



8Gb Fibre Channel Scalability Advantage in VMware[®] vSphere[™] 4

QLogic 8Gb Adapter Outperforms Brocade[®]

QLogic Offers Best Performance and Scalability in vSphere 4 Environments



Executive Summary

Server consolidation through virtualization of the enterprise data center improves server/processor utilization and lowers data center capital and operational costs. IT administrators must ensure that none of the subsystems become a bottleneck for successful deployment of a virtualized and consolidated data center. The evolution of consolidated server deployments and the move to 8Gb Fibre Channel infrastructure requires higher scalability when connecting servers to storage. To meet the growing demands of consolidated and virtualized environments, enterprise IT administrators must deploy a scalable, high-performance adapter architecture that can address the demands placed by multiple virtual machines (VMs) or guest operating systems, as well as applications, in virtualized environments running simultaneously on a single physical server.

To help IT administrators make the best, most informed adapter choice, QLogic performed a series of head-to-head performance benchmarks showing the I/O performance and scalability advantages of the QLogic 2500 Series 8Gb Fibre Channel Adapter over the Brocade 8Gb Fibre Channel Adapter. QLogic compared the overall performance of these 8Gb adapters when attached to an industry-leading, solid-state storage array to emulate real-world vSphere 4 environments.

Key Findings

The QLogic and Brocade 8Gb Fibre Channel Adapters were tested with the most current software and firmware available, in a test environment that enabled an unconstrained assessment of IOPS, throughput performance, and scalability in a vSphere 4 environment. The test results showed that:

- **The QLogic 2500 Series 8Gb Fibre Channel Adapters offers up to 36 percent higher IOPS and up to 8 percent higher throughput compared to the Brocade 8Gb Fibre Channel Adapter.**
 - **Sequential Read Operations: QLogic 2500 Series Adapter IOPS is up to 36 percent higher than Brocade.**
 - **Sequential Write Operations: QLogic 2500 Series Adapter IOPS is up to 35.7 percent higher than Brocade.**
 - **Sequential Read/Write Operations: QLogic 2500 Series Adapter IOPS is up to 35.4 percent higher than Brocade. Throughput is higher by up to 8 percent.**
- **Virtual Machine Scalability: The QLogic 2500 Series Adapter scales by up to 79.3 percent more than Brocade.**

VMware Micro-Benchmark and VMware Scalability Performance

Configuration

The IOmeter tool benchmarked the QLogic 2500 Series 8Gb Fibre Channel Adapter against the Brocade 8Gb Fibre Channel Adapter in an exchange environment with minimum subsystem latency.

The IOmeter test setup (Figure 1) consisted of the latest 8Gb adapters from QLogic and Brocade, running on current, commercially-available drivers installed in an Intel® Tylersburg two quad core (eight cores total) server running vSphere 4. The Intel Tylersburg server was connected to a Texas Memory Systems™ RamSan®-325 (with 32GB total capacity) through a Brocade® 300 Series 8Gb switch. Using a solid state disk removed the latency introduced by a slower mechanical disk, and provided the performance benchmark expected from next-generation storage arrays.

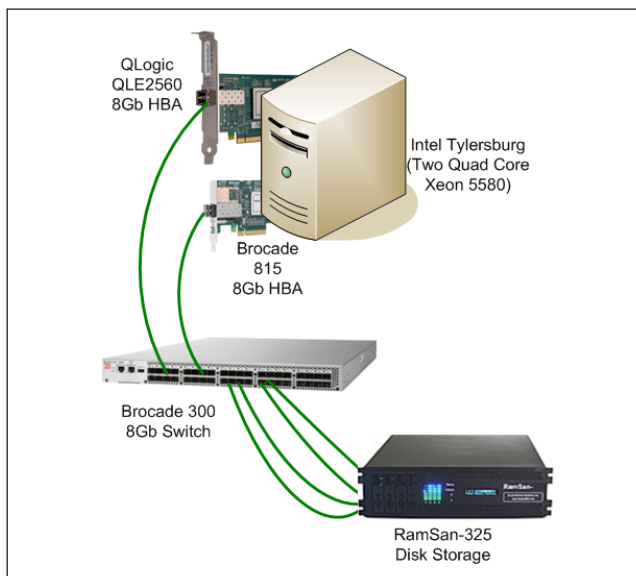


Figure 1. IOmeter Test Setup for Micro-Benchmark

One initiator and four target RamSan ports were configured in a zone to the 8Gb Brocade 300 Fibre Channel switch. Four LUNs on four target ports were configured for micro-benchmark. Eight LUNs (one LUN per VM) were configured for the scalability benchmark. Tests were performed to compare I/O performance of the QLogic and Brocade 8Gb Fibre Channel Adapters in a vSphere 4 virtualized environment with Windows Server® 2008 R2 as a guest operating system. IOmeter measured the IOPS and throughput values across a range of block sizes.

All measurements were made with out-of-the-box settings for the adapters from both companies, using the latest commercially available hardware and software.

