

Cisco UCS and Cisco MDS 9000 Family: Better Together

What You Will Learn

The Cisco Unified Computing System™ (Cisco UCS®) brings unique capabilities that help scale and simplify x86 server deployments. To deliver these benefits, it is built on unique features that are new in the industry and originated more from its architecture than its components. The Cisco® MDS 9000 Family provides high-bandwidth, highly scalable, and highly available secure storage connectivity and unifies physical and virtual storage, enabling transparent communication and management. The MDS 9000 Family is an excellent counterpart for Cisco UCS, delivering exceptional performance, flexibility, topology-independent availability, management simplicity, and scalability to help customers derive value from the most challenging application environments. New applications can be deployed transparently while using Cisco UCS and the MDS 9000 Family according to numerous customers' opinions and underscored by the tremendous market success of these solutions. Analyst's reports indicate that Cisco UCS has the number-one revenue market share in x86 blades in the United States (IDC, December 2014), and that the MDS 9000 Family has the number-one market share of revenue in modular Fibre Channel networking (Dell'Oro, December 2014).

A solution using Cisco UCS plus the MDS 9000 Family demonstrates that the total value is more than the sum of the parts. The benefits of this powerful combination are based on three main pillars:

- Better performance
- Easier management
- Better support

This document elaborates on the main aspects of the combined solution, showing both the synergy of Cisco UCS and the MDS 9000 Family and the differentiation from alternatives.

Introduction

In the era of digitalization, mobility, social networking, and the Internet of Everything (IoE), data center and cloud infrastructure increasingly represents strategic a business asset for organizations of all kinds. Companies are looking into how to best design, scale, and integrate the various constituents to use technologies that work together and simplify management. Application uptime 24 hours a day, every day, is now the norm, and Fast IT is not just a marketing message but a goal for everyone.

In the storage networking market, Cisco is the clear leader in all categories. Extraction and elaboration on data from the Q3CY14 Ethernet switch quarterly report and Q3CY14 SAN switching market share report (Dell'Oro, December 2014) shows that Cisco is the number-one vendor in revenue for general block storage networking, file-based data access networking, Fibre Channel and Fibre Channel over Ethernet (FCoE) combined networking, and modular Fibre Channel storage networking. Cisco is the technologically leading company in Fibre Channel fabrics.

With more than 25,000 customers worldwide, more than 135,000 chassis sold, more than 12 million ports shipped since 2002, and a growing market interest, Cisco is the most credible long-term Fibre Channel vendor in the industry today. A large selection of Fortune 500 data centers rely on MDS 9000 Family field-proven reliability, achieving nonstop operations, 99.999 percent availability, and a demonstrated uptime of more than eight years. The purpose-built application-specific integrated circuits (ASICs) in MDS 9000 Family products consistently deliver top performance and robust features, plus massive scalability with ease of use and detailed control, offering low total cost of ownership (TCO) for enterprises. Deterministic performance and latency, wire-speed throughput with no restrictions on local switching, investment protection, and complete backward compatibility all make the MDS 9000 Family the best candidate for virtualized and containerized applications and next-generation flash-based storage solutions. As a standards-based product line, the MDS 9000 Family can be used to connect to servers from any vendor with any host bus adapter (HBA) model and any disk array, offering our joint customers optimal benefits and choice without compromises. When used in conjunction with Cisco UCS, the fastest-growing server infrastructure and number-one x86 blade server in the U.S. market, organizations can gain benefits of both product lines and an even more powerful solution.

Cisco MDS 9000 Family

Designed specifically for Fibre Channel storage networking, the MDS 9000 Family has achieved its tremendous success as a result of several factors.

New 16-Gbps Fibre Channel Portfolio

Cisco has technologically leaped ahead of the competition as a result of a completely refreshed offering, now upgraded to 16-Gbps Fibre Channel, doubling port speed from that of the previous generation of products. Cisco's offering is more recent than competitive offerings and benefits from the latest and best innovations in ASIC design and architectural approaches, leading to improved performance, higher availability, exceptional scalability, and simplified operations.

The MDS 9000 Family product line is broad and differentiated, so that every customer's needs can be accommodated in the best possible way. With fixed-configuration switches, multiservice appliances, and mission-critical directors, the MDS 9000 Family product line has an excellent combination of price, performance, and flexibility for all data centers. The current portfolio of MDS 9000 Family 16-Gbps Fibre Channel switches includes:

- Cisco MDS 9148S 10G Multilayer Fabric Switch: Fixed-configuration fabric switch, with 12 to 48 16-Gbps Fibre Channel ports at wire speed
- Cisco MDS 9250i Multiservice Fabric Switch: Multiservice node with wire-speed performance on all ports, up to 40 16-Gbps Fibre Channel ports, 8 FCoE ports, and 2 1/10-Gbps Fibre Channel over IP (FCIP) or Small Computer System Interface over IP (iSCSI) ports
- Cisco MDS 9706 Multilayer Director: Mission-critical director-class device with up to 192 16-Gbps Fibre Channel or 10-Gbps FCoE wire-speed ports, ready for 32-Gbps Fibre Channel and 40-Gbps FCoE connectivity
- Cisco MDS 9710 Multilayer Director: Mission-critical director-class device with up to 384 16-Gbps Fibre Channel or 10-Gbps FCoE wire-speed ports, ready for 32-Gbps Fibre Channel and 40-Gbps FCoE connectivity

The Cisco Fibre Channel and FCoE networking portfolio is further enhanced by several products in the Cisco Nexus® Family product line.

Investment Protection

Investment protection continues to be a primary consideration for customers. Cisco continues to respond with full backward compatibility with previous generations of the same MDS 9000 Family product line as well as adjacent product lines, including Cisco Nexus switches and Cisco UCS. Whereas many competitors make programmed obsolescence their most apparent feature, Cisco keeps delivering on the investment-protection promise, with full appreciation from customers. In addition, the new modular director-class Fibre Channel switching devices, though designed in the era of 16-Gbps Fibre Channel and 10-Gbps FCoE speeds, are ready to be upgraded to 32-Gbps Fibre Channel, 128-Gbps Fibre Channel, and 40-Gbps FCoE in the future without the need to replace any components. Competing offerings require major equipment upgrades to move from 16 Gbps Fibre Channel to 32-Gbps Fibre Channel speeds, or to 40-Gbps FCoE.

