Get the Most Out of Data Center Consolidation

Brocade networking solutions help ensure that organizations benefit from decreased costs and increased business agility as they consolidate their data centers.
Organizations continue to consolidate their data centers to cut costs, simplify their infrastructure, and boost service delivery and business agility. Consolidation, along with technologies such as server and storage virtualization and convergence, places additional demands on the data center infrastructure.

Understanding the resulting performance, availability, security, and space/power requirements is critical to selecting the right IT infrastructure partner. With its broad product portfolio, Brocade® is uniquely positioned to help organizations address these requirements and realize the financial and business benefits of data center consolidation.
INTRODUCTION
The number of organizations consolidating their data centers has grown steadily over the past few years as these organizations move to streamline both IT infrastructure and operations. Current economic conditions have created an even greater need to consolidate data centers to cut costs while boosting agility to address fluid business conditions.

Brocade is uniquely positioned to assist organizations with data center consolidation projects. With its robust Fibre Channel product family and comprehensive IP networking product portfolio, Brocade offers end-to-end connectivity for data and storage networks within the data center and across the enterprise. Brocade high-performance solutions help organizations achieve significant cost reductions and efficiencies in the data center and position themselves strategically for the future.

This paper examines the business drivers for data center consolidation: technology trends that are reshaping the data center, key issues IT managers need to address in implementing data center consolidation, and how Brocade can help organizations get the most value from data center consolidation.

THE DOLLARS AND CENTS OF CONSOLIDATION
Whether through mergers and acquisitions or organic growth, organizations often find themselves with dozens of data centers to manage. Each contains server, storage, and network equipment that’s managed by a cadre of computer operators, system administrators, and other IT staff. Not only are infrastructure and personnel duplicated across numerous data centers, but servers and storage devices are generally under-utilized—even as organizations are paying for a large number of software licenses.

Many organizations also have application servers and storage scattered throughout remote offices. These devices pose data security risks as well as management headaches, so IT managers are looking to bring these resources into the data center as well.

Consolidating resources into a few data centers fulfills a number of goals and provides many benefits, from reducing expenses to modernizing infrastructure. Industry research and case studies have shown that data center consolidation can provide overwhelmingly positive Return On Investment (ROI). Concentrating computing resources into a small number of physical locations lowers the cost of IT operations as well as hardware and software expenses. Larger data centers are not only more cost-effective, but they also enable organizations to transform their infrastructures by replacing older equipment with high-performance, multi-function platforms designed to support today’s demanding applications and virtualized environments.

Organizations have found that data center consolidation allows them to:

• Reduce the number of physical sites dedicated to data centers, generating space and energy savings
• Cut operations costs by consolidating IT staff
• Simplify infrastructure and management by reducing the number of devices that need to be monitored and maintained
• Standardize and update infrastructure for greater efficiency
• Boost performance and enhance Service Level Agreements (SLAs)
• Increase reliability
• Improve data security
• Leverage advanced technology for greater business agility
THE VALUE OF VIRTUALIZATION
Two key technology trends are reshaping today’s data centers: virtualization and convergence. Server, storage, and network virtualization have matured and are being widely used to enable data center consolidation. Virtualization allows organizations to consolidate application servers and storage servers into resource pools that can be allocated dynamically to meet changing traffic loads and business needs. As a result, organizations can better utilize their computing power and storage capacity.

For example, virtual machine technology enables organizations to consolidate multiple application workloads onto a single physical server. Consequently, they can reverse the proliferation of physical servers, resulting in less hardware and more flexibility in how server resources are used. Virtualization can increase server utilization from a typical rate of 15 percent to an average rate of 60 percent, according to some studies, and processor utilization to as high as 80 percent. In addition, server virtualization supports rapid deployment of new applications.

Similarly, storage virtualization allows organizations to dynamically manage storage resources as virtual storage pools with little regard for what physically resides on the back end. Pooled storage resources can serve a single server, many servers, or even a server farm. Moreover, organizations can create very large logical disk volumes from a storage pool as needed, maximizing disk storage utilization.

With both server and storage virtualization, organizations benefit from fewer devices to manage, a smaller equipment footprint in the data center, and reduced power and cooling costs. In addition, storage virtualization helps eliminate application downtime when IT needs to add disk capacity to the system. Virtual storage software further reduces operations overhead and optimizes storage usage by automatically moving data from one storage tier to another based on access patterns and data retention policies.

VIRTUALIZING THE NETWORK
Virtualized network services augment and extend server and storage virtualization by abstracting the physical network infrastructure so that IT can use virtual connections to access shared pools of physical resources. This simplifies resource management, strengthens security, and boosts resiliency. Network virtualization technologies are key enablers of data center consolidation, making it possible for organizations to utilize application server and storage resources very efficiently and to ensure data is transmitted securely.

