



DATA CENTER FABRIC

Leveraging 8 Gbit/sec Fibre Channel End to End in the Data Center

The continuing expansion of data centers and the introduction of new technologies such as server and fabric virtualization are driving the need for higher storage networking performance and greater capabilities from the data center fabric. The new Brocade Fibre Channel (FC) switch family meets current and near-future storage networking needs by doubling the current standard FC speed of 4 Gbit/sec to 8 Gbit/sec. New Brocade 8 Gbit/sec Host Bus Adapters work in concert with Brocade 8 Gbit/sec fabrics to deliver high performance and advanced functionality end to end.

BROCADE

INTRODUCTION

In January 2008, Brocade® introduced 8 Gbit/sec capabilities for the Brocade 48000 Director and the new Brocade DCX Backbone platform. Brocade is expanding this leadership position with the introduction of an entire family of 8 Gbit/sec switch products targeting a range of data center environments—from the enterprise to Small and Medium Business (SMB). In addition Brocade is launching 8 Gbit/sec Host Bus Adapters (HBAs), providing the industry's first end-to-end 8 Gbit/sec solution for SMB to enterprise customers. These high-performance solutions are driven by a new family of Brocade 8Gbit/sec ASICs, which process and route data with much higher levels of efficiency. In addition to doubling performance throughput, these new ASICs offer new capabilities that align with growing data center requirements for IT process automation, energy efficiency, and reduced Operating Expenses (OpEx).

Steady increases in performance and functionality have been the hallmark of Fibre Channel evolution over the past decade. With the periodic doubling of transport speed from 1 to 2 Gbit/sec and from 2 to 4 Gbit/sec, storage administrators have quickly exploited the new performance capabilities and advanced features to build more optimized storage networks. With the introduction of Brocade 8 Gbit/sec switches and HBAs, it is now possible to fully integrate advanced functionality that extends from the fabric all the way to the server platform.

In trying to decide where enhanced performance and capabilities can be applied in your own environment, consider the following:

- **Storage Growth.** Storage Area Network (SAN) storage capacity has dramatically increased year over year in almost all data centers. As SAN storage grows, so do the fabrics that interconnect storage with servers.
- **Large Fabrics.** As fabrics grow, more Inter-Switch Links (ISLs) are used to keep pace with storage and server scaling.
- **Higher Levels of Performance.** In large-scale data centers, moving SAN bandwidth-intensive hosts to 8 Gbit/sec connectivity enables the servers to achieve higher levels of performance using fewer HBAs and a smaller cabling infrastructure.
- **Server Virtualization.** Hosting multiple operating system instances on a single host platform dramatically increases storage I/O demands, which in turn drives up host SAN throughput.
- **Tiered Services.** In a shared environment, in which IT may be using chargeback to serve internal customers, a tiered services model requires the ability to specify service levels for hosted applications and to monitor and manage these services end to end—all capabilities of Brocade 8 Gbit/sec solutions.
- **Backup.** Large amounts of traffic to tape or disk during backups require the fastest SAN speeds possible to fit within backup windows.
- **Operational Flexibility.** While not all hosts, storage, and ISLs currently require maximum speed capability, it is much easier to architect data center fabrics when high-speed ports are available.
- **Investment Protection.** Existing SANs can be significantly enhanced with new capabilities enabled by 8 Gbit/sec port speed. Integrated Routing and Adaptive Networking services are compatible with legacy SAN equipment, extending their Return on Investment (ROI) as data center fabrics scale.

Data centers may have some or all of these needs today. Although meeting these needs may not require an immediate upgrade to 8 Gbit/sec for all storage applications, future plans for expansion, virtualization, and fabric scaling will make acquiring 8 Gbit/sec capabilities today a safe and well-founded decision. As fabrics scale, for example, only half the number of ISLs is required with 8 Gbit/sec links than with 4 Gbit/sec links. Likewise, the ISL oversubscription ratio is halved by upgrading from 4 to 8 Gbit/sec ISLs, using the same number of links.

At long distances, 8 Gbit/sec can earn a very fast ROI compared to 4 Gbit/sec, due to the high cost of dark fiber or WDM links. Almost all of these native FC extension links support 8 Gbit/sec speeds, so utilization can be doubled on links that usually cost thousands, if not tens of thousands, of dollars per month. This can quickly justify the equipment cost for the increased speed capability.

Building a high-performance foundation that provides the flexibility to selectively deploy 8 Gbit/sec as needed simplifies data center fabric management and accommodates the inevitable growth in applications and data over time.

EVOLVING DATA CENTER VIRTUALIZATION

Virtualization of server platforms can dramatically increase the need for higher-speed capability in the SAN. Some virtualized hosts have 10, 20, or even 30 operating systems, which can exceed the capacity of a 4 Gbit/sec HBA. Brocade's 8 Gbit/sec end-to-end solutions can prevent this saturation and increase the ROI on server hardware and virtualization software investments.