Multiprotocol Flexibility, Application-Centric Infrastructure, and Open Source Cloud Solutions

The MDS 9000 Family delivers multiprotocol flexibility and industry-first hardware-enabled slow-drain detection and recovery, and integrates with Cisco UCS and Cisco Nexus platforms and with Cisco's data center strategy in general. For customers adopting Cisco Application Centric Infrastructure (ACI), the MDS 9000 Family product line has become the default solution for Fibre Channel access to data. Cisco Smart Zoning for the MDS 9000 Family is a recent innovation to make Fibre Channel zoning application aware.

The MDS 9000 Family is well suited for OpenStack cloud deployments, offering an embedded adapter for Cinder. Programmability has also been enhanced with a native onboard Python interpreter.

Another reason for the recent commercial success of the MDS 9000 Family is the customer upgrade cycle. In 2014, customer spending increased as customers upgraded their storage networking infrastructure in response to growing demand for bandwidth and for disaster-recovery solutions. Cisco has been able to capitalize on these needs and expand its market share. Adoption of 16-Gbps arrays and flash-memory storage has also been responsible for increased performance requirements, so that 75 percent of Fibre Channel networking sold today is capable of 16 Gbps.

Cisco Unified Computing System

Cisco UCS, introduced in 2009, is Cisco's offering in the blade server market. It is positioned as a data center platform, combining computing, network connectivity (LAN), and storage connectivity (SAN) resources in a single system. Cisco UCS can consolidate both physical and virtual workloads onto a single, centrally managed and automated system for computing, networking, and storage access. Unique features such as stateless computing, service profiles, virtual interface cards (VICs), and unified ports allow Cisco customers to reduce IT efforts and costs through unified management of all these components and an optimized use of resources.

Cisco UCS already surpassed 40,000 customers worldwide and is the top-selling x86 blade server system in the United States. A high percentage of Cisco UCS platforms are sold as part of integrated computing stacks, also known as converged systems. Built using best-in-class products, these solutions include computing, networking, and storage resources in a single solution, often with a single management tool for the hybrid cloud model. Vblock Systems, FlexPod, VSPEX, VersaStack, UCP Select, and SmartStack are the commercial names of these solutions. The MDS 9000 Family is an optional element of these systems and has contributed to their success.

Cisco UCS consists of a number of components that work together to provide a high-performance computing, networking, and storage environment with a robust feature set. Cisco UCS consists of blade servers, network adapters (VICs), blade chassis, I/O modules (IOMs), and fabric interconnects. Inclusion of an all-flash storage blade is another option to further strengthen the solution. Targeted at small and medium-sized business data centers and remote offices, Cisco UCS Mini is a new compact computing solution that uses the same blades, network adapters, and chassis as its well-established counterpart. However, cost and footprint optimizations have been achieved by eliminating the IOMs and replacing them with a new type of fabric interconnect, fitting directly into slots in the back of the chassis. Cisco UCS and UCS Mini are managed through the Cisco UCS Manager and Cisco UCS Central Software GUIs.

Because it is standards-based and open for adoption in a multivendor data center, Cisco UCS provides the option to connect to both Cisco and third-party Fibre Channel SANs. This document describes the main benefits customers can gain when connecting Cisco UCS to an MDS 9000 Family storage networking fabric.

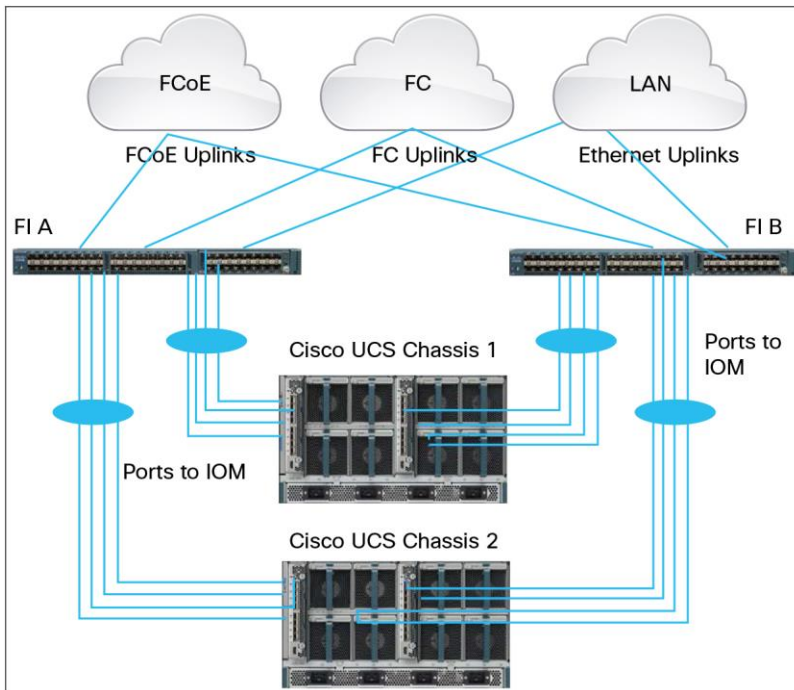
Cisco UCS and Cisco MDS 9000 Family Deployment Options

Many deployment options exist for Cisco UCS plus the MDS 9000 Family. In many cases, Cisco Nexus switching devices are used between Cisco UCS and MDS 9000 Family platforms. In other cases, Cisco UCS is directly connected to MDS 9000 Family switches. According to the size of their deployment and their disaster-recovery needs, customers can choose among MDS 9000 Family models, from the cost-effective MDS 9148S fixed-configuration switch, to the flexible MDS 9250i multiservice switch, to large directors such as the MDS 9706 or 9710.

