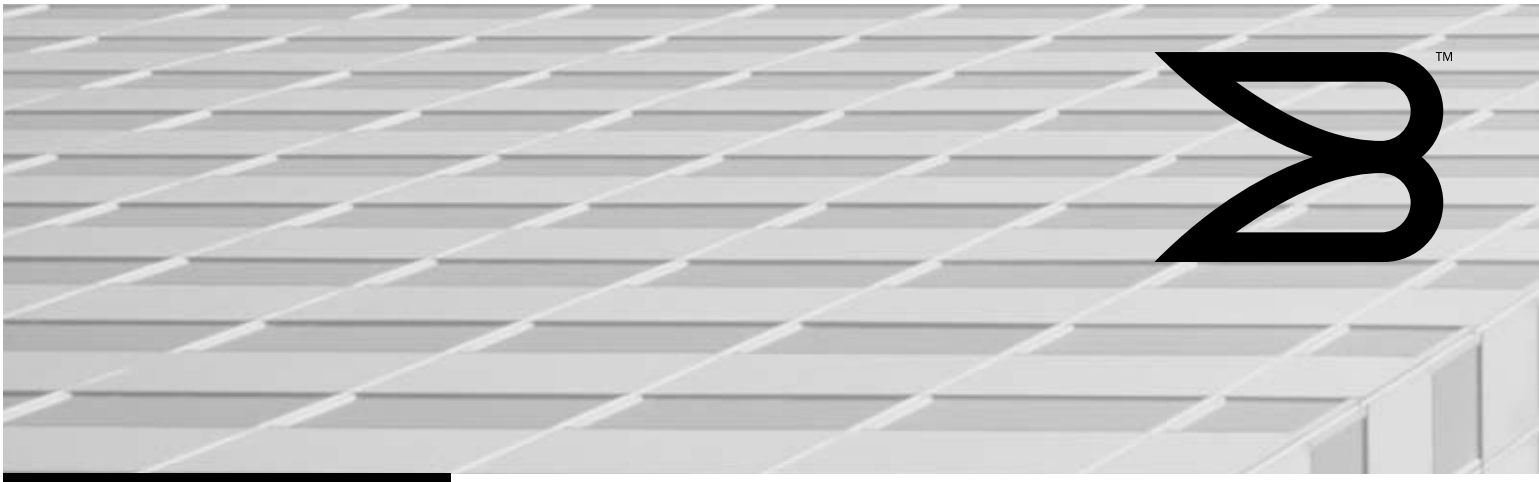

STORAGE AREA NETWORK

# Going “Green” with Brocade

Brocade solutions are designed to increase energy efficiency in today’s data centers.

BROCADE

**As today's IT organizations face the critical challenges of continued data growth and limited data center energy resources, they are turning to more energy-efficient devices to help them reduce their power usage and overall storage costs. Today, Brocade® is designing highly efficient data infrastructure solutions and participating in key industry initiatives such as The Green Grid consortium and the Storage Networking Industry Association (SNIA) Green Storage initiative. As a result, IT organizations now have more flexible choices to reduce their data center energy usage and keep their operations running smoothly.**

## THE GROWING CHALLENGES OF AN EFFICIENT DATA CENTER

Among all the challenges CIOs and IT administrators currently face, two historical trends are on a collision course. On the one hand, the geometric growth in data processing is generating ever-increasing demand for servers, storage arrays, and the infrastructure to support those devices. According to IDC projections[1], the total volume of corporate data generated worldwide in 2007 will be approximately 255 exabytes (one million terabytes). The projected total volume of corporate data worldwide for 2010 is nearly a zetabyte (one billion terabytes). More data means more hardware, larger data centers, and the requisite increase in power and cooling to sustain continuous operations.

On the other hand, the limited availability and increasing cost of energy worldwide is undermining the energy utilities' ability to supply reliable power. Several factors are contributing to this trend and pointing to an impending conflict between projected supply and demand:

- Increased competition between developing and developed countries for limited energy resources
- Regulations to reduce environmentally harmful emissions from fossil fuels such as coal and oil
- Lack of accelerated investment in sustainable energy sources

Because all modern enterprises depend on information technology, IT organizations must be able to align energy consumption with energy availability and simultaneously accommodate data growth as part of a viable IT strategy. Using today's technology, organizations can build sophisticated data centers in a cost-effective manner. However, even a generous budget cannot guarantee that they will have the necessary energy resources to power it in an economical manner. In fact, Gartner recently forecast that half of the data centers worldwide will not have sufficient power and cooling by the end of 2008.[2]

1. *The Expanding Digital Universe*, IDC 2007

2. *Gartner Says 50 Percent of Data Centers Will Have Insufficient Power and Cooling Capacity by 2008*, Gartner Inc. Press Release, November 29, 2006

## DRIVING INDUSTRY INITIATIVES FOR ENVIRONMENTAL EFFICIENCY

In response to this approaching data center energy crisis, Brocade and other IT industry vendors are participating in the newly formed The Green Grid initiative (www.thegreengrid.org) in recognition that "energy efficiency in the data center is the most significant issue facing technology providers and their customers today."[3]

This statement represents a significant shift in IT focus, which traditionally has concentrated on optimizing compute resources and storage operations. The Green Grid consortium takes a holistic view of the entire data center ecosystem and is thus examining all elements that contribute to energy consumption and waste.