For example, organizations can logically separate traffic by assigning servers and service devices to specific Virtual LANs (VLANs), which helps them meet SLAs and regulatory compliance. For instance, all financial transaction traffic can be placed into a secure VLAN that’s accorded high-priority and low-latency handling by the network.

Virtual Routing and Forwarding (VRF) technology allows multiple instances of a routing table to coexist in the same router at the same time, so overlapping or identical IP addresses can be used without conflicts. Organizations can use VRF tables to create secure service zones. For example, each VLAN can be associated with a VRF, providing another layer of traffic isolation.

For its part, Virtual IP (VIP) technology helps organizations assign one or more IP addresses to a server without binding the address to a physical interface. VIP is useful for supporting redundant connections. It increases uptime by allowing a server to accept packets based
on their VIPs, independent of the interface on which the packets are received. If a Network Interface Card (NIC) fails, for example, the server can still receive VIP packets on its other interfaces, ensuring uninterrupted application and data access.

Another important technology for data center consolidation is Virtual Private LAN Services (VPLS). For business continuity purposes, organizations maintain redundant data centers and backup sites. VPLS allows geographically dispersed sites to share an Ethernet broadcast domain and communicate as if they were on the same LAN. This greatly simplifies connectivity among multiple data centers, enabling data synchronization.

**CONVERGENCE**

Another trend that will have a significant impact on data center operations is the convergence of local and storage area network technologies, specifically the Fibre Channel over Ethernet (FCoE) effort underway in IEEE. FCoE is an encapsulation protocol that enables the transport of Fibre Channel storage traffic over a new version of Ethernet called Converged Enhanced Ethernet (CEE).

This enhanced version of Ethernet has Fibre Channel-like features so that it can carry storage traffic while preserving data integrity. CEE also features congestion control and per-priority flow control, so that network devices can control the flow of a single traffic class without affecting the flow of other traffic classes on the same link.

FCoE encapsulates the entire Fibre Channel frame intact and unchanged into CEE frames, enabling servers and storage devices in the data center to use a single link for both Ethernet and Fibre Channel communications. With CEE networks, organizations will be able to share a single physical transport layer for multiple protocols, including TCP/IP, FCoE, and InfiniBand.

For example, FCoE will enable the flow of SAN and LAN traffic from a server to a switch. Once the unified traffic arrives at the FCoE switch, it is inspected, separated, and forwarded to the proper destination—Fibre Channel traffic is forwarded to SANs over Fibre Channel ports and LAN traffic is sent over CEE ports to its next destination. Importantly, FCoE preserves existing Fibre Channel services and can be supported by existing management tools, which means reduced training costs and faster deployment.

Converging LAN and SAN infrastructures and leveraging the price-performance curve of Ethernet:

- Simplifies server connectivity and cable routing
- Eliminates extraneous hardware by reducing the number of storage and networking adapters, cables, and switch ports needed
- Reduces capital expenses with common I/O cards, routers, and switches
- Boosts SAN performance from 4 and 8 Gbps Fibre Channel speeds to 10 Gigabit Ethernet (GbE) and future 40 and 100 GbE speeds
- Mitigates complexity
- Lowers Operating Expenses (OpEx) as a result of having a single technology to manage

With FCoE, organizations will have a more cost-effective and efficient way to build virtual server and storage environments capable of supporting today’s low-latency, high-bandwidth applications (see Figure 1).
Figure 1.
High-performance Brocade networking solutions provide a reliable foundation for data center consolidation.
ISSUES IN DATA CENTER CONSOLIDATION

In order to achieve a solid ROI from data center consolidation along with the benefits of virtualization, organizations must plan carefully. Consolidation and virtualization both lead to a concentration of resources, which places additional performance, availability, scalability, and security demands on the network infrastructure. Understanding the following issues is key to successfully transforming a data center:

• Very high performance
• High availability
• Non-disruptive scalability
• Security
• Power and space efficiency
• Virtualization and traffic engineering capabilities

Very High Performance

The load on application and storage servers continues to grow as application workloads and the sheer volume of digital data increases exponentially year over year. Application servers are already moving towards higher-speed links, from 1 GbE to 10 GbE in the near term and from 10 GbE to 40 GbE over the next few years. Virtualization puts further pressure on network performance as physical resources are concentrated on virtual devices. With virtualization, the ratio of applications per server is as much as 10 to 1, for example, resulting in the need for much bigger network pipes to connect servers to storage and to link servers to the LAN for user access. In addition, organizations need to maintain end-to-end Quality of Service (QoS) for each virtual machine.