This document focuses on the fabric interconnects and network adapters for Fibre Channel connectivity between Cisco UCS and the MDS 9000 Family. The same principles apply to both classic Cisco UCS and Cisco UCS Mini, with Fibre Channel port count and scalability the only differences.

A Cisco UCS deployment has two fabric interconnects, Fabric Interconnect A (FI A) and Fabric Interconnect B (FI B), which correspond to Fibre Channel (FC) Fabric A and B respectively. Cisco UCS Manager runs on the fabric interconnects and provides the GUI for configuring and monitoring Cisco UCS. The fabric interconnects house the southbound-facing ports (or backplane traces for Cisco UCS Mini), which provide the internal connectivity to the blades, and the northbound-facing ports, which provide the external connectivity to the Ethernet and Fibre Channel networks and other optional direct-connect devices. There are different types of fabric interconnects ports that serve different functions; this document focuses on Fibre Channel uplink ports and FCoE uplink ports. Physical connectivity is achieved by connecting a Cisco UCS uplink port to an MDS 9000 Family port (Figure1).

Figure 1. Cisco UCS and Cisco MDS 9000 Family Connectivity



The VIC is a converged network adapter (CNA) that is installed on a Cisco UCS blade server and provides the capability to create virtual Ethernet (vEth) adapters and virtual host bus adapters (vHBAs). vEths and vHBAs are recognized by operating systems as standard PCI devices.

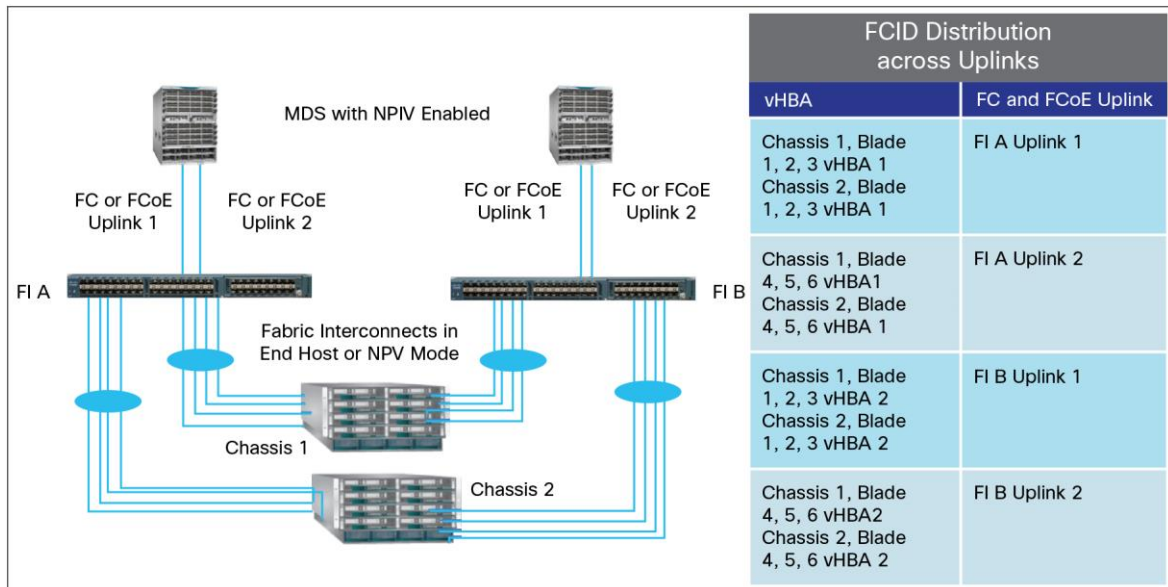
Two modes of operation can be used when the Cisco UCS fabric interconnect is connected to the Fibre Channel or FCoE SAN:

- End-host mode (default)
- Switch mode

End-Host Mode

End-host mode on Cisco UCS uses the node-port virtualization (NPV) feature to assign multiple FCIDs to a single port instead of relying on the traditional one-to-one relationship between the N-port and FCID. To enable connectivity between Cisco UCS and the MDS 9000 Family switch, N-port ID virtualization (NPIV) is enabled globally on the MDS 9000 Family switches. Figure 2 shows the Cisco UCS fabric interconnect connected to the MDS 9000 Family switch in end-host mode and the FCID distribution across the Fibre Channel and FCoE uplinks.

Figure 2. End-Host Mode Connectivity and FCID Distribution



Edge NPV allows an N-port to proxy other N-ports on the NPV-enabled switch to request FCIDs from the connected NPIV-enabled switch. When the Fibre Channel switch is running in NPV mode, the Fibre Channel services are running remotely on the NPIV-enabled switch rather than locally on the NPV-enabled switch. The NPV N-port looks like a host to the NPIV-enabled switch, rather than another switch in the Fibre Channel SAN fabric. NPV mode on Cisco UCS is called end-host mode. For Cisco UCS to connect to an MDS 9000 Family Fibre Channel switch in NPV mode, end-host mode (NPV mode) is required on the Cisco UCS fabric interconnects. The same requirement applies to FCoE uplinks connected in end-host mode to MDS 9000 Family or Cisco Nexus Family switches.

Switch Mode

Switch mode on Cisco UCS enables the fabric Interconnects to be connected as regular Fibre Channel switches to MDS 9000 Family and Cisco Nexus Family switches. Cisco UCS fabric interconnects will have domain IDs, and the blade vHBAs will log in to the fabric interconnects directly. The FCID is allocated by the Cisco UCS fabric interconnect.

Switch mode allows direct connection of storage devices to the Cisco UCS fabric interconnects. A Cisco UCS Invicta™ Series Solid State System array or any other qualified storage array can be directly connected to the Cisco UCS fabric interconnect when Cisco UCS is running in switch mode. Zoning on the fabric interconnect can be performed using Cisco UCS Manager, or it can be performed on the MDS 9000 Family switch and later imported into Cisco UCS.

