# Facts About SAN Power Consumption

Reducing power consumption in a data center is one of the top priorities for IT professionals. When trying to design an energy-efficient data center, it is important to take a holistic view of the entire data center, comparing the solutions for total power consumption and weighing the costs and benefits. Designing a network with individual products consuming the lowest power in each category could end up making the total power use higher. If not properly designed, the resulting solution could also increase the overall cost due to performance, high-availability, and reliability issues.

The objective of this document is to present facts about SAN power consumption and demonstrate how the Cisco® MDS 9000 Family can help reduce overall power use in the data center.

Power Consumption in the Data Center

According to a Dell power usage study in 2006, all networking devices consume only 15 percent of the total power in the data center (Figure 1), and SAN switches consume only a small percentage of this total.

Figure 1.   Power Consumption in the Data Center
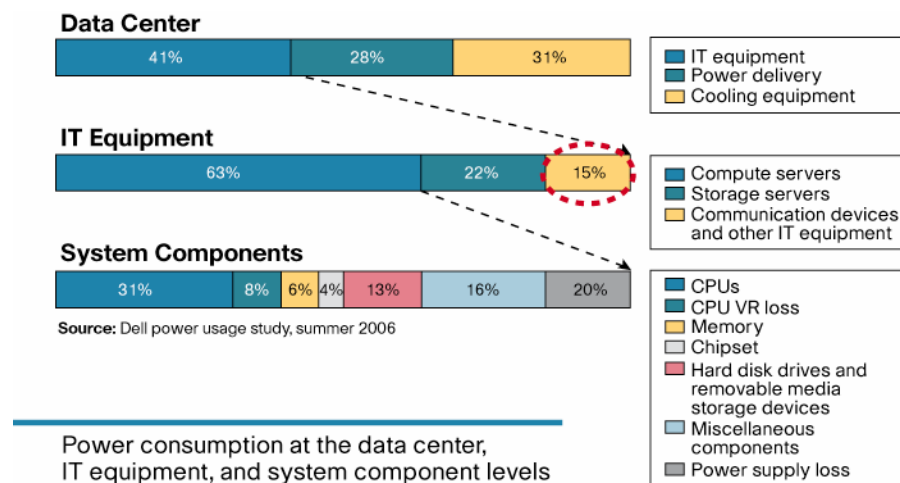
However, SAN switches play an important role in reducing overall power consumption in the data center:

- **Fabric virtualization:** Cisco MDS 9000 Family VSANs allow greater consolidation of SANs by logically virtualizing them on a single physical infrastructure.
- **Server consolidation:** The Cisco MDS 9000 Family enables and accelerates deployments of server virtualization and blade servers.
- **Storage virtualization:** The Cisco MDS 9000 Family enables optimal utilization, consolidation, and tiering of physical storage.
- **Unified I/O:** Cisco is the first vendor to deliver unified I/O technology and transparently integrate it with the Cisco MDS 9000 Family products. The introduction of Fibre Channel over Ethernet (FCoE) enables reduction in the number of network adapters in the servers and allows consolidation of LAN and SAN access-layer switches.

Cisco MDS 9000 Family Power Use Facts

This section discusses Cisco MDS 9000 Family power use and how the Cisco MDS 9500 Family helps reduce overall data center energy consumption.

Fact 1: Cisco MDS 9500 Series Multilayer Directors help reduce data center power by enabling greater server consolidation.

Cisco MDS 9000 Family Fibre Channel switching modules deliver integrated intelligent services, advanced features, and consistent and reliable performance while consuming only marginally more power than competing products on a per-switch basis.

For example, for a 144-port 8-Gbps SAN, Cisco MDS 9000 Family modules consume only about US$20 a month more power than a corresponding competitive solution.

