



## **SERVER CONNECTIVITY**

# **Extending Fabric Services from the Fabric to Servers with Brocade Fibre Channel (FC) Host Bus Adapters (HBAs)**

Providing server connectivity products is the next step in fulfilling Brocade's mission to deliver enterprise-class, end-to-end storage networking solutions. With the introduction of Brocade server connectivity solutions, Brocade is now extending fabric-based services to data center server platforms for dependable and high-performance storage access.

**BROCADE**

**CONTENTS**

**Introduction.....3**

**The Next-Generation Data Center.....3**

**Server Consolidation and Virtualization .....4**

**The Brocade Server Connectivity Solution .....5**

**Why Brocade.....5**

    High Performance and Scalability..... 5

    Virtualization Mobility and Awareness ..... 6

    Host- and Fabric-Level Support for Quality of Service (QoS) ..... 7

    Unified SAN Management ..... 8

**Summary .....9**

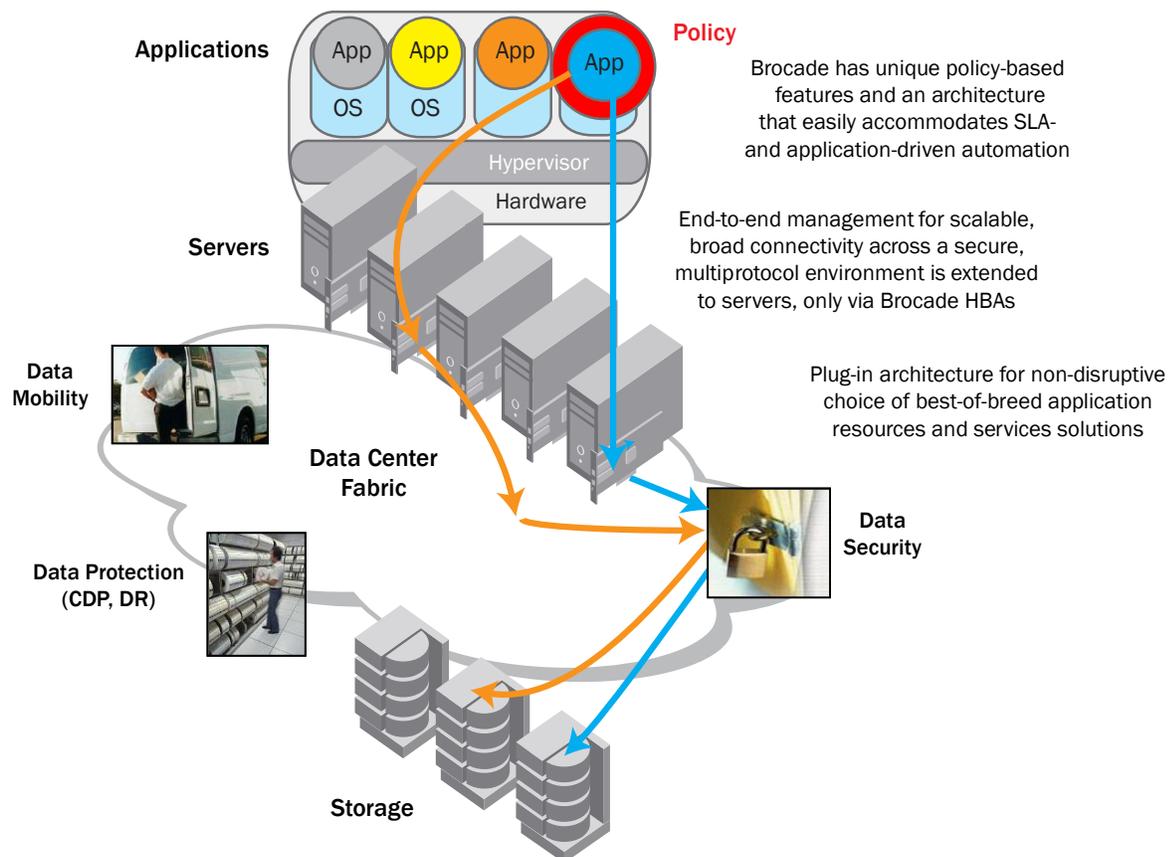
## INTRODUCTION

Brocade® has a vision of the next-generation data center with end-to-end, uniform alignment and management of virtualized components to meet the needs of a specific application, its data, and the connection between the two. This vision is being realized with the Brocade DCX® Backbone platform, Brocade 8 Gigabits per second (Gbps) switches, Brocade Fibre Channel (FC) Host Bus Adapters (HBAs) and Brocade Data Center Fabric Manager (DCFM™).

In response to the ongoing exponential growth of data, the proliferation of new Web applications, compliance to regulatory requirements, and the demands of global business operations, the data center is being transformed. In today's data center, virtualization technologies and concepts reside on the server, the network, and the storage—all components of the data center fabric—with each component in its own frame of reference. However, in the next-generation data center, end-to-end virtualization alignment is a key requirement to meet the need for applications map to customer business goals.

