SERVER CONNECTIVITY

The Brocade Server Connectivity Advantage

Providing server connectivity products is the next logical step in fulfilling Brocade’s mission to deliver enterprise-class, end-to-end networking solutions. Brocade server connectivity solutions extend network services to data center server platforms for dependable and high-performance network access.
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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 any specific application, its data, and the connection between the two. This vision is being realized with the Brocade One™ architecture.

In response to the continued 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 enable organizations to deliver cloud IT architectures that meet application needs and map to their business goals.

In addition, as organizations strive to simplify network architectures and operations, they are looking at Data Center Bridging (DCB) and Fibre Channel over Ethernet (FCoE) as technologies that will enable them to reduce cost and complexity to more efficiently meet those 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 for their SAN infrastructure. 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.
Brocade presents an innovative architecture (see Figure 1) that enables the seamless evolution of the data center for increased efficiency and reliability—with minimal disruption. Brocade Host Bus Adapters (HBAs) extend the intelligence and advanced fabric services of Brocade FC fabrics into servers. 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 Converged Network Adapters (CNAs) enable server I/O consolidation to drastically simplify server deployments, while driving down Total Cost of Ownership (TCO) by delivering both CapEx and OpEx savings.

Brocade believes that the 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 how it 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 a better use of their computing and networking resources. Server consolidation and virtualization have emerged as key initiatives for data center administrators towards meeting their objectives in this area. Server I/O consolidation, through the use of CNAs, helps amplify these benefits by delivering further reductions in cost and complexity.

Virtualization is transforming the traditional relationship between servers, storage, and network. For example, running a high 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 and to achieve higher virtualization ratios.

In a non-virtualized environment, every application is tied to a physical server, which in turn connects to a physical SAN or LAN access layer 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 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 network infrastructure and server connectivity solution enables organizations to apply network policies at the VM level. Such policies will then be able to “follow” the application transparently as it moves to a new physical server. So 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](image-url). Servers in the data center fabric before and after server virtualization
THE BROCADE SERVER CONNECTIVITY SOLUTION

The Brocade server connectivity solution is an integral component of the Brocade portfolio. Brocade HBAs and CNAs build upon five generations of the industry's most advanced ASIC technology. 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 network 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, Brocade HBAs are virtualization-aware, and can extend these services with VM granularity.

Brocade CNAs are also ideal for virtualized environments, as they provide the performance necessary for the increased workload and they help overcome the adapter sprawl that is so common in virtualized environments by consolidating multiple 1 Gigabit Ethernet (GbE) Network Interface Cards (NICs) and FC HBAs into a single adapter. They also offload certain hypervisor switching functions to enhance performance and free up the CPU for additional application processing.

DIFFERENTIATION

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 and CNA capabilities. As you can see, these features are most, if not all, unique to the Brocade family of adapters and not available in competitors' products.

High Performance and Scalability

As explained earlier, server virtualization increases I/O demand: server consolidation leads to aggregation of network and storage I/O, which in turn leads to the proliferation of 1GbE NICs. In virtual server environments, performance of the applications under load is one of the key concerns for server administrators. Depending on the type of application, high bandwidth or high I/O processing capacity are key requirements.

Brocade 8 Gbps HBAs deliver up to 1,600 MB/sec (full-duplex) of throughput per port for high bandwidth demanding applications such as backup or video streaming. N_Port Trunking\(^1\) takes this even further by allowing two 8 Gbps ports on the HBA to be trunked together into a logical 16 Gbps pipe. Trunking two 8 Gbps ports enables 3,200 MBps data rates. N_Port Trunking 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. Brocade CNAs also support line-rate 10 Gbps performance per port to support high-bandwidth applications.

However, many enterprise applications, such as email or databases, are less bandwidth demanding and require a high I/O processing capacity at small block sizes. Leveraging the expertise in delivering the highest performing switching ASIC in the industry, Brocade HBAs and CNAs have unmatched I/O processing capabilities. With up to 500K I/Os per Second (IOPS) per port (up to 1M IOPS per dual port adapter), Brocade adapters are uniquely qualified to support high numbers of transactional workloads consolidated into a single physical server. In addition, Brocade CNAs offer customers choice in selecting the storage protocol that best fits their needs—FCoE or iSCSI over DCB or traditional 10 GbE.

\(^1\) Available in a future driver version
Ultimately, this means that businesses of all sizes can scale their virtual server deployments and virtualize high-demand, mission-critical applications with greater confidence, resulting in better server resource utilization and lower capital and operational costs. This also 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.

![Diagram of Brocade adapters with superior I/O capability](image)

**Figure 5.** Brocade adapters with superior I/O capability

**Virtualization Mobility and Awareness**

Today, server virtualization enables workload mobility. Just being able to migrate the workload between physical servers is not sufficient; the relationship to the network and storage must also be maintained. Brocade has made it much easier to fully utilize server mobility by providing the advanced fabric services to underpin our Partner mobility solutions. Visibility from both an adapter 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's link to the network, and then rely on those service levels to be maintained through the environment as VMs are migrated from one server to another, with their personality profiles (virtual ports, security, QoS, and SLA) consistently maintained. This means a more manageable and reliable virtualized environment.
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 only makes sense 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 fabrics to define three distinct priority levels. 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 Server Application Optimization (SAO). Brocade’s SAO extends QoS in the data center from the fabric all the way to the footsteps of the workloads—a capability unique to Brocade, and gives customers peace of mind when deploying mission critical applications in virtual environments.

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**Figure 6.** Virtualization mobility is a key component of server virtualization

**Figure 7.** QoS priorities for each virtual workload end to end in the data center
Brocade CNAs support the DCB set of standards that include Priority-based Flow Control (PFC) and Enhanced Transmission Selection (ETS). These protocols can be used to assign different levels of priorities to different types of traffic traversing the unified link between the server and the network, and to ensure that congestion for one type of traffic (traditional TCP/IP network traffic) will not affect other traffic (FCoE or iSCSI storage traffic).

**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 storage 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 to provision end-to-end features—supporting multiple protocols, technologies, and services through a unified management interface. Brocade Data Center Fabric Manager (DCFM) provides unified manageability with a simple and easy-to-use interface to configure, monitor, and maintain server connectivity resources across a data center from a centralized location.

In addition, Brocade DCFM restores the application level visibility in virtualized environments by integrating with industry leading virtualization hypervisors to provide end-to-end 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.

Finally, Brocade provides the 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 network visibility to differentiate their solutions, while IT managers can preserve the investment in their preferred management tools.

**Figure 9.** Centralized management in the fabric
CONCLUSION

By extending its expertise from the network to the server interconnect, Brocade is able to execute a much more holistic approach to next-generation data center requirements. Vendors who supply only adapter products, for example, are not positioned to provide end-to-end management of the network and have control only over their own point product functionality. For advanced services such as data migration, virtualization, Quality of Service, Adaptive Networking, security, and data encryption, Brocade’s comprehensive management of both fabric and adapter elements enables a much higher degree of stability, unified management, and support. At the same time, technical innovation of new network 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 thus accelerate the development of new functionality that extends from the server interconnect to the storage port and optimizes our customers’ applications and storage environments.

Available through Dell, Brocade HBAs and CNAs can be provisioned alongside Brocade switch, director and backbone products to create an integrated end-to-end managed solution.