However, in the context of the whole data center, a Cisco MDS 9000 Family solution promotes greater server consolidation, thus reducing overall power consumption. The fact is that servers consume a significantly greater fraction of the power in a data center. An IT administrator will save more power and costs by designing a SAN that helps reduce the total number of physical servers rather than by trying to squeeze every watt out of the SAN equipment. That is exactly where the Cisco MDS 9000 Family adds value. With virtual machine–aware and virtual machine–optimized SANs[1], the Cisco MDS 9000 Family helps deliver a holistic solution for energy-efficient data center design by providing better consolidation. For example, a global law firm expects to reduce the number of physical servers by more than 65 percent using a Cisco MDS 9000 Family solution, hence significantly reducing the power consumption as well as number of devices managed[2].

The competition cannot deliver a comparable consolidation solution because of the inherent architectural drawbacks of its products. As discussed in the next section, inconsistent performance and unpredictable, highly variable latency can affect applications in virtual machine environments, limiting server consolidation.

Fact 2: Cisco MDS 9000 Family Fibre Channel switching modules use marginally more power to deliver exceptional integrated intelligence.

Cisco MDS 9500 Series Multilayer Directors are designed with purpose-built application-specific integrated circuits (ASICs) to deliver comprehensive intelligent capabilities, consistent and reliable performance, and investment protection. Cisco MDS 9000 Family Fibre Channel switching modules deliver more intelligence than corresponding modules from competitors (Figure 2).

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[1] The Virtual Machine Aware SAN http://www.cisco.com/en/US/prod/collateral/ps4159/ps6409/ps5989/ps9898/white_paper_c11-494982.html
[2] Global Law Firm Selects Switch Solution and Storage Upgrade for Data Center
http://www.cisco.com/en/US/prod/collateral/switches/ps9441/ps9670/case_study_C36-511531-00.pdf

Figure 2. Cisco Architecture Enables Intelligent and Power-Efficient SANs
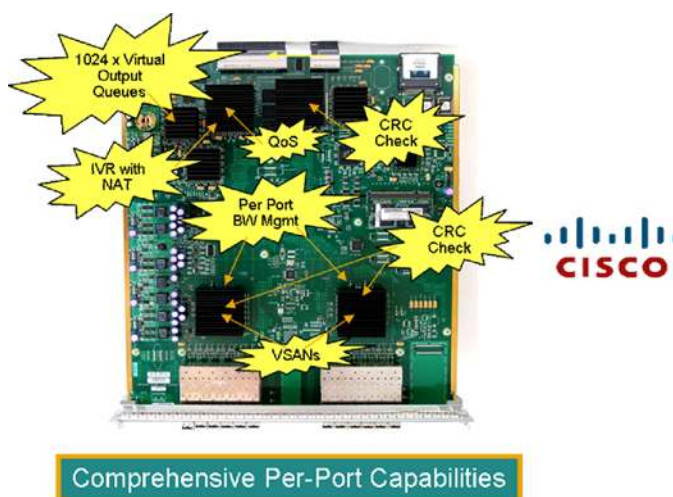
This integrated intelligence is instrumental in designing power-efficient SANs:

- Integrated VSANs and Inter-VSAN Routing (IVR) allow SAN consolidation and device sharing.
- Virtual output queues (VOQs) offer predictable, nonblocking performance.
- Quality of service (QoS) enables differentiated services on consolidated physical infrastructure.
- PortChannels with up to 16 links across any port of any module enable high-throughput and high-resiliency connectivity.
- Port bandwidth reservation offers bandwidth guarantees.
- Cyclic redundancy check (CRC) on each port helps avoid dangerous data corruption and provides quick fault isolation in the network.

The architectural advantages of the Cisco MDS 9500 Series offer unique value, including 100 percent wire speed and fair load balancing for large and small frames, very consistent and predictable performance and latency, sufficient buffering for all ports, even and predictable throughput for many-to-one and many-to-few configurations, and a better-than-advertised oversubscription ratio. To deliver this unique value, Cisco MDS 9000 Family Fibre Channel switching modules use marginally more power individually, while reducing total power consumption in the consolidated data center.