Systems that generate excessive heat, for example, require air conditioning systems that in turn consume more power. The heat dissipation represents inefficient use of power by the system; the cooling represents an inefficient use of power to offset the original inefficient use of power. To avoid compounding this problem, the consortium is working towards developing new ways to resolve core inefficiencies and thus relieve the overall power burden.

Brocade is also working with the Storage Networking Industry Association (SNIA) to solve energy issues specific to storage networking. The SNIA Green Storage Technical Working Group concentrates on the carbon impact of the complex of servers, switches, directors, storage arrays, and tape subsystems that form data center storage networks. As the umbrella organization for storage-related hardware and software vendors, resellers, integrators, and end users, the SNIA will focus on raising consciousness around environmentally responsible storage networking practices and identify ways to resolve the contradiction between data growth and power scarcity.

## THE KEY ELEMENTS OF A GREEN DATA CENTER

As newer and more energy-efficient solutions come to market, IT organizations must first understand how, when, and where to deploy them as part of a strategic data center. In fact, going green in the data center can have many facets, such as:

- Reducing overall power consumption
- Maximizing power utilization
- Reducing the amount of hardware via consolidation
- Decreasing the amount of storage required to meet data processing requirements

As this multifaceted approach implies, there is no single solution for optimizing data center energy efficiency. IT organizations will need to implement comprehensive strategies that cooperatively integrate hardware, software, and other operational elements.

In contrast to consumer electronics that more readily lend themselves to energy-saving features (such as EPA Energy Star compliance), data center infrastructures pose greater challenges in achieving energy efficiency. Business today is global and data centers must typically support 7×24×365 operations. Data transactions demand immediate response times to meet both business and customer satisfaction requirements. As a result, there are few idle elements in a storage network that could leverage, for example, low-power hibernation techniques typical of consumer electronics.

Recognizing that data centers are inherently power-hungry, IT organizations must be able to temper the energy appetite by maximizing data transaction output per unit of energy consumed. Some advances have already been made on this front, as Brocade has demonstrated by proactively incorporating power efficiency into its product designs.

3. *The Green Grid Opportunity*, The Green Grid 2007

In addition, new storage technologies—such as server and storage virtualization, information lifecycle management, storage compression, and data deduplication—are enabling more efficient storage asset utilization and a reduced carbon footprint.

When attempting to increase energy efficiency in the data center, IT organizations should consider the following key areas:

- Servers
- SAN infrastructure
- Storage systems

### Servers

Given the sheer volume of file and application servers used in today's enterprises, servers are a prime candidate for a green makeover. More efficient AC-to-DC conversion, reduced heat dissipation, and more efficient use of CPU cycles by individual servers all have a significant impact when multiplied by the thousands of servers typically found in large data centers. By enabling multiple instances of operating systems and applications to be hosted on a single server hardware platform, server virtualization promises to reduce the total amount of hardware and associated power consumption for business applications.

Likewise, blade server architecture significantly reduces the hardware footprint required to support applications and, depending on the vendor, might have greater energy efficiency than rack-mounted or standalone servers. As a result, the combination of concentrated blade servers and server virtualization software can support more data transactions with less energy—helping to reduce the size of the data center and its cooling requirements.

In blade server environments, Brocade blade SAN switches and Brocade Access Gateway solutions enable integrated SAN connectivity without requiring a separate switch chassis, power supplies, and cooling fans. Sharing the power and cooling resources of the blade switch chassis reduces overall energy costs and heat dissipation requirements.

### SAN Infrastructure

For the storage network infrastructure that connects servers to storage, the complex of switches and directors typical of large data centers represents another green challenge. Data sheet power ratings sometimes vary from actual usage, depending on how the storage network is designed and what layers of connectivity must be supported.

The energy efficiency of directors in particular varies widely from vendor to vendor. For example, Brocade recently lab-tested the power consumption of the Brocade 48000 Director against a similarly configured competitive director. To provide an impartial evaluation, an independent electrician from Emerson Process Management monitored the testing and verified the results. Table 1 clearly illustrates why it is so important to promote power efficiency as a critical design goal in product development—the differences from one product to the next can be dramatic.

