDS-9500	MirrorView, MirrorView/A, SAN Copy, SRDF/A, SRDF/S, Fibre Channel Routing

The following configuration shows a completely redundant replication environment using Connectrix MDS extension devices. The configuration uses Connectrix extension products and EMC’s array replication software in a highly redundant and available configuration, enabling near zero downtime for a highly critical business application.



Remote Tape Vaulting using EMC Disk Library

Enterprises are looking for complete, integrated solutions for backup, recovery, and archiving that support a strategic approach to storage based on how applications use data. They are evaluating alternatives to traditional approaches where backup tapes are created onsite and transported to a secure location via courier. Remote backups to a secondary location improve an organization's recovery position while leveraging existing investments in equipment and networks. The solution also eliminates many of the problems that arise with manually transporting tapes between locations, such as loss or damage.

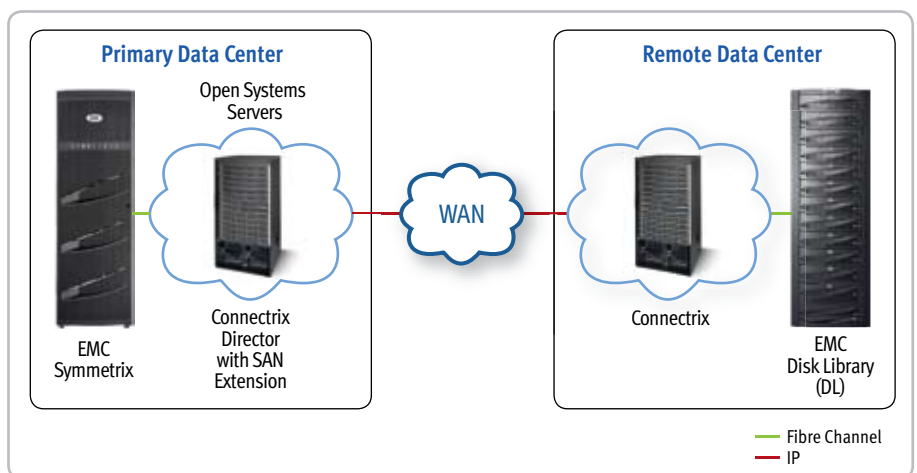
Connectrix MDS-9200 and MDS-9500 multi-protocol storage routers are at the heart of a remote EMC Disk Library vaulting solution—eliminating the distance limitations for backup-to-virtual tape with tape pipelining capabilities. Read and write tape pipelining maximize the efficient flow of data, using buffering and error recovery concepts and extending the capabilities over great distances to remote locations via emulation. These multi-protocol distance extension routers virtually eliminate the performance impact of distance, extending the scope and value of virtual tape-based backup solutions and making a distance virtual tape backup, recovery, and archive solution very attractive.

The EMC Disk Library Difference

EMC offers a feature-rich product offering. Hardware compression, rate-limiting ports, tape pipelining, and FastWrite technologies are integrated in all extension and routing offerings. These features allow customers to get more efficient use of their WAN connectivity.

Remote Virtual Tape Configuration

The following shows an example where a company required offsite storage of backup data. This company had a remote data center with no ability to access the virtual tape drive there. Utilizing an EMC SAN extension solution, this company was able to access the remote virtual tape library for remote backups. This solution allowed Recovery Point Objectives and Recovery Time Objectives to be reduced from 24 hours to less than one hour.



Virtualize and Automate

EMC Invista

Organizations are looking for ways to strategically align business applications and storage infrastructure so that cost, performance, reliability, and availability characteristics best match business requirements. For many organizations, storage virtualization provides a strategic approach to simplifying the movement of data across a multi-tiered heterogeneous environment to meet business objectives.

EMC Invista is an enterprise-class, SAN-based block virtualization solution that provides data migration, pooling, tiered storage, non-disruptive tech refreshes across heterogeneous arrays, and operational efficiency via centralized and standardized volume management. Invista employs a unique stateless (no cache) split-path architecture to ensure data integrity and performance, and runs on intelligent SAN-switch technology from Cisco.