## THE NEXT-GENERATION DATA CENTER

Brocade's reputation in enterprise data centers is built on providing high-performance and high-availability storage data access, fabric extensibility and robustness, and streamlined fabric management. This track record is so well established that today the vast majority of global enterprise data centers rely on Brocade technology. These data centers are evolving from facilities that simply house conventional server and storage systems to much more sophisticated infrastructures that leverage both server and storage virtualization to streamline data operations and maximize use of physical resources.



**Figure 1.** The Brocade data center fabric

Brocade presents an innovative architecture (shown in Figure 1) that enables the seamless evolution of the data center for increased efficiency and reliability—with minimal disruption. Simply put, Brocade HBAs extend the intelligence and advanced fabric services of Brocade fabrics into the server. As a result, storage administrators can easily deploy and manage data services, such as virtualization and Quality of Service (QoS), end to end across the fabric from servers to storage.

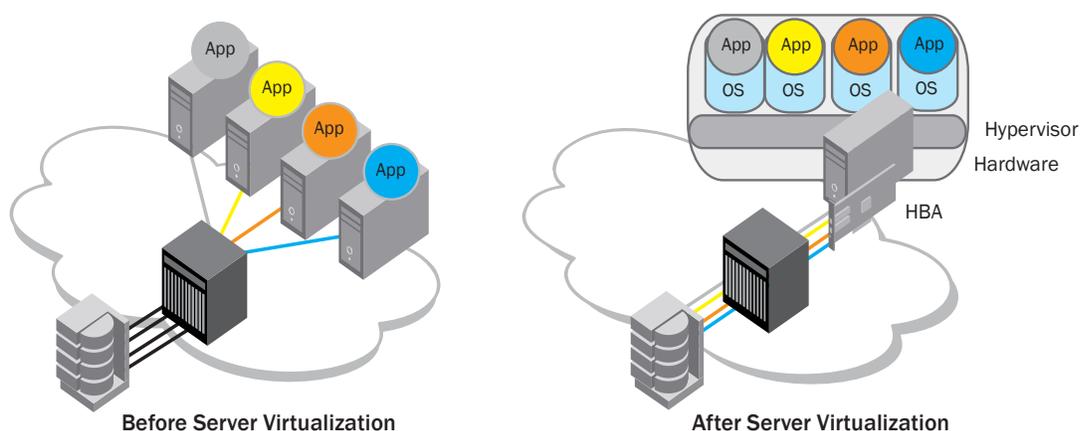
Brocade believes that next-generation data center will integrate products and services from many different vendors, and these components will work together to enable end-to-end virtualization from servers to storage. As you come to understand more about the Brocade server connectivity solutions, you will see that Brocade is a key component of the next-generation data center to provide these capabilities.

