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The Cisco MDS Family: Driving Intelligent SAN ROI

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We've seen a rapid evolution in SAN fabric switching technologies in the past 18 months. The entire switching category is exploding with more intelligent, flexible, and scalable fabric architectures. Enterprises are very keen to get their hands on real-time fabric management tools, virtual abstraction capabilities, and multi-protocol support, to name just a few advances. Why? Because these technologies are central to establishing significant SAN ROI. One of the primary suppliers of such ROI-enhancing advances is Cisco's MDS 9000 Family of Multi-layer Directors and Fabric Switches. The technical developments that Cisco has brought to bear on the switching market in terms of intelligent application platform, virtualization, advanced zoning, scalability, and investment protection have combined with a strong ROI story to become a very compelling platform. In this report we will take a look at some key SAN fabric considerations, and then take a deeper view into the core elements of the Cisco MDS 9000 family, exploring both the technical and economic impacts area of this product family. Everybody knows Cisco is in the storage game to win big, and the MDS 9000 family is a perfect showcase of the arsenal now at their disposal.

Fabrics Make or Break the SAN

When we sit down to talk with managers of leading SAN-based data centers, they all uniformly state that there is no end to the potential technical complexity they *could* architect into their SAN fabrics. A vast range of functionality, topology, and performance parameters can be deployed to meet the needs of literally any particular data center. However, architecting a fabric to provide these advances while still achieving solid ROI is the true challenge. It is now well understood amongst the user community that the choice of fabric switching technology can have a profound ripple effect on the ROI of the entire storage infrastructure.

Because of this economic reality, the vast majority of SAN shops rightly view the selection and deployment of their fabric switching architecture as one of the most

pivotal decisions they will make. More than ever, the wrong choice can lead to long-term economic sub-optimization for the entire storage infrastructure. In short, the fabric can make or break the entire SAN.

To that end, we have identified several areas in which fabric technologies can have significant variance in their ability to enable economic returns. The major factors that will impact a SAN fabric ROI are listed below:

ROI Factor: Scalability

One of the major obstacles to establishing a cost effective SAN infrastructure is ensuring the efficient scaling of the fabric into higher port counts with support across multiple host platforms and storage resources. Especially for high growth storage environments, we often find that storage managers have overlooked some of the hidden scaling costs associated with incremental fabric growth. A sub-optimal

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fabric topology can lead to unused ports, reducing the overall return of the switching environment, not to mention a range of performance and utilization impacts on the storage environment that follow from poor scaling. In the most egregious cases, we see customers deploying entirely new physical SANs to address their near-term scaling issues; a potentially significant and strategic misallocation of resources. For this reason, we consider fabric scalability to be one of the top ROI factors.

ROI Factor: Software Leverage

A major economic component that is often overlooked during evaluation is a SAN fabric's aggregate software leverage factor. Does the switching environment support a full range of software capabilities, from basic provisioning and performance management to zoning, virtualization and fabric-based application deployment? Without this full range of software functionality, optimizing ROI can be difficult. Again, especially for high growth SANs, the ability of the fabric's software to provide control and insights into the SAN is critical to a range of functioning including provisioning, availability, scalability, and usage case flexibility. The range and power of a vendor's fabric switching software *absolutely* matters in determining its ultimate ROI.

ROI Factor: Availability

While nobody would argue against the criticality of HA for a SAN fabric, the truth is that not all SAN fabrics are created equal when it comes to providing an easy entrée into an HA architecture. For example, we see many shops that spend considerable sums establishing redundant storage fabrics, all in the name of HA, but doing so at a considerable

cost and toil. It is imperative that all IT teams find the most cost-efficient methods available to step into a fabric availability schema that does not compromise uptime, but avoids the need to physically replicate fabric components or under-utilize precious port resources.

ROI Factor: Topology Flexibility

Beyond the obvious need to architect a high performance fabric, a well structured storage topology is also cost efficient. Typically, this means leveraging a combination of switches and directors in core/edge topology for optimal future deployment flexibility and port efficiency. A poor switching technology choice can destroy this flexibility. For example, a fabric's ability to support virtual abstraction or network-resident applications is a critical component in establishing a flexible architecture. Absent this ability in a large fabric, the economic return of the entire SAN will be hampered by the need to physically design each fabric to address specific business purposes (e.g. homogeneous OS support, backups, high performance fabrics, etc.) For these reasons, customers must think deeply about the inherent flexibility of a given fabric switching platform *before* they deploy.

All of these ROI factors considered together comprise the aggregate economic power of any given fabric switching infrastructure. Failure to consider all of these elements in product selection can lead to a less than optimal SAN value for years to follow. It is no exaggeration to say that the choice of switching fabric technology is the linchpin of determining the value of the SAN across time.

As a prospective purchaser of fabric switches, knowing how a potential vendor will stack up

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against these ROI variables is absolutely essential. With this profile, we will now turn to take a deeper look at how the Cisco MDS 9000 Family of Directors and Switches measures up.