Brocade recognizes these three phases for evolving virtualization in the data center:

- **Phase 1.** The primary business driver for this phase is the reduction of Capital Expenditures (CapEx), as a result of server consolidation and flexible test and development.
- **Phase 2.** The challenge for Phase 2 is characterized by growth and deployment of Disaster Recovery (DR) solutions and the need for high availability and automated server provisioning. The primary business drivers are reduction of OpEx and the requirement for Business Continuity (BC). Here are some typical use cases:
 - Automated server provisioning and applications deployment using pre-built Virtual Machine (VM) "templates"
 - Data center architectures and products that provide High Availability (HA) and no interruption of service during server maintenance or failure
 - Storage replication and automated restoration of service to support DR goals
- **Phase 3.** We are now moving into this phase, in which business drivers are flexible IT, variable cost, and further OpEx reductions. Phase 3 will provide data centers with policy-driven utility computing, service-level management, and end-to-end service provisioning.

Virtualization has fundamentally transformed the traditional relationship between servers, storage, and the fabric interconnect. Running many VMs on a single server hardware platform can dramatically increase the requisite Input/Output (I/O) load and mandate offloading as much I/O processing as possible, so that CPU cycles can be devoted more productively to application processing. Fully leveraging server virtualization therefore requires more powerful, high-performance storage adapters, as illustrated in Figure 1.

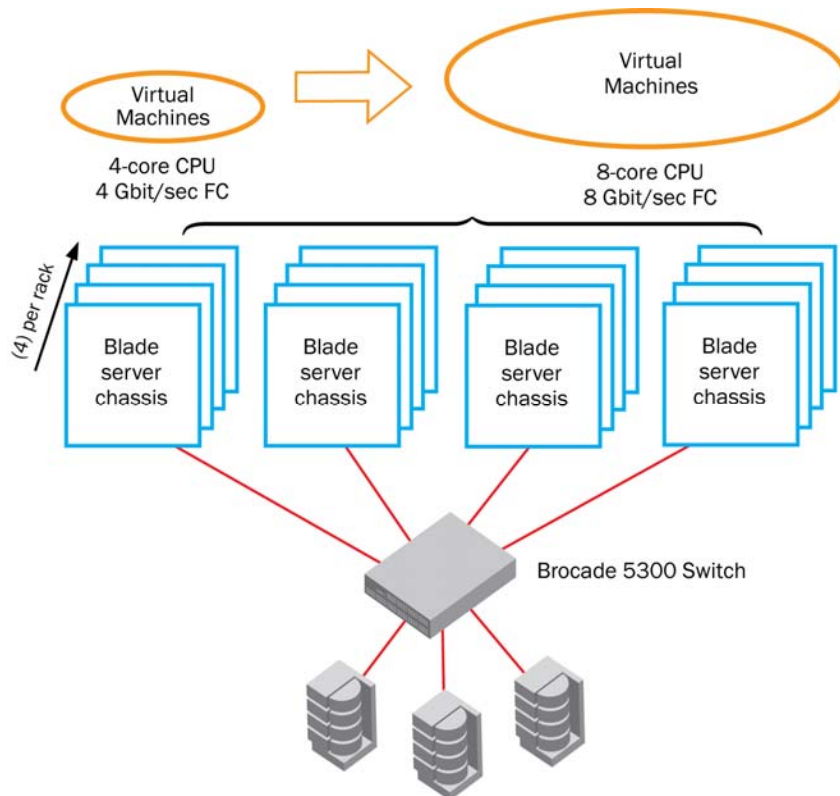


Figure 1. Scaling virtual servers with the Brocade 8 Gbit/sec technology

Brocade's new family of 8 Gbit/sec switches supports the rapidly growing data center by delivering 8 Gbit/sec performance on every port with no oversubscription. A completely non-oversubscribed switching architecture enhances server scalability by enabling the rapid growth of virtual servers without compromising data center performance.

Integrated Routing (IR) fabric service is a new option on the Brocade DCX Backbone and Brocade 5300 and 5100 Switches with the release of Fabric OS® (FOS) 6.1. As of FOS 6.1, IR can be activated on FC8 port blades with up to 128 IR ports per Brocade DCX chassis. (When there are two Brocade DCX chassis connected via Inter-Chassis Links, a total of 256 IR ports are available.) No additional hardware is required to enable per-port Fibre Channel Routing; only an optional IR software license is required. IR can be enabled on the maximum number of ports on the Brocade 5300 (80 ports) and Brocade 5100 (40 ports) via user configuration.

Brocade 8 Gbit/sec HBA ASICs support a maximum of 500k I/O per Second (IOPS) per port (>1M IOPS on a dual-port HBA) to free up the host processors and meet virtualization productivity goals. In the future, two 8 Gbit/sec HBA ports will be able to be combined into a single, ultra-high-speed 16 Gbit/sec connection using Brocade ISL Trunking technology, which balances traffic flows at the frame level. Currently, the benefits of Brocade 8 Gbit/sec switching technology are extended directly to VMs via N_Port ID Virtualization (NPIV), so that special Brocade features, such as Top Talkers and QoS Traffic Prioritization, can be applied to individual VMs. *This end-to-end fabric and host integration is unique to Brocade and offers the industry's highest I/O performance for virtualized environments.*

Brocade 8 Gbit/sec HBAs complement industry-leading performance with advanced storage functionality to further streamline virtualized server operations. To meet regulatory compliance requirements, for example, Brocade 8 Gbit/sec HBAs implement the industry standard Fibre Channel Security Protocol (FC-SP) and will support in-flight data encryption for secure network transactions.