Table 1 shows the differences between the end-host mode and switch mode.

Table 1. End-Host Mode Compared to Switch Mode

End Host mode	Switch Mode
NPV on UCS FI's and NPIV on Cisco MDS	No need of NPV/NPIV
FI Connected as "NP", "TNP" ports	FI Connected as "E" or "TE" ports
FCID provided by MDS	FCID provided by UCS FI
No Domain ID given to FI's	Domain ID assigned as per the fabric guidelines
Zoning done on the MDS	Zoning done on UCS FI or MDS
Direct attach of storage to FI is not supported	Can directly attach storage array to FI's

Advantages of Using Cisco MDS 9000 Family with Cisco UCS

Connecting the MDS 9000 Family with Cisco UCS provides multiple advantages. The main benefits of this powerful combination are:

- Better performance
- Easier management
- Better support

Better performance is one of the main consequences of the combined solution, with 50 percent more bandwidth for FCoE uplinks from Cisco UCS fabric interconnects to MDS 9000 Family switches. End-to-end VSANs, VSAN trunking, and Inter-VSAN Routing (IVR) are additional benefits for those seeking multitenancy in the data center. Increased high availability is achieved by configuring exclusive fabric-port (F-port) PortChannel technology, avoiding host relogin in the event of link failure.

Easier management is another major outcome. Common Cisco NX-OS Software operating system and management tools create a uniform and homogeneous solution. IT administrators can use the same skills across computing, SAN, and LAN environments. Smart Zoning reduces administration overhead without sacrificing end-node control. Automated and multitenant hybrid clouds can be created from those building blocks.

Better support is also an evident advantage. Companies can eliminate concerns about feature compatibility and interoperability and the need to discover who is responsible for a solution by having a single vendor to contact. Troubleshooting is simpler and faster, improving uptime and providing piece of mind.

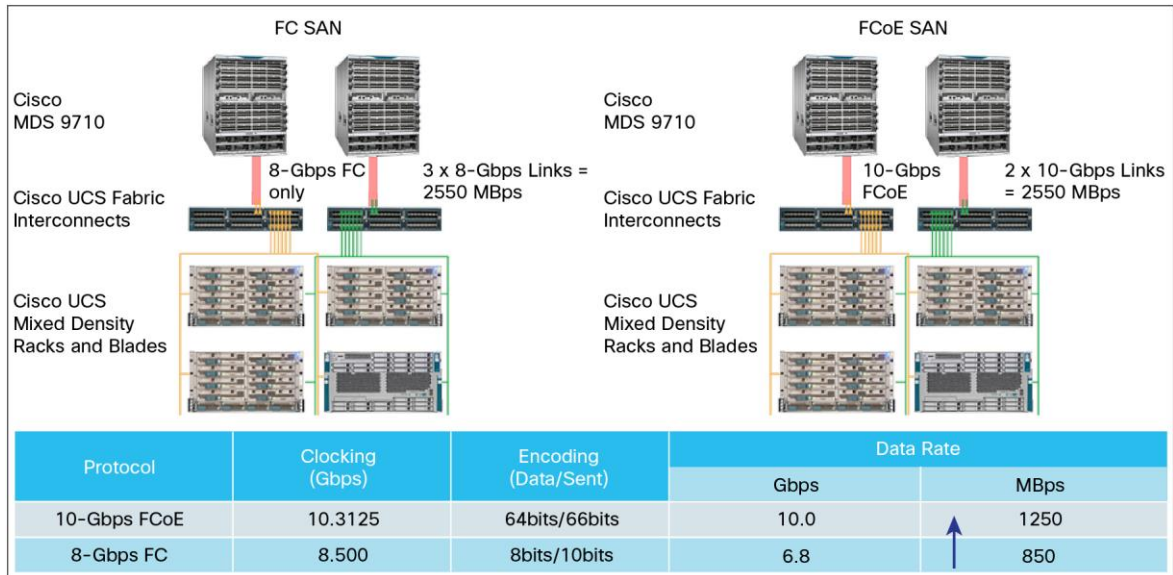
The following sections discuss these benefits in detail.

50 Percent More Bandwidth

The current generation of Cisco UCS fabric interconnects supports unified port technology. Every such port can be configured as a Gigabit Ethernet port, 10 Gigabit Ethernet port, 10-Gbps FCoE port, or 2/4/8-Gbps Fibre Channel port. The number of such ports depends on the specific fabric interconnect model. For example, the Cisco UCS 6248UP 48-Port Fabric Interconnect offers up to 48 unified ports, whereas the Cisco UCS 6324 Fabric Interconnect offers up to 4 unified ports. The MDS 9000 Family provides 2/4/8/16-Gbps Fibre Channel connectivity, and specific models also support FCoE. As a result, the two most typical options to interconnect Cisco UCS and the MDS 9000 Family are either 8-Gbps Fibre Channel or 10-Gbps FCoE. When trying to get the most bandwidth per link, organizations should consider 10-Gbps FCoE. However, the throughput advantage is not just in the 20 percent range, but in the 50 percent range.

Figure 3 shows Fibre Channel and FCoE SANs built for a bandwidth of 2500 MBps. A Fibre Channel SAN needs three 8-Gbps Fibre Channel links, whereas two 10-Gbps FCoE links provide the same bandwidth.

Figure 3. Fibre Channel and FCoE SANs



Depending on the overall architecture and scale, the use of fewer ports can lead to significant reduction in cabling, licensing, and hardware costs. If the 8-Gbps Fibre Channel connectivity option works with both Cisco and third-party storage networking devices, the FCoE connectivity option works only with MDS 9000 Family devices.