ROI Factor: Investment Protection

At the end of the day, the most important financial question for any SAN deployment is whether or not it will provide ongoing high returns to the enterprise over many years. This is the main question of investment protection. Because SANs evolve over time, we find that most enterprises will have a wide range of upgrade schedules, resulting in multitude of products being deployed simultaneously. In a poorly architected SAN, this can lead to significant incompatibility issues. Accordingly, from a SAN fabric perspective, finding ways to ensure backwards and forwards compatibility for varying performance levels (e.g. going from 1G or 2G to 4G or 10G) is non-optional.

Meet the MDS 9000 Family

Cisco's MDS 9000 Family of switching products are at the core of that company's efforts in the fabric switching space. Initially introduced in 2002, the MDS 9000 Family is now in its second generation of offerings. Note that it is the first switching product family to introduce 1G, 2G, 4G, and 10G switching modules, all with forward and backward integration capabilities (the MDS 9000 platform is 8G ready, as well.)

Ranging from entry-level SAN switches up to multilayer director switches, the MDS 9000 Family covers the entire range of potential SAN fabrics in the enterprise. We will first focus in this briefing on the 9500 series Multilayer Director platform, which fully

exemplifies what Cisco can offer. After this brief overview, we will then look at key enabling technologies that differentiate the entire MDS 9000 product family.

Directing the Fabric: MDS 9500

At the core of the latest generation in the Cisco MDS 9000 Family is the 9500 series Multilayer Directors. The 9500 constitutes the flagship director-class switching architecture from Cisco, and so it stands as the foundation of the company's enterprise SAN strategy. There are several aspects of Cisco's design approach that we feel should be mentioned about the MDS 9500 Family in order to appreciate its full business impact.

Design Approach: High Availability

Designing for easy HA is a quality that distinguishes "the best" switching technologies from "the rest". All of the supervisor and switching modules comprising the MDS 9500 are designed to support non-disruptive fail-over through full redundancy of major components. Leveraging redundant crossbar bandwidth, they can support up to 2.2 tbps per system, ensuring that the loss of any crossbar will not impede the performance or operation of the entire fabric. Additionally, the 9500 series supports non-disruptive software upgrades, and stateful process restarts. In fact, the supervisor module of the MDS 9500 has an ongoing software monitoring function that oversees all software processes in the director, restarting those that fail without any impact on fabric traffic. The customer benefit of this pervasive HA-centric design is the assurance of knowing that whatever director-based deployment is considered, High Availability will be assured.

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Design Approach: Scalability

Given the high port count and oversubscription requirements of today's multi-switch SAN environments, scalability in both physical and logical terms is non-optional. The MDS 9500 platform is designed for optimal leverage on both fronts (e.g. the MDS 9513 with 13-slots in 14-RU form factor can deliver up to 528 1G/2G/4G ports.) Any core/edge topology that even the largest SAN shop with 1000s of ports might desire can be met with the wide range of switching modules available in the MDS 9500 vast arsenal. And equally critically, Cisco's industry standard Virtual SAN (VSAN) technology takes that physical scalability to the next level by allowing the abstraction of physical fabric resources into highly scalable virtual fabrics. This combination of physical scale *and* logical scale means that any multi-switch SAN architecture can be built on the MDS 9500 platform with confidence.

Design Approach: Modular Flexibility

A defining characteristic of the Cisco MDS 9500 platform is its inherent deployment flexibility, as evidenced in the range of module types available. MDS actually puts the director-class platform on the trajectory for which it was originally conceived: To become a true hub for all manner of network-centric storage services. On the MDS 9500, customers can easily add multi-protocol modules for IP functionality, a Storage Services Module for intelligent network-based applications (leveraging the SANtap protocol and FAIS-based Network-Hosted Virtualization) and SAN-based backup capabilities. Not to mention, the platform supports a wide range of FC switching modules to meet customers' port count and bandwidth requirements. And

again, because this platform is designed for full HA support, once customers begin building on the 9500, they can continue to expand and shift its duties in the fabric without concerns over software or hardware disruption. This flexible design encourages SAN customers to shift their thinking into a truly network-centric approach to data center computing, in much the same way Cisco's networking innovations have done for the IP networking world.

Tech Differentiators Drive ROI

In addition to the differentiation in design approach explored above, prospective customers should know that the MDS 9500 Multilayer Directors possesses some key integrated intelligence that is available across all modules. From our perspective, there are two key MDS software intelligence elements that merit explicit discussion, especially when considered in the ROI context that is the focus of this profile.

Cisco Virtual SAN (VSAN)

Cisco's Virtual SAN (VSAN) software is at the very center of the ROI potential for their entire architecture. First, it is critical to understand the distinction between zoning and VSAN. Fabric zoning is designed to restrict the visibility and connectivity of resources within the fabric. As such, zoning is a best practice security mechanism in today's storage fabrics. It is an especially critical element in heterogeneous SANs where multiple host platforms can unintentionally compete for storage resources. It is worth noting that all MDS devices support enhanced hardware-based fabric zoning as a basic component of their architecture, and can support multiple zones per port.