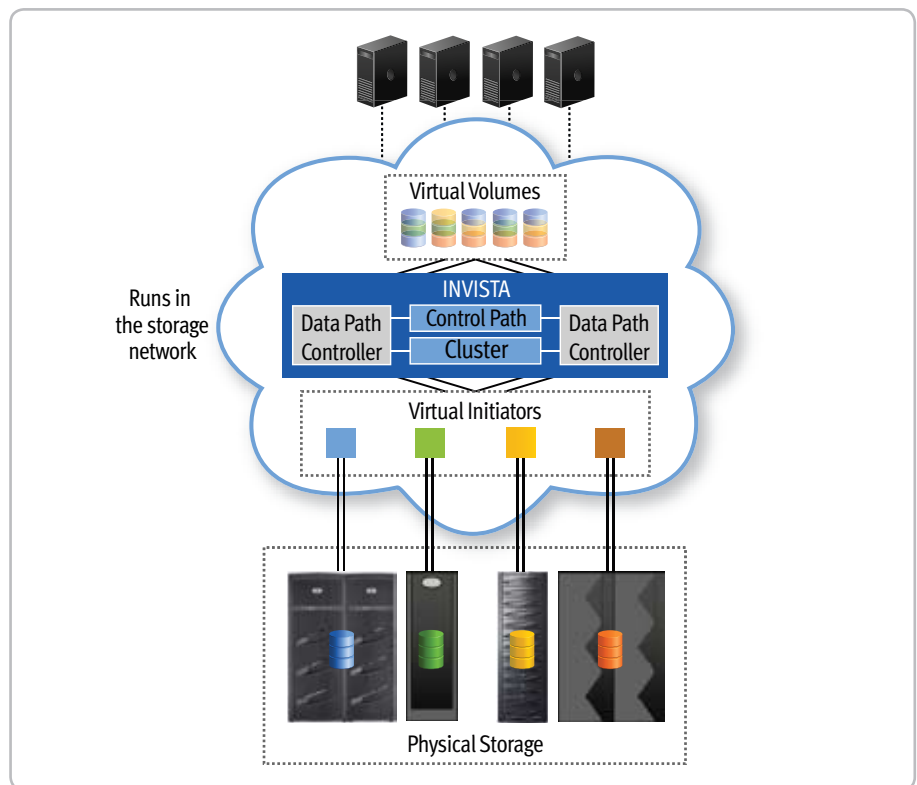
EMC Invista with MDS-9200 or MDS-9500 is a solution which enables the virtualization of storage in networked storage environments that dramatically reduces the amount of downtime associated with the movement of data across storage tiers in support of information lifecycle management (ILM) strategies. Invista leverages the specialized processing power in the Connectrix MDS-9000 intelligent application platforms for deployment of network-based storage virtualization at wire speed. An intelligent application platform, the MDS-9200 or MDS-9500 is a high-performance, highly available platform that can be incorporated into an existing SAN infrastructure.

A network-hosted Invista virtualization solution can be greatly enhanced through close integration with an underlying layer of network intelligence and capability. The Connectrix MDS-9200 and MDS-9500 platforms support many intelligent features that contribute to the overall value and effectiveness of the solution.

The EMC Invista Difference

- MDS-9200 and MDS-9500 blades feature, a high-performance, split-path architecture with hardware acceleration on every Fibre Channel port to increase scalability, performance, and flexibility compared to other architectures.
- A fully pipelined, multi-CPU RISC memory system paired with every I/O port provides inline software processing capabilities to increase scalability, performance, and flexibility.
- High availability is designed into the MDS-9200 and MDS-9500, with failover capable Data Path Controllers (DPCs) at every Fibre Channel port, as well as dual-redundant power and cooling.
- E-Port connectivity provides switch-like connectivity and scalability into existing SAN fabric with line-rate application and data-handling performance for Invista.

EMC Invista with the Connectrix MDS-9200 or MDS-9500 platforms provide comprehensive network-based Dynamic Volume Mobility to allow storage administrators to move storage volumes from one storage array to another without application disruption. With data copy performed by Invista within the SAN fabric, no host processing cycles are required. The virtualized storage environment is easily managed for responding to rapidly changing I/O performance or complex operations like technology refresh and lease rollovers by leveraging Invista Dynamic Data Mobility.