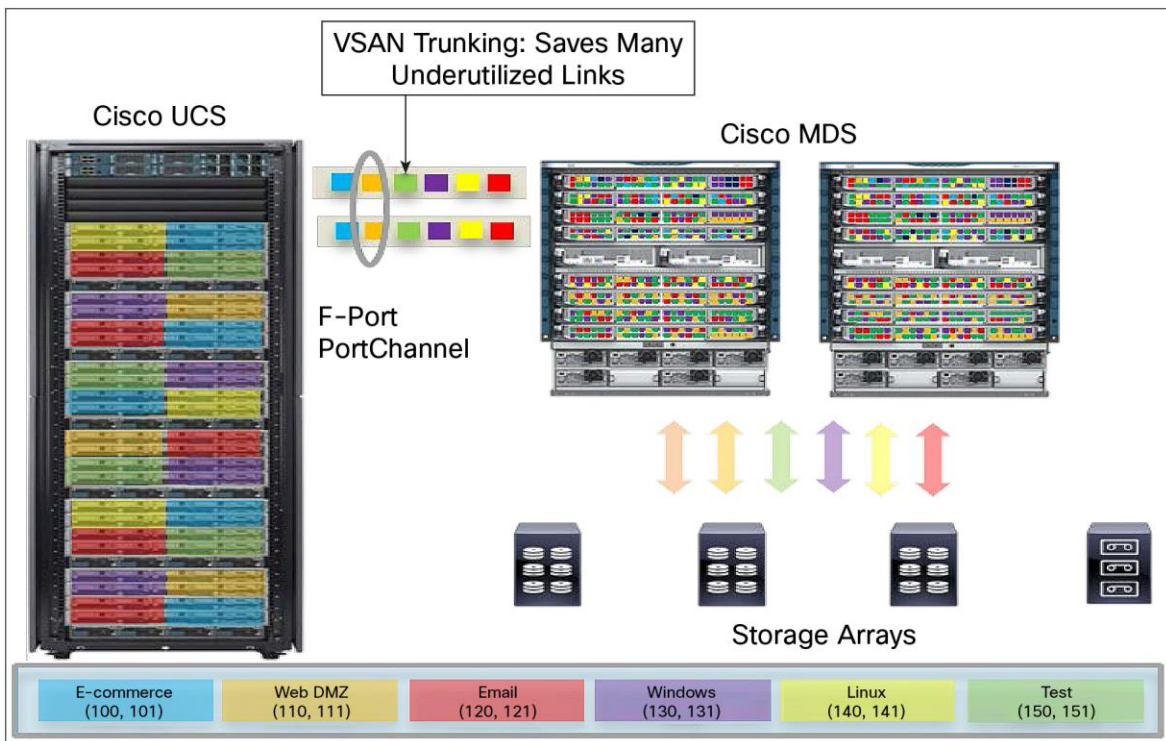
End-to-End VSANs, VSAN Trunking, and Inter VSAN Routing

VSAN technology provides the capability to partition a physical fabric into multiple logical fabrics. It is a virtualization technology that Cisco introduced in 2003 and that INCITS T11 standardized in 2004 under the name Virtual Fabric Tagging (VFT). Any MDS 9000 Family switch port resides in one and only one VSAN. Despite being an optional feature, VSAN technology has been adopted on a massive scale. According to data that Cisco collected from its installed base, 90 percent of MDS 9000 Family director customers use VSANs in their production environments. The average number of VSANs used is between 4 and 7, but some customers use more than 32 VSANs. The maximum tested and supported number of VSANs for Cisco devices is 80.

To save ports when interconnecting MDS 9000 Family switches, each with multiple VSANs enabled, organizations can transport multiple VSANs over the same link. This capability is part of the standard and derives from the fact each frame is tagged with the relevant VSAN number. As a result, multiple frames from multiple VSANs can be carried over the same shared link without being mixed up. This feature is called VSAN trunking and fully aligns with a similar feature in Ethernet environments.

VSANs and VSAN trunking are also supported on Cisco UCS. Therefore, organizations can implement an end-to-end VSAN solution and use VSAN trunking to save up to 85 percent of the uplink ports. VSANs and VSAN trunking can be used to enable multitenancy, which can start from within Cisco UCS and extend to the SAN. Different blades can be assigned to different VSANs, and compartmentalization of storage traffic can be achieved with hardware enforcement. Figure 4 shows the advantages of VSANs and VSAN trunking for Cisco UCS with the MDS 9000 Family.

Figure 4. VSANs and VSAN Trunking



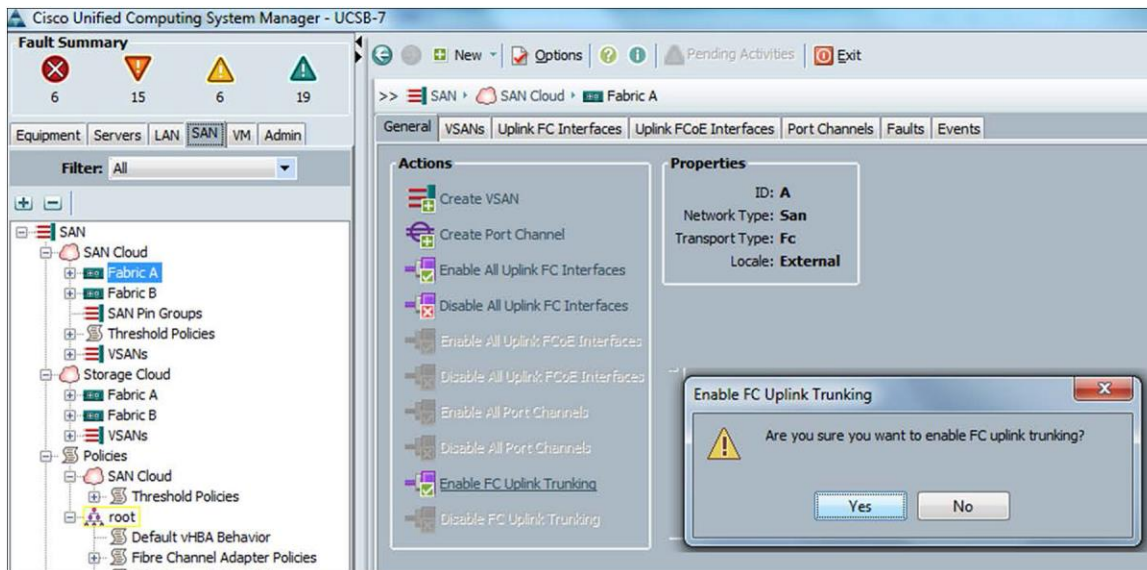
The use of these features is possible only when Cisco UCS is connected to another Cisco networking device, be it a Cisco Nexus Family or MDS 9000 Family switch. These features are not supported when third-party switches are used. When Cisco UCS is connected to third-party Fibre Channel switches, VSANs are not supported, nor is VSAN trunking, leading to suboptimal configurations.