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VSANs enable the SAN administrator to abstract all of their port resources from a physical SAN fabric and create logical (“virtual”) SANs based on the needs of their various application groups. VSANs can be established based on physical port identity or device address schemes (e.g. WWN.) Each of these VSANs can then support their own zoning functionality. All fabric services associated with those virtualized ports are also replicated, making it a truly abstracted entity from a management standpoint.

This manner of fabric abstraction is important because it eliminates the need to create a redundant physical SAN when the administrator simply desires to isolate a given application group from the infrastructure. Rather than build a new switching environment, any given physical topology can be virtualized, thereby creating a “collapsed” physical infrastructure. Such an infrastructure is then capable of seamlessly servicing multiple application groups in an isolated fashion. This is a powerful example of how switching technologies have evolved in recent years to enable an entirely new level of flexibility. It is a defining characteristic of the software intelligence in the MDS platform.

From an ROI perspective, VSANS are absolutely critical, in both hard and soft cost savings. Because the SAN administrator can abstract out an entire fabric, it eliminates a costly investment in a new physical fabric; it is simply a reassignment of available ports on a given physical topology. This amounts to fabric consolidation, increasing the average port count utilization, and avoiding stranded ports on isolated physical fabrics. Additionally, from a soft cost perspective, because all fabric

services are also replicated in the VSAN, the administrator can easily manage multiple fabrics from the same management platform. We believe that the economic implications of this technology are significant if used aggressively in the enterprise SAN.

Intelligent Fabric-based Applications

Another key ROI-enhancing element of software intelligence within the MDS 9000 Family is the ability to support fabric-based storage applications. This is very advanced SAN fabric functionality, and we view it as central to driving adoption of network-resident computing in the coming years.

Accessible through the MDS 9000 Storage Services Module (SSM), there are several Cisco technologies that combine to make a range of fabric-based applications possible:

- Cisco’s FAIS-based Network Hosted Volume Management.
- Cisco’s SANTap-based Network Assisted Applications.
- Cisco’s Network-Accelerated Serverless Backup (NASB) and Fibre Channel Write Acceleration for Distance Extension of replication applications

To elaborate on one of these fabric-based applications, administrators can leverage Cisco’s SANTap protocol to run a range of 3rd party storage applications for provisioning, migration, backup and replication, to name just a few. This approach differs significantly from deploying storage applications in-band (a potential compromise to fabric availability) or out-of-band (consuming host CPU and I/O, and requiring ongoing management). Because a network-based approach like SANTap resides

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completely on the switching architecture, it can service *all* hosts, regardless of operating systems and allows multiple applications to be added to services and storage simultaneously.

Taneja Group has firmly stated for years that network-resident approaches, such as the intelligent services deployed through the Cisco MDS 9000 Storage Services Module, constitute a fundamental advancement for the entire data center. The ROI advantages of deploying applications via Cisco MDS SSM are significant. Specifically, it enables investment protection by removing key functions like backup, replication and migration from costly silos at the storage array or host layers. Additionally, because MDS SSM-deployed applications are truly heterogeneous to both their supported storage and host environments, it means greater management leverage for the IT team. These are concrete ROI benefits that will become obvious during any serious evaluation process of this technology.

Both Cisco's virtualization (VSAN) and fabric-based application capabilities (through the MDS SSM), combine with the design advantages of the MDS 9000 platform discussed above, to create a powerful set of tools for creating a SAN infrastructure that delivers a defensible SAN ROI, as well as the flexibility and scalability we discussed previously.

Taneja Group Opinion

This profile has focused on Cisco MDS and its ROI potential for one critical reason: "*Improving our storage economics*" is continually cited to us as one of the top reasons

customers seek to invest in advanced SAN fabrics. While any SAN is a cost savings over DAS, we believe that the MDS 9000 takes SAN cost controls to an entirely new level. Again, not all SAN fabrics are created equal.

Additionally, the modularity of the MDS platform itself means that customers will be able to invest as required by growth or need for new services (e.g. IP storage services, fabric-based applications via MDS SSM, DR/BC, etc.) all without resorting to monolithic investments. This transforms the switch fabric into an *engine* for capital conservation in the IT infrastructure rather than making it into a cost center.

End users tell us that building a SAN fabric optimized for *economical* scalability, flexibility, and availability is the biggest challenge they face. We know that not all technologies are up to the challenge. The key, in our opinion, is to intelligently integrate some of the major leverage points within the SAN switching fabric itself (e.g. application support, virtualization, intelligent routing, and multiple protocols) such that the customer does not have to engage in costly *ad hoc* deployments that only sap time and resources.

We believe that Cisco is delivering on this integrated vision with the MDS 9000 Family. They are providing customers with an entire platform that can be scaled or customized as required to meet the full range of technical or business SAN requirements, all with a built-in economic story that amplifies the enterprise's demand for verifiable ROI. Based on our analysis of this platform, we are especially convinced that very compelling returns are possible for a range of critical initiatives such

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as SAN consolidation, backup and recovery, and disaster recovery/business continuity.

For customers that are deadly serious about developing an advanced SAN fabric with built in considerations for their ROI, the MDS 9000

Family is a great place to begin their evaluations. Not all SAN fabrics are created equal, and Cisco is proving that point in spades with MDS.

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