## SERVER CONSOLIDATION AND VIRTUALIZATION

In an effort to reduce cost and complexity in the data center, customers are looking for ways to make better use of their computing and networking resources. Server consolidation and virtualization have emerged as key initiatives for data center administrators towards meeting these objectives. Virtualization is transforming the traditional relationship between servers, storage, and fabric interconnect. For example, running a large number of Virtual Machines (VMs) on a single physical server dramatically increases the I/O load and mandates offloading as much I/O processing as possible. That way CPU cycles can be devoted more productively to application processing to achieve higher virtualization ratios.

In a non-virtualized environment, every application is tied to a physical server, which in turn is connected to a physical SAN switch port in a “static” manner. Applying network policies such as zoning or QoS—or monitoring application performance—is simple because the application is permanently associated with the physical port. With server virtualization, multiple applications reside in a physical server and share a physical SAN port. Furthermore, applications can move across the virtualized server infrastructure, based on a number of user-defined policies, to respond to dynamic business requirements. A virtualization-aware SAN infrastructure and server connectivity solution enables organizations to apply network policies at the VM level. These policies, part of the VM “profile,” will then be able to “follow” the application transparently as it moves to a new physical server, as shown in Figure 2.

As such, consolidation and virtualization are driving new connectivity requirements that legacy solutions are no longer able to meet, such as streamlined manageability, increased performance and I/O processing power, and virtualization awareness.



**Figure 2.** Servers in the data center fabric before and after server virtualization

## THE BROCADE SERVER CONNECTIVITY SOLUTION

The Brocade server connectivity solution is integral to the next-generation data center evolution. Brocade HBAs build upon five generations of the industry's most advanced Fibre Channel switching ASIC. They leverage the technology and expertise that have made Brocade the market leader in storage networking, extending them to the server.

At the same time, technical innovation of new storage networking services and capabilities is facilitated when both fabric and server connectivity components are brought under the same architectural umbrella. By introducing server connectivity solutions, Brocade can accelerate the development of new functionality that extends from the server interconnect to the storage port and optimizes our customers' applications and storage environments.

Leveraging the technology from our Fibre Channel switches, Brocade HBAs extend Adaptive Networking services such as QoS from the fabric and into the server. Leveraging Virtual Channel (VC) technology and N\_Port ID Virtualization (NPIV), Brocade HBAs are virtualization aware, and can extend these services with VM granularity.

## WHY BROCADE

Brocade has engineered and will continue to engineer capabilities to enable its end-to-end solutions in the data center fabric. The following sections describe and illustrate three focus areas of Brocade HBA capabilities. As you can see, most, if not all, of these features are unique to the Brocade family of HBAs and not available in competitor products.

### High Performance and Scalability

As explained earlier, server virtualization increases I/O demand: server consolidation enables aggregation of storage I/O. In virtual server environments, performance of applications under load becomes one of the key concerns for server administrators. Brocade HBAs can deliver the necessary performance to scale virtualized environments with greater confidence, resulting in better server resource utilization and decreased capital and operational costs.