The data center network infrastructure must deliver backbone-class bandwidth and consistent end-to-end latency to ensure that applications meet their SLAs, resources are maximized, and data sharing and collaboration are optimized. During peak hours, the limits of switching fabrics can be severely pushed, so it is important that data center switches have very high packet forwarding capacities and be capable of non-blocking behavior. In addition, the data center network infrastructure must support high-speed MAN/WAN connectivity to enable the synchronization of data across data centers for disaster recovery purposes.

High Availability

Data center consolidation intensifies the need for high network availability because applications and data are concentrated at a few sites. For organizations whose users need 24×7 access to critical data, downtime—including planned downtime for maintenance and upgrades—must be minimized.

Organizations need to equip the data center with networking devices that avoid single points of failure by having high-availability features built into the hardware and software. Network equipment for the data center should have the following high-availability characteristics:

• Redundant components such as management modules
• Switching fabrics
• Power supplies and fan modules
• Hot-swappable components
• In-service or hitless (non-disruptive) software upgrades
• Hitless failover
• Graceful restart
In addition, organizations should design for redundancy with duplicate data center assets to ensure business continuity and fast disaster recovery. To this end, organizations need to ensure that their networks support high-performance redundant links as well as key redundancy protocols, such as VRRP. Likewise, the ability to perform non-disruptive maintenance and system upgrades is crucial for maximizing uptime.

**Non-disruptive Scalability**

Demands on the data center change over time, as do technologies. Consequently, organizations must be able to add capacity and new capabilities to the network infrastructure without disrupting user access or degrading performance. Specifically, they need the ability to expand port densities, bandwidth, and uplink capacities and to adopt new technologies such as IPv6, 40 GbE, and CEE without having to rip and replace existing network equipment. Organizations should look for network platforms that can support future high-speed interfaces without becoming oversubscribed and that provide a migration path to emerging technologies.

**Security**

Robust security capabilities are essential for protecting mission-critical applications and data in the data center from misuse, unauthorized users, and both internal and external threats. Organizations must utilize network equipment that provides key security features such as traffic isolation, data encryption, and usage tracking and logging for compliance purposes.

**Power and Space Efficiency**

Data centers have limited power and cooling. Therefore, organizations need to evaluate each network device for its power consumption. They should look for energy-efficient devices that feature a low wattage per Gbps of throughput or low power consumption per port.

Data centers, no matter how large, also have a limited amount of space. Expanding network capacity by adding racks of equipment or additional chassis translates into a recurring expense. To avoid multiplication of devices, organizations need network equipment that has a compact form factor and can be expanded without an increased footprint.

**Virtualization and Traffic Engineering Capabilities**

As noted earlier, network virtualization provides a level of abstraction that simplifies the deployment of virtual servers and storage by requiring fewer changes to the underlying physical infrastructure. Network virtualization features reduce configuration and ongoing operations overhead, while traffic engineering capabilities enable load balancing and path selection, which support performance and security objectives.
THE BROCADE END-TO-END DATA CENTER SOLUTION

Data center consolidation presents a wide range of connectivity challenges that very few vendors can address. However, Brocade is uniquely positioned to meet these challenges. As a global leader in storage networking, Brocade has expanded its leadership position in networking through the acquisition of Foundry Networks, an industry pioneer in IP networking solutions.

With its combined product set, Brocade can provide an end-to-end data center solution that encompasses the SAN, LAN, and WAN. The Brocade DCX™ Backbone family, NetIron® MLX Series of switching routers, and BigIron® RX Series of Ethernet switches provide a solid foundation for data center consolidation, including support for virtualized environments.

Designed for performance without compromise, Brocade solutions provide wire-speed performance on all ports for all services and protocols, along with industry-leading port capacity per system. Organizations benefit from a compact, energy-efficient data center infrastructure designed for backbone-class performance, continuous availability, non-disruptive scalability, and robust security at a much lower cost than competing solutions.

The following sections highlight each platform’s role in the data center and the key features that support data center consolidation.

The Brocade DCX Backbone Family

The preeminent Brocade SAN platform, the Brocade DCX Backbone family provides high-density Fibre Channel connectivity and supports virtualization services that enable organizations to consolidate storage resources into a single pool that can be dynamically allocated, monitored, and managed. Delivering more than four times the performance of competitive offerings, the Brocade DCX supports nearly 400 wire-speed 8 Gbps Fibre Channel connections to meet data growth and the access demands of high-performance applications and virtual machines.

The Brocade DCX is designed to provide greater than 99.999 percent uptime, with features such as redundant control processor modules; redundant, hot-pluggable power supplies, fans, processors, core switching, port blades, and optics; and non-disruptive firmware download and activation. The Brocade DCX multiprotocol architecture has been future-built for FCoE/CEE and supports a variety of performance optimization, virtualization, and security services—helping to ensure that service levels are maintained or exceeded.