Mainframe FICON Solution

Many mainframe customers are challenged with how to upgrade host and storage technologies in the least disruptive manner and how to get the most value out of those investments as the infrastructure expands and evolves. Often they lack the tools, resources, or information needed to deploy and maintain optimized FICON architectures.

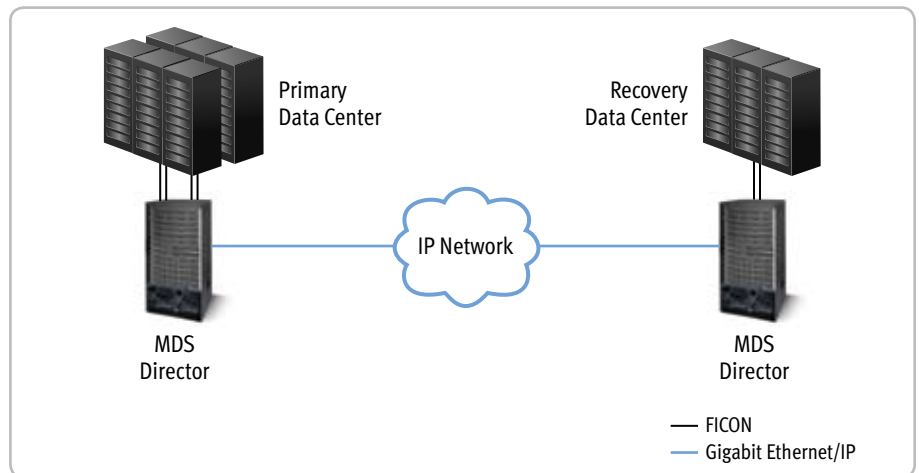
Whether you are planning a migration to FICON or deploying a FICON upgrade/expansion, EMC can help you design, deploy, and maintain an optimized FICON storage infrastructure. With EMC mainframe solutions and services, you'll benefit from a powerful combination of two decades of mainframe experience, IBM compatibility, and industry-leading innovation to meet your most demanding workloads. EMC solutions to improve mainframe data availability include EMC Geographically Dispersed Disaster Restart (GDDR) for automated disaster restart, the EMC TimeFinder® family for local replication, and the EMC SRDF family for remote replication. And with EMC AutoSwap™ software, you can move application workloads from one Symmetrix system to another—automatically and without interruption.

The EMC Mainframe FICON Difference

- Broad switch portfolio: Full family of FICON switches and directors, from high-performance core backbones to cost-effective edge switches, all managed via FICON Management Server/CUP.
- Maximize throughput over distance: EMC unique FICON disk emulation and read/write tape pipelining technology ensure maximum disk and tape performance for faster backup and recovery over distance.
- Comprehensive FICON services: EMC's tools-based FICON consulting services help companies plan, deploy, and optimize mainframe storage infrastructures.
- Data migration expertise: EMC has helped hundreds of customers with local and remote data migrations, from planning to implementation and project management.

To meet the need for global access to information, optimized FICON infrastructures, and improved business continuity and disaster recovery, mainframe companies deploy EMC FICON storage, EMC SRDF disk mirroring software, and Connectrix FICON switches, routers, and extension products. Connectrix MDS Fabric Manager Server centrally manages the mainframe application infrastructure.

Deploying a FICON infrastructure with remote disk mirroring solution from EMC enables customers to build a high-performance, highly scalable storage infrastructure that will help them meet their recovery point and recovery time objectives, meet compliance requirements, and protect valuable corporate information assets, while meeting service level requirements and optimize resources. EMC's unique expertise in mainframe storage networks allows customers to benefit from our in-depth knowledge, experience, and best-practices guidance.



Information Management

In today's dynamic business environment, IT executives are faced with the challenge of protecting more data, meeting shorter recovery objectives, ensuring regulatory compliance, and achieving ever-increasing service levels to the business, all while trying to contain costs. At the same time, SAN growth and sprawl are adding management complexity with more ports, more devices, more fabrics, more protocols, and multiple locations, making effective storage management extremely difficult and time consuming.