In addition, the new Brocade fabric service, Adaptive Networking, provides configurable Quality of Service (QoS) for each VM. With the increasing use of VM mobility to shift application workloads from one hardware platform to another, conventional networking methods are no longer sufficient. Brocade meets the needs of more dynamic virtualized environments by providing an integrated fabric and HBA solution that can selectively deploy security and QoS to VM-hosted applications as required, as shown in Figure 2.

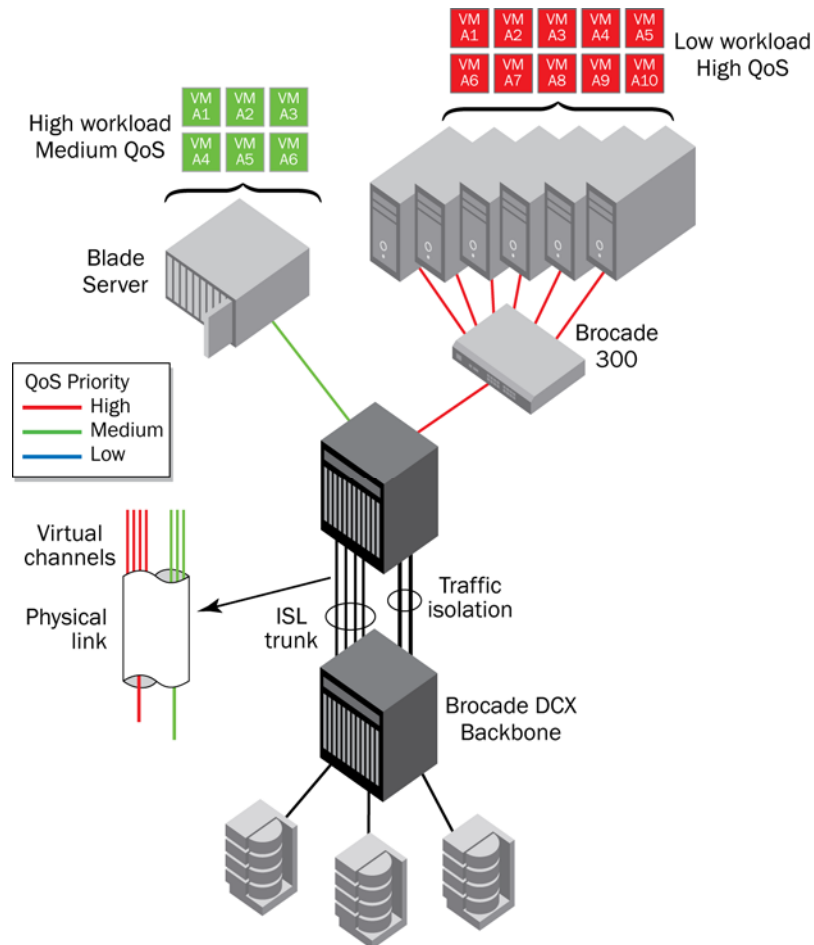


Figure 2. Brocade Adaptive Networking fabric services optimize VM traffic

Brocade 8 Gbit/sec Products

The Brocade DCX Backbone, Brocade's first 8 Gbit/sec platform, with 16-, 32-, and 48-port blades, was released in early 2008. In May 2008, Brocade completed the transition to 8 Gbit/sec with the release of Fabric OS 6.1 and a full family of new switches and HBAs for end-to-end connectivity in the data center:

- Brocade 815 (single port) and 825 (dual port) HBAs
- Brocade 300 Switch with 8, 16, and 24 ports
- Brocade 5100 Switch with 24, 32, and 40 ports
- Brocade 5300 Switch with 48, 64, and 80 ports
- FC8-16, FC8-32, and FC8-48 port blades for the Brocade 48000 Director

Brocade 8 Gbit/sec switches comply with industry standards; and fabrics with 4 and 8 Gbit/sec devices interoperate seamlessly. Visit the Brocade Web site for data sheets describing these products: www.brocade.com

CONCLUSION

Speed increase in Brocade switching platforms is one of many advantages from Brocade's next generation ASIC family. Higher speed in the data center brings the immediate benefit of higher-performing ISLs and increased scalability; since ISL performance is doubled, more ports can be used for servers and storage. In addition, 8 Gbit/sec is needed for server virtualization, scaling of fabrics, backups, and high-performance computing requirements. New capabilities, such as Adaptive Networking and Integrated Routing, plus the enhanced power efficiencies of the new switch platforms are also important drivers for adoption of 8 Gbit/sec technology. Every data center user has or will have these needs in the future, and as data center plans are developed, Brocade's integrated end-to-end 8 Gbit/sec solution provides the broadest choice of capabilities with the highest performance and efficiency.

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