For example, Brocade Fabric OS® (FOS), the software that runs on all Brocade SAN equipment, provides fabric-based services that include data encryption and Adaptive Networking services, which provide QoS, Ingress Rate Limiting, and Traffic Isolation. Virtual Fabrics, a Brocade FOS capability, enables organizations to partition a physical SAN into Logical Fabrics and isolate them by application, business group, customer, traffic type, and so on. These features support efficient resource allocation and agile provisioning as well as data security.

In addition, the Brocade DCX is a compact, energy-efficient platform, requiring only 33 percent of the rack space of competitive offerings and 20 percent of the power. As a result, organizations can deploy more server and storage equipment in their consolidated data centers, generating both CapEx and OpEx savings.
The NetIron MLX Family
A family of high-performance routers, the Brocade NetIron MLX Series plays a key role at the core and edge of the data center, providing Layer 2/3 connectivity to the enterprise network, to remote data centers, and to the Internet. The NetIron MLX enables organizations to collapse multiple network layers, which simplifies the data center infrastructure and reduces both CapEx and OpEx for data center consolidation projects.

With an extremely efficient chassis design, the NetIron MLX delivers 3.2 Tbps of forwarding capacity and high-density, wire-speed 1 GbE and 10 GbE ports at one-third the cost and a much smaller footprint than equivalent competitive solutions. Designed to be future-proof, the platform is 40/100 GbE-ready. In addition, the NetIron MLX is a highly scalable platform, supporting up to 1 million IP routes in its Forwarding Information Base (FIB) and key routing protocols—including IPv4, IPv6, and MPLS and GRE tunneling.

For maximum uptime, the NetIron MLX features redundant hardware, including redundant management modules, switch fabrics, power supplies, and fans. Hitless failover, featuring non-stop software design with hitless software upgrades, helps ensure continuous operation. The NetIron MLX supports key router resiliency and network virtualization protocols, including VRRP, VRRPE, VSRP, RSTP, and MSTP, as well as Multi-VRF, which allows organizations to create multiple security zones and simplified VPNs for different applications and business units.

In addition, the NetIron MLX has the lowest power consumption and heat dissipation among routers in its class, consuming 80 percent less power than competing solutions. The leading density of each router in this series and the small form factors yield significant savings on rack space and cooling costs, reducing overall operating expenses.

The BigIron RX Family
The Brocade BigIron RX Layer 2/3 switches are ideal for aggregating LAN and server connections within the consolidated data center. A high-performance, high-density platform, the BigIron RX features state-of-the-art packet processing technology and is the industry’s only switch with 512 × 10 GbE ports (or 1536 × 1 GbE ports) in a single chassis. Fine-grained QoS support ensures that even low-latency and low-jitter applications meet their SLAs.

The high-availability architecture of the BigIron RX features separate control and data planes and fully redundant power supplies, management modules, fan trays, and switch fabric modules. All modules are hot-pluggable, and cable management and module insertion are on the same side of the chassis for easier serviceability.

The BigIron RX also supports the ability to gracefully shut down a switch fabric module for scheduled maintenance with zero packet loss. Features such as hitless Layer 2 software upgrades within a release, hitless Layer 2 failovers, sub-second switchover to the standby management module, and graceful OSPF and BGP restart all help maximize uptime, even during maintenance.

Scalability and future-proofing features include hardware support for dual-stack IPv4/IPv6 routing and a migration path to FCoE. In addition, the BigIron RX offers the highest power efficiency in its class, and features the same high-density and efficient footprint as the NetIron MLX.
DATA CENTER CONSOLIDATION WITH BROCADE

Consolidating data centers can yield significant cost savings and business flexibility. As a price-performance leader, Brocade offers a holistic solution for data center consolidation, enabling organizations to achieve their consolidation objectives and transform their data center infrastructure into a fully virtualized environment capable of supporting network convergence.

The Brocade DCX, NetIron MLX, and BigIron RX families combine breakthrough performance, high availability, scalability, and energy efficiency with long-term investment protection—enabling organizations to reduce the cost and complexity of consolidating their data centers. With high-performance, multi-service Brocade solutions, organizations can reduce the networking equipment required in the data center, resulting in a smaller overall footprint for connectivity devices, lower energy usage, simplified cabling, and fewer devices to configure, operate, and manage.

In today’s economy, it is critical that data centers facilitate current operations and provide the flexibility for future business growth. The Brocade portfolio of innovative networking solutions provides performance without compromise along with a future-proof investment, helping organizations benefit from decreased costs and increased business agility as they consolidate their data centers.

To learn more about Brocade solutions, visit www.brocade.com.