EMC delivers the management tools and capabilities required to effectively manage today's global storage infrastructures.

EMC Connectrix MDS Fabric Manager Server provides centralized management of multiple enterprise directors and switches and a high-level view of the enterprise storage network within the local data centers or at geographically dispersed locations. EMC ControlCenter provides centralized monitoring and management of Symmetrix, CLARiiON, the Connectrix family, and third-party switches and hubs. It integrates enterprise management frameworks and creates a single point of control.

Connectrix MDS Fabric Manager Server enables centralized management of global SAN environments, reducing the complexity and cost of storage network management. With enterprise-class reliability, proactive monitoring/alert notification, and unprecedented scalability, EMC helps organizations optimize resources, maximize availability, and enhance security for today's global storage network infrastructures.

The EMC Information Management Difference

- **Centralized management:** Enables centralized management of multiple remote Connectrix SANs through a single pane of glass, driving efficiencies and reducing costs.
- **Global SAN visualization:** Provides end-to-end visualization of the extended SAN, including routers, switches, and extension—facilitating configuration and asset tracking.
- **Unmatched scalability:** Scales easily to manage growing fabrics with fewer licenses, reducing capital and operating costs.
- **Heterogeneous environments:** Support for multi-vendor devices and fabrics, protecting investments and reducing management costs.
- **Advanced functions:** Supports key features, including 4 and 10 Gbit/sec interfaces for maximum application performance; Port channeling for optimized data flow and fewer ISLs; and VSAN for superior network segmentation and security.
- **Proactive performance monitoring:** Proactively measures and graphs realtime and historical SAN performance against user-defined thresholds, identifying bottlenecks and under-utilized links.
- **Export reports to facilitate capacity planning.**
- **Automated event management:** Reduces administrative effort by enabling customized and automated actions based on predetermined rules in response to defined events or schedules.

Add Intelligence

Storage Resource Management for Enterprise Environments

SANs can be complex environments consisting of heterogeneous hardware and software components. Configuring and managing heterogeneous servers, operating systems, HBAs, directors and switches, and storage devices can be challenging, especially in large environments. To manage a SAN, businesses need to be able to discover these components and map the relationships among them. Once the SAN topology is understood, the next step is to configure, monitor, and manage access to these components.

EMC provides a number of management applications and tools to effectively manage today's global storage infrastructures. EMC ControlCenter provides centralized management to help streamline SAN management operations across heterogeneous storage networks. With ControlCenter, users can discover the network topology, view the relationships between components, automate zoning and device masking tasks, and monitor the SANs health and performance. There are two products within the EMC ControlCenter suite that provide additional SAN management capabilities—SAN Manager™ and SAN Advisor™.

SAN Manager automatically discovers, maps, and displays the entire SAN topology at a high level or in detail. Users choose to display specific physical and logical information about each object in the topology. This information can help storage administrators better manage their storage infrastructures by correlating all SAN elements in context. With SAN Manager, administrators can view physical devices such as host bus adapters (HBAs), servers, and storage arrays. Logical information such as zoning and storage-device masking definitions can also be viewed, allowing administrators to fully analyze SAN performance and health.

SAN Advisor helps validate constantly changing and growing SAN environments. SAN Advisor's import and validation capabilities extend beyond just physical devices and connectivity to include zoning, VSANs (virtual SANs), and user-defined group information.

The EMC SRM Difference

- Automatically correlate and display relationships of SAN infrastructure elements across host bus adapters (HBAs), SAN ports, and storage array ports.
- Centralize and automate complex management tasks to reduce overhead.
- Streamline SAN configuration management across multi-vendor SAN devices and storage arrays.
- Automated event management reduces administrative effort by enabling customized and automated actions based on predetermined rules in response to defined events or schedules.
- Quickly and accurately validate existing SAN environments.
- Simulate proposed physical and logical SAN changes for interoperability, availability, and performance.
- Conceptualize and design new SANs or model changes to your existing SAN using EMC and industry best practices.
- Automatically document the entire SAN environment to streamline reporting and change tracking.
- Build an action plan for implementation of the changes validate that the plan was correctly implemented.