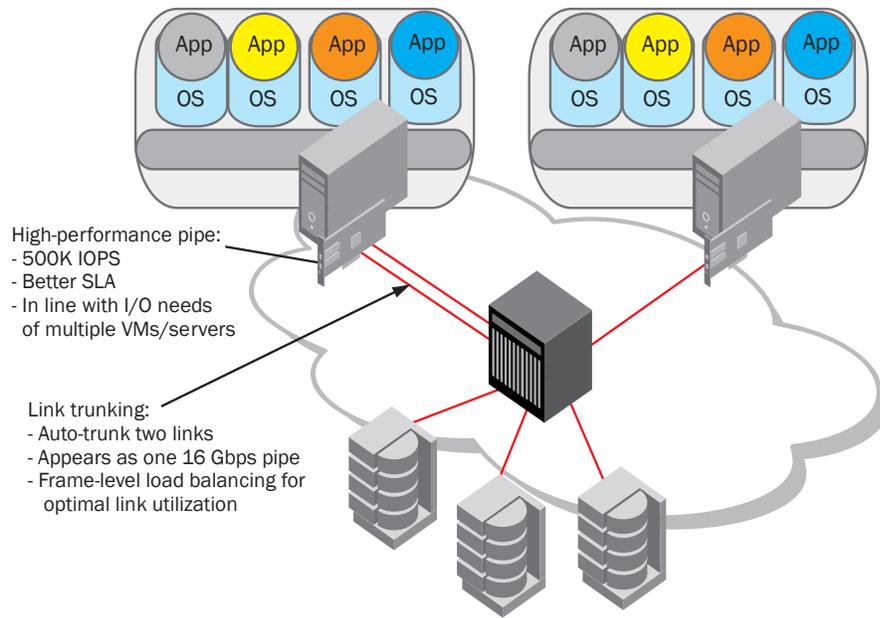
Doubling the bandwidth from 4 to 8 Gbps allows more data to travel down the pipe, without which consolidated server workloads may be constrained waiting for the I/Os to complete. 500,000 I/Os per Second (IOPS) per port provides the headroom to enable truly dynamic workload consolidation. This in turn allows IT managers to achieve operational load-balancing objectives, such as shutting down physical servers during periods of peak electrical cost and consolidating their applications onto fewer servers.

N\_Port Trunking <sup>1</sup> is an ASIC-based technology designed to enable a resilient pipe with frame-level load balancing. When enabled, N\_Port trunks are automatically negotiated at the hardware level with no driver overhead or user interaction. N\_Port Trunking takes this even further by allowing 2 x 8 Gbps ports on the HBA to be trunked together into a logical 16 Gbps pipe. Trunking 2 x 8 Gbps ports permits 3,200 Megabits per second (Mbps) data rates with up to 1 million IOPS of I/O processing, allowing servers to achieve even greater application consolidation.

Raw 8 Gbps bandwidth, however, is not the entire answer. Brocade HBAs also deliver significant I/O performance without sacrificing power and CPU utilization goals. The goal is to minimize the processing required in the host CPU by offloading I/O processing to the HBA and freeing up host CPU cycles.

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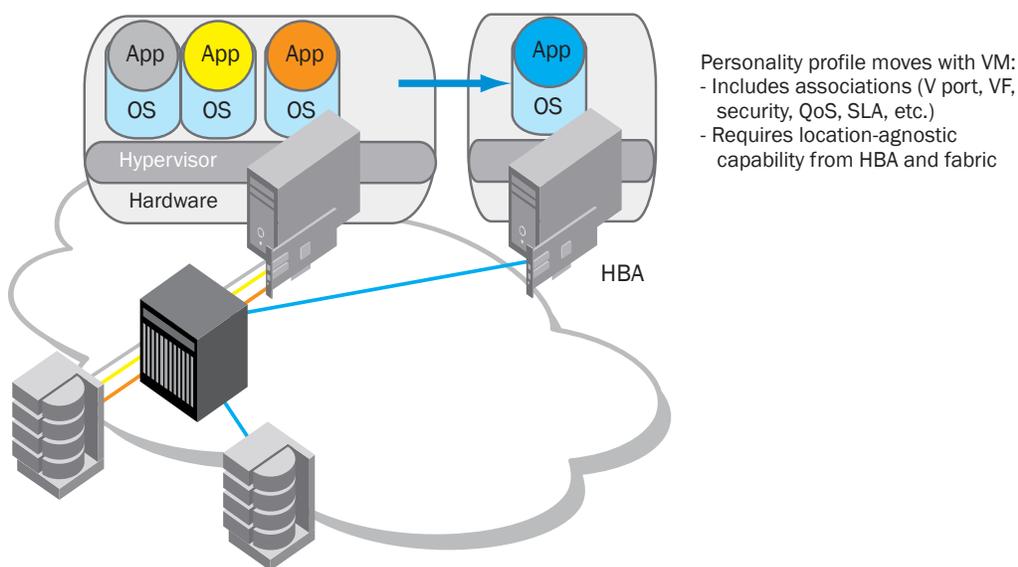
<sup>1</sup> Available in a future driver version