Corresponding switching modules from the competition use less power because those modules use a simplistic switch-on-chip architecture. The competition's director products are just a networked mesh of fabric switches with blocking architecture and limited capabilities, suffering from inconsistent, unreliable performance and unpredictable, highly variable latency. For example, such architecture can adversely affect virtual machine environments; as VMware VMotion moves virtual machines across the SANs, the applications can suffer from significant latency variations. Insufficient buffer credits can cause credit starvation on high-bandwidth links and negatively affect performance on 8-Gbps ports. Lack of CRC can lead to the forwarding of corrupt frames, resulting in undetected data corruption in the data center. These limitations and architectural challenges can be detrimental to the design of power-efficient consolidated and virtualized data centers.

Cisco's architectural advantages and integrated capabilities allow efficient deployments of tiered applications on consolidated SAN infrastructure, reducing overall power use, simplifying management, increasing operational efficiency, and reducing total cost of ownership (TCO).

Fact 3: The Cisco MDS 9000 Family uses less power for intelligent services.

As data centers evolve, increasing numbers of services are provided by the network. Cisco pioneered the services-oriented architecture (SOA), in which intelligent, high-performance services are integrated into the network. This integration eliminates the need for separate appliances, increasing consolidation and reducing power consumption.

Cisco's fundamental architectural advantage enables the Cisco MDS 9000 Family to be more power efficient in delivering integrated intelligent fabric applications. For example, Cisco MDS 9000 18/4-Port Multiservice Module (MSM) supports intelligent services such as VSANs, IVR, SAN extension using Fibre Channel over Internet Protocol (FCIP), Internet Small Computer System Interface over IP (iSCSI), Cisco Storage Media Encryption (SME), network-hosted storage virtualization, continuous data protection, remote replication, and Cisco Data Mobility Manager (DMM). The competition needs four different modules to deliver only a limited subset of these services, and three of these modules each consume more power than Cisco's single offering (Table 1).

Table 1.   Cisco's Consolidated Services Enable Power-Efficient SANs

Applications	Cisco	Competition	More Power Efficient
Encryption	Cisco 18/4-Port Multiservice Module (176W)	Module 1 (235W)	Cisco
Data mobility	Cisco 18/4-Port Multiservice Module (176W)	Module 2 (193W)	Cisco
FCIP	Cisco 18/4-Port Multiservice Module (176W)	Module 3 (184W)	Cisco
iSCSI	Cisco 18/4-Port Multiservice Module (176W)	Module 4 (171W)	Both are about the same

False and Misleading Claims About Cisco MDS 9000 Family Power Use

The competition makes claims that Cisco MDS 900 Family switches are less power efficient than their competing products. As already demonstrated, these claims are completely baseless. In real data center environments, the Cisco MDS 9000 Family SAN switches use marginally more power than the competition's SAN switches, but they help reduce the overall data center power consumption better than the competition.

The competition uses false numbers and misleading comparisons. It chooses typical (measured) power consumption numbers for its own products, but the worst-case numbers (meant for power budgeting and safety scenarios) for Cisco MDS 9000 Family products, incorrectly inflating the Cisco numbers by 15 to 20 percent. Additionally, in making power-efficiency claims, the competition conveniently chooses simplistic scenarios in which the network traffic is limited to certain ports using local switching. Real data centers do not have servers and storage with such restrictive topologies. In realistic scenarios, in which devices are connected across the fabric, the competition's products suffer from inconsistent performance, unpredictable and highly variable latencies, and lack of high availability. The Cisco MDS 9000 Family, however, has been designed to provide predictable, consistent, and reliable performance, regardless of the network topology.

Conclusion

Cisco is committed to holistically reducing power in the data center through fabric virtualization, server consolidation and virtualization, storage virtualization, and unified I/O.

The Cisco MDS 9000 Family helps reduce data center power by enabling greater server consolidation. Cisco MDS 9000 Fibre Channel switching modules provide more value per watt through advanced integrated capabilities and predictable high performance to reduce the number of devices deployed in the data center, thereby enabling power-efficient data centers. Cisco SOA delivers integrated intelligent fabric applications, increasing consolidation and reducing power consumption.

For More Information

http://www.cisco.com/go/storage

http://www.cisco.com/en/US/products/ps6780/index.html

http://www.cisco.com/en/US/prod/collateral/ps4159/ps6409/ps4358/data_sheet_c78-492690_ps5991_Products_Data_Sheet.html

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