Securing Critical Assets

Connectrix MDS Storage Media Encryption (SME) with RSA Key Manager for the Data Center

EMC's information-centric security strategy recognizes that information security is ultimately an information management problem. You can't secure what you don't manage. The tools needed for information-centric security directly protect structured and unstructured information and transactions, the infrastructure that stores and manages it, and the identities of people who have access.

EMC is integrating technology from its security division, RSA®, into its portfolio of storage products. The Connectrix MDS family provides network-based encryption for tape and virtual tape libraries.

Connectrix MDS Storage Media Encryption (SME) can leverage RSA technology for centralized key management across multiple encryption points within the infrastructure and SME helps customers comply with common security standards including PCI DSS and Sarbanes-Oxley. Connectrix MDS Storage Media Encryption is available in two ways:

- Via an encryption software license for Connectrix MDS-9222i switch customers
- Via the addition of an 18/4 multi-services module blade (if the customer doesn't already have one in place) and encryption software license for MDS-9500 and MDS-9200 series customers

Tape encryption benefits customers by providing data protection in the event of theft or loss of backup media (drives or tapes) within the data center, during transfer between locations, or, in the case of drives, when they are replaced as part of maintenance activity.

Refer to www.EMC.com/security for complete details on EMC's entire security portfolio.

Chapter 4: EMC Services

EMC Makes Information Lifecycle Management Work for You

EMC's service offerings help you access, design, implement your networked storage environment. In addition, EMC offers technical training, consulting, and the industry's best customer service organization.

- EMC provides platform-independent consulting on storage infrastructure strategy, management, optimization, consolidation, and business continuity planning.
- EMC offers planning and design, project management and implementations, and/or integrations for data migrations, data consolidations, data center consolidations, and disaster recovery projects.
- EMC's 7,000 Customer Service representatives deliver always-on, 24x7 coverage.
- EMC Consulting and Technical Education services provide effective, efficient knowledge transfer to customers to ensure that benefits are realized.

EMC Services empowers users by allowing them to leverage information assets and provide a return-on-investment today and tomorrow. An expert staff in Customer Service and Consulting services—extended and expanded by Authorized Services Network Partners—delivers seamless services that lead to business results from consulting through support. Users can depend on the storage expertise that EMC Services offers. EMC Services includes the ability to assess, design, implement, train, service, and support.

EMC Consulting

EMC Consulting is a component of the EMC Services business. EMC Consulting staff helps customers optimize their storage infrastructures by ensuring that the solution implemented achieves a return on investment and addresses business needs and goals. EMC Consulting staff understands that the current and anticipated demands of information storage infrastructure requirements should add value, not cost, to a business. Business continuance, data security, data availability, adaptability, flexibility, scalability, and operational effectiveness represent important issues, which every deployment must carefully consider.

EMC Consulting services are delivered in several distinct practice areas:

- Business and Technical Consulting
- Planning, Design, and Architecture
- Implementation and Integration
- Data Migration
- Residencies

Using proven best practices and time-tested procedures, EMC Consulting ensures effective project management throughout the engagement. EMC Consulting experts consider all intricacies of deploying an enterprise solution and guarantee consistent delivery at the highest level of quality. The results of an EMC Consulting engagement typically include a complete financial analysis that forms the basis for a comprehensive business justification.

Engaging EMC Consulting Services and Establishing Project Goals

A project initially begins with discussion and agreement between EMC Consulting and the customer contacts. An initial meeting establishes the goals and the scope of the assignment and the customer determines the appropriate internal resources to assign to the project, specifically, staff from the areas under analysis. EMC Consulting provides skilled consultants experienced in planning, design and architecture, business analysis, information storage management, project management, implementation and integration, data migration, data consolidation, and business continuance.