Under specific circumstances, a host device in one VSAN may need to talk to a target device in another VSAN. Normally, this behavior would be prevented by the logic of separation and confinement that underlies VSAN technology. However, by exception and for specific host-to-target communication, inter-VSAN communication can be enabled without merging those VSANs. This capability is achieved with IVR, which is implemented in hardware on the MDS 9000 Family switches. By connecting Cisco UCS to MDS 9000 Family switches, organizations can configure and exploit IVR across the entire system.

High Availability with F-Port PortChannels

Link aggregation is a general term describing the act of combining multiple, individual physical links into a single, logical link with the goal of increasing bandwidth and availability between switches. Cisco's term for Fibre Channel link aggregation is port channeling. PortChannels are a Cisco enhancement that bundles multiple Inter-Switch Links (ISLs) together into a single logical link. Almost all Cisco Fibre Channel and FCoE networking product customers appear to use PortChannels in production environments with satisfaction.

Figure 5. FC Uplink Trunking



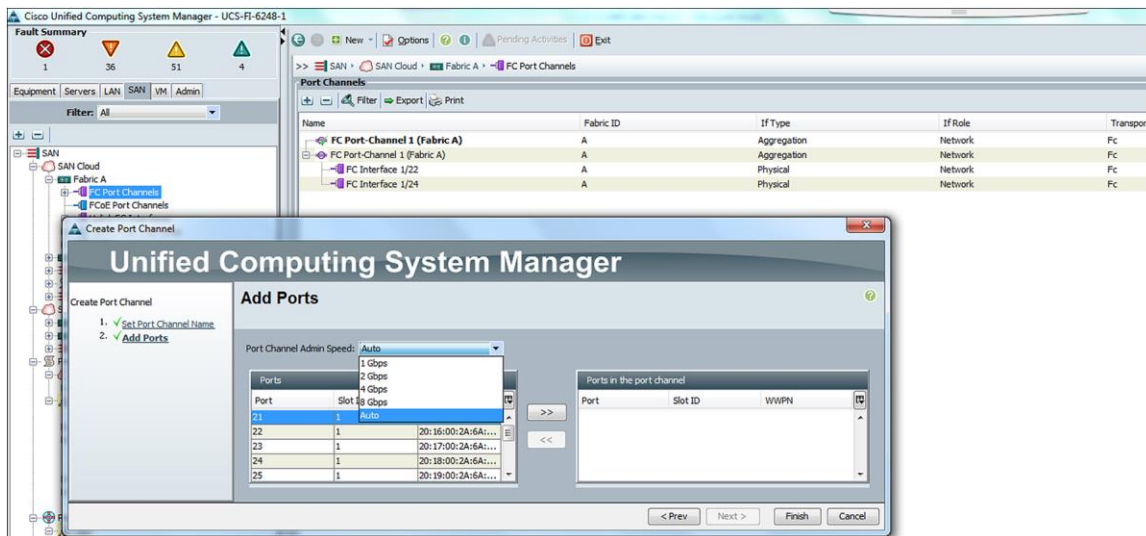
PortChannels are also supported on Cisco UCS when it is configured in switch mode. When the more typical end-host mode is used, a slight variation of PortChannels is supported, called F-port PortChannels. With this technology, organizations can configure a PortChannel with multiple F-ports between Cisco UCS and MDS 9000 Family platforms, improving bandwidth and reliability. The same is true for FCoE links, by configuring vF-port PortChannels. This feature is available only when Cisco UCS is connected to another Cisco networking device, be it a Cisco Nexus Family or MDS 9000 Family switch. This feature is not supported when third-party switches are used. Consequently, when connecting Cisco UCS to third-party Fibre Channel switches, PortChannels and F-port PortChannels are not supported, forcing to use of pin groups instead. Pin groups are a mechanism used in Cisco UCS to pin a particular server vHBA link to an uplink. Table 2 lists some of the differences between individual links with pin groups and F-port PortChannels.

Table 2. Differences between Individual Links and F-Port PortChannels

Individual Links	F-Port Port Channels
No Bandwidth aggregation	Bandwidth Aggregation with Multiple redundant links
No Fault tolerance	High availability and Fault tolerance
HBA re-login required during link failure	No re-login required when there are active links in Port-channel
No load balancing across links	Load balanced across links in Port Channel
Cannot scale bandwidth of a single link	Additional links added to Port Channel increases bandwidth

F-port PortChannels provide additional benefits over individual links and pin groups. If a single member link fails, the hosts using it remain logged in to the fabric and no relogin is required. In the case of pin groups and individual links, relogin occurs with some chance of unexpected problems. PortChannels thus provide fault tolerance. PortChannels also offer agile bandwidth scaling: if a PortChannel is overutilized, additional members can be added dynamically, as shown in Figure 6.

Figure 6. Adding PortChannel Members with Cisco UCS



The hosts that are logged in can immediately use the additional bandwidth without any intervention. In addition, PortChannels lead to optimal traffic distribution with detailed load balancing based on the source ID (SID), destination ID (DID), and originator exchange ID (OXID) on a per-VSAN basis, and no wasted bandwidth. PortChannels also help simplify operations because they do not require preplanning: administrators can avoid the guesswork of identifying top talkers and the task of assigning them individually to specific links.