**Figure 3.** Brocade FC HBAs with superior I/O capability

**Virtualization Mobility and Awareness**

Today, server virtualization enables workload mobility. Just being able to migrate workloads between physical servers is not sufficient: the relationship to the storage must also be maintained. Brocade has made it much easier to fully utilize server mobility by providing the advanced fabric services to support our partners' mobility solutions. Visibility from both an HBA and switch point of view provides greater intelligence to virtualized solutions. For example, if a link is saturated, it can be recommended that the VM move to another physical server. This allows IT managers to use policies to define the profile of each workload link to storage and then rely on those service levels to be maintained through the fabric as VMs are migrated from one server to another, with their profiles (virtual ports, security, QoS, and SLA) consistently maintained, as shown in Figure 4. This means a more manageable and reliable virtualized environment.



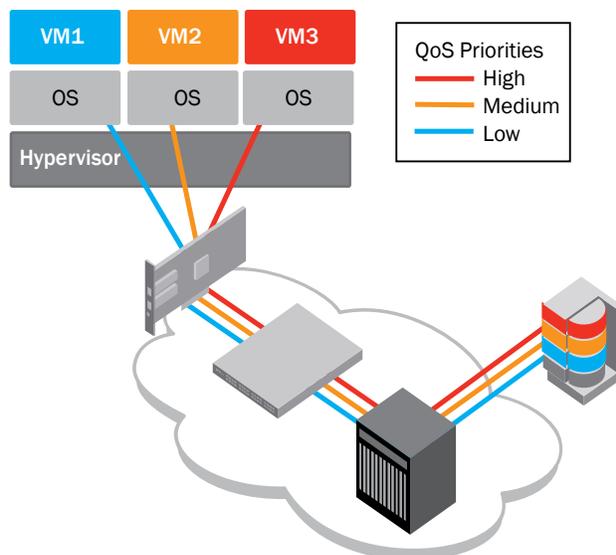
**Figure 4.** Virtualization mobility is a key component of server virtualization

Enabled by server virtualization and mobility, a fully dynamic data center allows workloads with different SLAs to co-exist on physical servers. While these workloads reside on the same physical server, the SLA makes sense only if workloads can be associated with QoS levels starting at the VM and enforced end to end through the fabric. ASIC-based Virtual Channel technology is used in Brocade HBAs and switches to define three priority levels for workloads. No matter where the workload lands, Brocade provides dynamic traffic flow prioritization to balance Business Continuity (BC) objectives, while delivering peak performance for high-transaction applications when they need it.

The results are automation, risk mitigation, and protection in environments in which SLAs must be maintained regardless of changing conditions. Truly dynamic operations can be enabled only with Brocade HBA Server Application Optimization (SAO). Brocade HBAs extend QoS in the data center from the fabric all the way to the workload footprint—a capability unique to Brocade.

### Host- and Fabric-Level Support for Quality of Service (QoS)

As shown in Figure 5, QoS priorities are assigned to each virtual workload and are reflected through the HBA to destination storage LUNs.