**Table 1.**
Energy usage comparison for enterprise-class SAN directors.

| Measurement Category | Competitive Director (348 Ports) | Brocade 48000 (384 Ports) |
|---|---|---|
| **Amps** | 13.3 AC | 5.2 AC |
| **Watts** | 2368 | 1005 |
| **Volt-Amps** | 2727 | 1061 |
| **KWh/Month** | 1730 | 734 |
| **Metric Tonnes $CO_2$/Year** | 8.7 | 3.7 |

The lab testing results further highlighted the disparity between efficient and inefficient power designs when all port blades were removed from the competitor's director chassis. Even devoid of port cards, the competitor's product consumed more power (5.6 Amps) than a fully loaded Brocade 48000 Director (5.2 Amps). Neglecting power utilization criteria in product design has a severe impact on power and cooling costs as well as a negative environmental impact. This is not sustainable for data centers that must continually accommodate growth in SAN connectivity to meet their business requirements.

The current trend in data center consolidation is to eliminate more SAN fabric elements by collapsing connectivity into larger-port-count directors in a tiered core-edge design. In addition, auxiliary storage services for multiprotocol support, distance connectivity, high-speed inter-switch links, fabric-based storage virtualization, and data migration facilities are being integrated on the most sophisticated director platforms.

The larger chassis required to support port connectivity and advanced storage services should therefore be designed for optimum energy efficiency, particularly for enterprise data centers that deploy hundreds of directors supporting thousands of servers and storage devices. Brocade's green strategy is to continue optimizing energy efficiency in its products while integrating additional advanced fabric-based storage services.

### Storage Systems

When it comes to storage arrays, there are several ways to minimize energy usage. Although individual disk drives might be relatively inexpensive, each spinning disk represents continuous power consumption. Typically, the faster the disk, the more power consumed. Mission-critical applications with high-availability and high-performance requirements might require the fastest disk drives and full mirroring (doubling the total number of disks) to sustain operations. As the data generated by those applications ages, however, it might have declining business value.

By combining information lifecycle management to track the value of data at any point in time with tiered classes of storage, organizations can migrate data from a higher-energy usage asset to a lower one. A second-tier storage array using lower-speed SATA drives, for example, would be a more energy-efficient repository for lower-value data before the data finally retires to an even more efficient media such as tape. In addition, new technologies such as a Massive Array of Idle Disks (MAID) provide on-demand access to disk data with the majority of drives in an array spun down until a data request is received.

Other green storage options attempt to reduce the total amount of storage required for corporate data. While data growth has been a constant for all enterprises, a significant portion is due to redundant copies of data dispersed throughout the network. For file-oriented applications, in particular, identifying and eliminating redundant copies of files can dramatically reduce total storage requirements.

Implementing a global namespace, for example, can help eliminate dispersed file silos and alleviate the need to replicate data as a convenience for local access. For instance, Brocade StorageX® enables a uniform, enterprise-wide file system namespace that simplifies administration and promotes more efficient utilization of storage regardless of geographical location. Likewise, data compression to disk and data deduplication technologies can preserve data accessibility while reducing the amount of storage, disk drives, and accompanying power usage required.

Data redundancy is also an inherent inefficiency for organizations with geographically dispersed sites and remote offices. If every remote location has its own storage system, green storage issues are multiplied across the corporate network. The current trend in remote storage consolidation is to centralize storage assets at an optimized central data center and leverage WAN acceleration to provide fast file access. For example, the Brocade suite of File Area Network (FAN) solutions is already helping organizations to centralize their storage assets while maintaining rapid response times for remote users.

One of the critical factors in understanding and tracking data center energy efficiency is using the right measurements. Whereas the former metric of cost-per-gigabyte of storage capacity was limited to hardware and operational costs, the green storage metric is now kilowatt cost-per-gigabyte or, more appropriately, kilowatt cost-per-disk. Even spare drives in a typical storage cabinet are always on, always spinning, always drawing power, and always dissipating heat. Implementing tiered storage, storage virtualization, lifecycle management, data compression, and deduplication can help lower the carbon impact of the data center while reducing overall storage costs.

## STRATEGIES FOR A GREEN ENTERPRISE

In response to the rising cost of energy and its limited availability, some IT organizations are simply relocating data centers to areas with lower energy costs. For example, new data centers being built along the Columbia River in Washington are taking advantage of the relatively lower cost of hydroelectric power compared to conventional coal- or oil-based power generation. While this does save money and lessens the environmental impact in regard to carbon-emitting power sources, there are still environmental issues concerning large hydroelectric dams.

Going green means that organizations must re-examine *all* aspects of their IT operations—including facilities, people, and infrastructure—so they can proactively implement best-practice strategies and identify areas where they can achieve greater power efficiencies.

Today, Brocade is actively participating in The Green Grid and SNIA Green Storage initiatives to help discover additional ways to minimize the impact of IT storage operations on power consumption. If, as Gartner forecasts, adequate power for many data centers will simply not be available, organizations have a vital interest in reducing their power requirements and implementing solutions that do much more work with far less environmental impact.

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