Common NX-OS Operating System and Management Tools

Cisco UCS, Cisco Nexus Family, and MDS 9000 Family products all support NX-OS as the foundational operating system, making feature commonality easy to achieve. This support also allows the use of a common management tool for all these products, a capability implemented with Cisco Prime™ Data Center Network Manager (DCNM). Cisco Prime DCNM acts as a single dashboard for all networking functions for Cisco data center architecture. Even Cisco UCS fabric interconnects are detected and shown on Cisco Prime DCNM topology maps, and statistics about Cisco UCS uplinks can be collected and viewed. Cisco Prime DCNM can also match service profiles to blades and inform the administrator of their operational status. With the additional capability to discover and report about disk arrays in the fabric and the use of virtual machine managers, Cisco Prime DCNM can effectively provide an end-to-end view of all communication within the data center. For customers adopting a combination of bare-metal and virtualized servers, the capability of Cisco Prime DCNM to provide visibility into the network, servers, and storage resources makes this tool in high demand, helping provide full control of application service-level agreements (SLAs) and metrics beyond simple host and virtual machine monitoring.

Use the Same Skills across Computing, SAN, and LAN Environments

The MDS 9000 Family and Cisco UCS use a common operating system (NX-OS) and a common management tool (Cisco Prime DCNM for SAN), and hence server and storage administrators can use their skills across both product lines. This feature helps administrators implement, maintain, manage, and operate the LAN and SAN environments without the need to learn new tools.

The same design concepts apply to all Cisco data center products discussed in this document, and feature commonality allows organizations to get the best capabilities from of the overall architecture. Customers who have already adopted a formal test plan for Cisco Nexus 7700 platform modular switches can reuse it for Cisco MDS 9700 Series Multilayer Directors, because of the strong similarities between the two platforms. The platforms share the same basic OS and related hardware, so In Service Software Upgrade and Downgrade (ISSU and ISSD), supervisor failover, power-supply redundancy (N:N and N+1:N+1), and fabric-card redundancy are the same. The process for testing the architectural design on the platforms also is the same.

The use of the same OS and hence the same command-line interface (CLI) command structure allows administrators to more easily design scripts to collect information from the devices. Scripts prepared for Cisco UCS can be used on MDS 9000 Family switches by using the same CLI commands.

Smart Zoning

Zoning is the security mechanism embedded in Fibre Channel fabrics. It allows communication among initiators (hosts) and targets (disk arrays) by selectively making them part of the same zone. In zoning, devices can talk to each other only when they are part of the same zone. On MDS 9000 Family switches, zoning is configured on a per-VSAN basis. The creation of large zones with multiple members has always been possible. However, to improve fabric security and stability and reduce possible side-effects of registered state-change notification (RSCN) messages, zones should be kept as small as possible. The single initiator and single target (SIST) approach was designed to help meet this need. The SIST approach also reduces the number of access control lists (ACLs) created on the switch. The downside of this approach is the additional administrative time. For any new host joining the fabric, one or more zones need to be created, depending on the number of target ports to which the host needs to talk. Large enterprises normally have some IT staff members devoted just to zoning, and up to 40 additions or changes may be required every single day. Zoning maintenance clearly requires a big effort. To address this challenge, Cisco introduced Smart Zoning.

With Smart Zoning, customers can simplify their zoning activities, reduce administration overhead, and preserve the same fundamental security modes offered by one-to-one zoning, including the ACL count. Smart Zoning creates large zones in which multiple initiators and multiple targets (MIMTs) coexist. The smart capability of Smart Zoning is the implicit and automatic pruning of undesired communications so that initiators cannot talk to each other, and nor can targets. Only initiator-to-target communication is allowed, offering essentially the same implementation as one-to-one zoning. Table 3 presents the advantages of Smart Zoning over traditional zoning methods.

Table 3. Advantages of Smart Zoning over Traditional Zoning

Operation	Today: One-to-One Zoning			Today: Many-to-Many Zoning			Smart Zoning		
	Zones	Commands	ACL Entries	Zones	Commands	ACL Entries	Zones	Commands	ACL Entries
Create Zones	32	96	64	1	13	132	1	13	64
Add an Initiator	+4	+12	+8		+1	+24		+1	+8
Add a Target	+8	+24	+16		+1	+24		+1	+16

In a typical deployment scenario, Cisco UCS is configured in end-host mode, and the NPIV feature is enabled for the MDS 9000 Family switch. With Smart Zoning enabled, IT administrators can easily configure large zones with 16 or even 32 members, and by associating one Smart Zone with a specific application or cluster of virtual servers, they can give Fibre Channel zoning a new capability: application awareness. For customers who prefer a graphical tool, Smart Zoning is supported by Cisco Prime DCNM.

Automated and Multitenant Hybrid Cloud Building Blocks

Cisco UCS Director is a multitenant tool that customers eagerly adopted to turn their data centers into private and hybrid clouds. Every department can be managed in isolation from others, with logical separation of resources. Cisco UCS Director lets users create and access the IT services they need without any human intervention. The orchestrator in Cisco UCS Director coordinates all available resources, provisions them, and allocates them to the required service for the user within minutes. Resource provisioning occurs through device adapters that are available for numerous Cisco products and some third-party products, mainly disk arrays. Both Cisco UCS and the MDS 9000 Family are natively supported by Cisco UCS Director. Cisco UCS Director can also orchestrate third-party products, but if they are not natively supported, a custom library of tasks needs to be built, requiring some effort and slowing down deployment of the solution.

Overall, Cisco UCS Director reduces the amount time needed to deploy new applications, makes IT more responsive, and helps prevent shadow IT. Cisco UCS Director delivers centralized lifecycle management for virtual and physical resources.