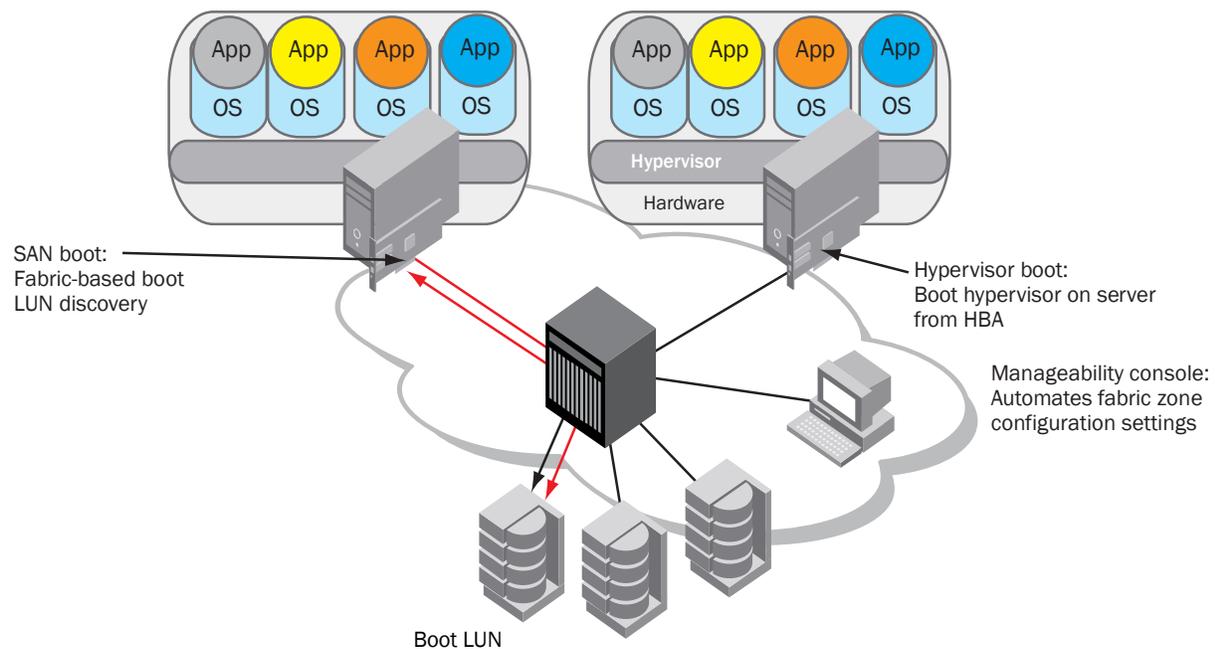
**Figure 5.** QoS priorities end to end in the data center

## Unified SAN Management

While virtualization has many benefits for IT organizations, it also adds a layer of management complexity by essentially “blocking” the application visibility from the network administrator. Without virtualization-aware manageability, the value of virtualization is severely diminished, and consolidation cost savings and efficiency improvements are lost. Brocade delivers the underlying technologies, protocols, and hardware for provisioning end-to-end features—supporting multiple protocols, technologies, and services through a unified management interface. Brocade DCFM provides unified manageability with a simple and easy-to-use interface to configure, monitor, and maintain server connectivity to the SAN.

In addition, Brocade DCFM restores application-level visibility in virtualized environments by integrating with industry-leading virtualization hypervisors to provide visibility from the VM all the way to the storage LUN. Coupled with NPIV, Brocade DCFM can also provide end-to-end performance statistics with VM granularity.

Brocade provides APIs to enable third-party policy-based management and orchestration functionality, so that end users do not have to give up their favorite tools when they move to high-performance, virtualized environments. This means that unified SAN management is enabled for Brocade’s partners and for their platforms, giving them the fabric visibility to differentiate their solutions, while IT managers can preserve the investment in their preferred management tools.



**Figure 6.** Centralized SAN management in the fabric

## SUMMARY

By extending expertise from the fabric to the server interconnect, Brocade can execute a more holistic approach to next-generation data center requirements. Vendors who supply only HBA products, for example, are not positioned to provide end-to-end management of the storage network and have control only over the capabilities of their own point product. For advanced services such as data migration, virtualization, QoS, Adaptive Networking, security, and data encryption, Brocade's comprehensive management of both fabric and HBA components enables much greater stability, unified management, and support. At the same time, technical innovation of new storage services and capabilities is facilitated when both fabric and server components are brought under the same architectural umbrella. By introducing server connectivity solutions, Brocade can accelerate the development of new functionality that extends from the server interconnect to the storage port and optimizes customer applications and storage environments.

Available through Brocade channel partners and OEMs, Brocade HBAs can be provisioned beside Brocade switch, director, and backbone products to create an integrated end-to-end managed SAN solution.

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