Business and Technical Consulting

EMC Consulting professionals begin the project by gaining an understanding of the customer's business goals, constraints, and issues. Next, they consider the demands that these business objectives and issues can place on a new information infrastructure. This entails a comprehensive understanding of the functions that support the customer's business model, including applications and the data required to support these functions. EMC Consulting documents project requirements in a Statement of Work, which is approved by the customer prior to project initiation.

Planning, Design, and Architecture

The results of a technical assessment lead to development of an operational environment. Assessment findings and accompanying financial justifications for the infrastructure support changes to the current environment. The financial justifications include the impact on the cost of operation and the customer's overall business, acknowledging that most financial benefits occur when implementing a new architecture based on business needs and objectives.

Implementation and Integration

EMC Consulting professionals produce an implementation plan based on business priorities. They explain migration from the existing infrastructure to the new design and identify project phasing, timelines, and resource requirements needed to implement the new infrastructure in an operational, production environment. The plan describes new operational procedures because staff members may need to adjust to significant procedural alterations—and may require additional training—in order to develop operational expertise in the new infrastructure. EMC Consulting works closely with IT staff to define and implement new procedures. Through solution overview sessions, consultants help staff learn and adapt to new procedures. The plan describes the integration with existing IT components and includes data migration, testing, and new change management and operational procedures.

Data Migration

EMC Consulting helps customers reduce the burden to the IT staff who must handle the labor-intensive and complex data migration tasks. In addition, by specifying best practice methodologies, tools, and procedures, EMC Consulting professionals ensure a smooth and seamless transition involving minimal risks to the IT environment.

Residencies

When a customer needs onsite support, typically after deployment of a new solution, EMC Consulting offers residencies to facilitate hands-on training of the IT staff and assist with the rollout of IT procedures and policy implementation.

EMC Customer Service

EMC reaches customers through an extensive customer service and technical support organization. Customer service representatives—located in support centers that “follow the sun” around the world—ensure that live customer service representatives remain available to deliver high-level, technical expertise for customers in any location. In order to escalate and resolve issues quickly, EMC co-locates its world-class customer service staff with hardware and software design engineers. Customer Service regularly dispatches customer engineers to visit EMC customers. When a customer purchases a new EMC solution, customer engineers collect site information and implement a solution that leverages a thorough understanding of the customer's business needs, storage requirements, storage topology, and network requirements.

Business Needs

EMC Customer engineers evaluate the customer's business needs, and then work cooperatively with them to improve productivity by enhancing data availability, scalability, server performance, and ease of management.

Storage Requirements

Customer engineers assess the current needs of the enterprise and help plan strategies to meet future needs.

Storage Topology

Customer engineers analyze the size and number of current general-purpose or dedicated servers; then they consider data distribution methods and management across the enterprise. They assess groups of users within the enterprise to develop an understanding of how users need to access storage data.

Network Requirements

Customer engineers analyze current network topology and help assess the number of users accessing data. They then determine the storage architecture and user protections required. These assessments and strategies lead to enterprise-specific network protocols and requirements (FTP, FC-AL, FC-SW, NFS, WebNFS, CIFS, TCP/IP, FDDI, Ethernet, ATM, SNMP, and NTP).

EMC Customer Support

Service represents a key component of EMC's total quality philosophy. EMC's Customer Service organization delivers customer satisfaction—while maintaining the highest customer satisfaction ratings in the industry. Customer Service at EMC starts with highly qualified and dedicated EMC customer engineers who are well trained on EMC equipment. Each customer is assigned a primary and secondary dedicated customer engineer.

Unlike traditional service operations, EMC uses remote service technology that allows continuous monitoring and diagnosis of all installed EMC equipment. As a worldwide organization, EMC Customer Service dedicates nearly 5,000 technical, field, and customer support personnel to service customers. Worldwide local customer support is also available directly through EMC Customer Service through EMC Authorized Services Network Partners, a virtual extension of EMC Customer Service, EMC-certified to deliver EMC customer service.

Use the following numbers to contact EMC to obtain technical support on hardware and software products:

U.S.: (800) 782-4362 (SVC-4EMC)

Canada: (800) 543-4782 (543-4SVC)

Worldwide: 1 + (508) 497-7901 (or contact your local EMC office)

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