Interoperability and Feature Compatibility

Any time that devices are interconnected, interoperability needs to be verified. Verification is particularly important in the storage environment. Every vendor publishes its own interoperability matrixes (also known as hardware and software compatibility lists). Cisco UCS is the same in this respect. Of course, full interoperability is much easier to achieve with products from the same vendor because they come from the same engineering organization and are readily available for internal testing. This is why the Cisco interoperability matrix clearly states that Cisco UCS and MDS 9000 Family products are interoperable provided that they meet some specified software release requirements.

Cisco UCS can also be connected to third-party Fibre Channel switches, and it has been proven to work in numerous production installations; however, customers need to be more careful about the software release used. Interoperability is tested, and so guaranteed, only for specific software releases. Moreover, not just the Cisco interoperability matrix needs to be consulted, but also the storage vendor's interoperability matrix. Because of the time required to conduct all testing, some delay may occur between the introduction of a new software release for public consumption and the official testing and listing of the release on the interoperability matrix.

Also note that Cisco UCS can interoperate with third-party Fibre Channel switches only when it is configured in end-host mode; check the interoperability matrix whenever Cisco UCS is configured in switch mode. Switch mode is supported in all models and versions of MDS 9000 Family (and Cisco Nexus Family) switches. The same lack of interoperability with third-party switches also is true for FCoE.

The Cisco UCS and MDS 9000 Family interoperability matrix can be found at the following links:

- [Cisco UCS Hardware and Software Interoperability Matrix](#)
- [Cisco MDS and Nexus Interoperability Matrix](#)

Note that even when interoperability is possible and certified, not all features may be available. For example, as already explained, the F-port PortChannels, VSANs, and VSAN trunking features are not available when third-party Fibre Channel switches are used because these switches do not support them. Even when third-party servers are connected to third-party Fibre Channel switches, features such as F-port PortChannels, VSANs, VSAN trunking, and FCoE cannot be used. This limitation is one more reason that a data center built on all Cisco technology is the best choice for customers.

Reduce the Need to Identify the Correct Support Service with Single-Vendor Support

When multiple vendors contribute to a complete solution, finding the responsible vendor when support is needed can be a challenge, and troubleshooting can be slow and difficult. Customers have tried to solve this problem by reducing the number of vendors they use or by adopting prevalidated converged systems for which a cooperative support agreement is in place among the various vendors of the solution. Ideally, customers want a single point of contact for any problem they may experience. This is exactly what they get when they invest in Cisco UCS for computing and the MDS 9000 Family for Fibre Channel networking. No other vendor offers both computing and Fibre Channel networking. Also, Cisco postsale support services are well known to be among the best. They have won several industry awards for effectiveness, time to resolution, and competence. Customers trust the Cisco Technical Assistance Center (TAC) for any support they may require, from information to troubleshooting and remediation. Cisco TAC operates 24 hours a day, every day, throughout the world. Customers who adopt both Cisco UCS and MDS 9000 Family platforms experience faster support and time to resolution. They also reduce risk through Cisco end-to-end support.

Better Support

Reducing the number of vendors involved in a data center solution helps make troubleshooting simpler and more effective. Cisco TAC staff members have expertise on all the products used in Cisco UCS, MDS 9000 Family, and Cisco Nexus Family solutions, and other solutions. With the partner support system, Cisco TAC also can involve storage array vendors to simplify the support process and coordinate effective troubleshooting. Cisco TAC can also provide support for products from partners with the recently introduced Cisco Solution Support Service for Critical Infrastructure. You can connect with data center experts to manage problems across a broad range of more than 80 technology groups at Cisco and our partners. When you entrust your solution to Cisco, we stand accountable for problem resolution within your covered data center. And we stay with you to coordinate all necessary actions and keep your case open until your problem is resolved. For more information about our solution partners, see [Cisco Data Center Solution Support for Critical Infrastructure](#).

Cisco Data Center Solution Support Service for Critical Infrastructure helps you resolve data center problems more quickly by adding a solution-level perspective to your device-level service contracts. Benefits include:

- **Faster problem resolution:** We accelerate problem resolution by taking ownership of your problem.
- **Reduced costs:** Our staff has the specialized knowledge needed to assist you when devices from different vendors do not work together properly. With less need for this specialized knowledge in house, you can staff your organization more cost effectively.
- **Flexibility:** Solution support gives you the flexibility to solve problems your way. If you call us first, we will promote resolution, including working with third-party products. If you start with a product support team, you can still call us and we'll take over from there.

Conclusion

A solution that uses both Cisco MDS 9000 Family and Cisco UCS platforms in the data center brings together best-in-class products for better performance, greater reliability, easier management, and easier maintenance. A solution using the MDS 9000 Family with Cisco UCS provides the following advantages over the competition:

- Multiprotocol flexibility allows organizations to deploy Fibre Channel and FCoE on a single chassis and more easily benefit from the advantages of both technologies.
- Gain 50 percent more bandwidth by using 10-Gbps FCoE links instead of 8-Gbps Fibre Channel links, making more effective use of ports.
- VSANs can logically segregate storage traffic and create multitenancy, and they are supported in the Fibre Channel fabric and in Cisco UCS.
- VSAN trunking provides options to allow multiple VSAN traffic over the same links, reducing the need for multiple links while segregating traffic.
- F-port PortChannels provide link aggregation, fault tolerance, and effective load balancing.
- Common OS and management tools ease network implementation, maintenance, and troubleshooting by relying on the same skill set across SAN, LAN, and computing environments.
- Smart Zoning reduces the need to implement and maintain large zone databases and eases management and implementation workloads.
- Organizations need to turn to just a single vendor when troubleshooting problems across computing and networking environments.
- A variety of support models are available across data center solutions to efficiently involve and coordinate partners and solve problems as needed.

The MDS 9000 Family provides superior performance, high availability, and intelligent and integrated storage networking for Cisco UCS environments in small, medium-sized, and large organizations. The combination of Cisco UCS and MDS 9000 Family storage networking devices provides abundant benefits for organizations that decide to invest in this solution.

For More Information

- [Cisco Unified Computing Servers](#)
- [Cisco MDS Switches](#)



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