Test Procedure

The tests were executed on the configuration shown in Figure 1 as follows:

1. A QLogic 8Gb single-channel PCI Express to Fibre Channel Adapter (QLE2560) was installed on the test server using the vSphere 4 drivers.
2. Work loads were created separately across a range of block sizes. Four LUNs were created and mapped to four target ports.
3. Tests were run for one minute on this setup.
4. These steps were repeated for the Brocade 8Gb single-channel PCI Express to Fibre Channel Adapter (815).

Test Results

The test results indicated superior performance by the QLogic QLE2560 adapter over the Brocade 815 adapter. The following graphs compare the QLogic and Brocade 8Gb adapter IOPS while performing sequential read, write, and read/write operations.

The tests show that the QLogic QLE2560 adapter has a performance advantage over the Brocade 815 adapter, especially at smaller block sizes supporting enterprise applications.

Sequential Read Operations

IOPS

At block sizes below 8KB, the QLogic QLE2560 adapter's sequential read IOPS was up to 36 percent higher than the Brocade 815 adapter's IOPS, as shown in Figure 2.

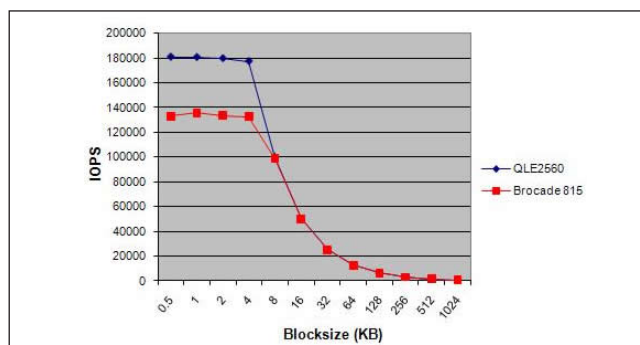


Figure 2. Sequential Read IOPS

Throughput

At block sizes above 8KB, the QLogic QLE2560 adapter and the Brocade 815 adapter were at parity.

Sequential Write Operations

IOPS

At block sizes below 8KB, the QLogic QLE2560 adapter's sequential write IOPS was up to 35.7 percent better than the Brocade 815 adapter's IOPS, as shown in Figure 3.

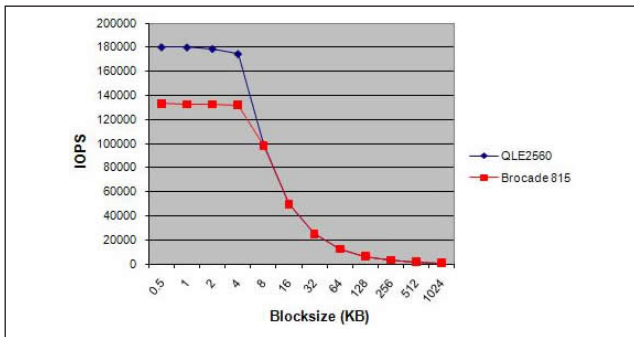


Figure 3. Sequential Write IOPS

Throughput

At block sizes above 8KB, the QLogic QLE2560 adapter and the Brocade 815 adapter were at parity.

Sequential Read/Write Operations

IOPS

At block sizes below 8KB, the QLogic QLE2560 adapter's sequential read/write IOPS was up to 35.4 percent better than the Brocade 815 adapter's IOPS, as shown in Figure 4.

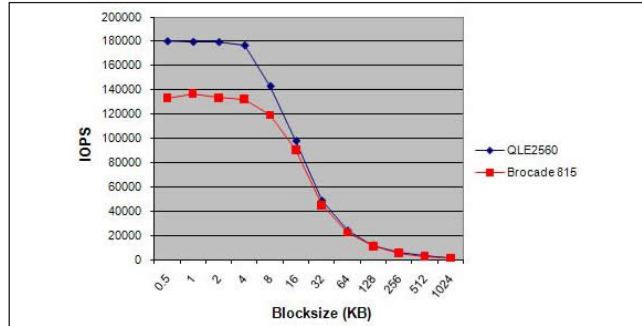


Figure 4. Sequential Read/Write IOPS

Throughput

At block sizes above 8KB, the QLogic QLE2560 adapter achieved up to 8 percent higher sequential read/write throughput than the Brocade 815 adapter.

Virtual Machine Scalability

QLogic 2500 Series 8Gb Fibre Channel Adapters meet the demand of today's data center (represented in this section of the white paper as *virtual server workload*). In vSphere 4 environments, the I/O performance is dependent on the workload generated by the VMs on a given ESX host. The vSphere 4 environment does not limit the number of VMs that can be hosted on a single physical server. For the purposes of this performance benchmark, QLogic implemented a configuration where the number of VMs (based on the workload generated) scaled from one to eight. The following figures illustrate how the QLogic 2500 Series 8Gb Fibre Channel Adapter performance scaled higher than Brocade as the number of VMs increase from one to eight.

- **Read IOPS Scalability at 512 Block Size.** As illustrated in Figure 5, QLogic scaled better than Brocade when going from one to eight VMs. QLogic scaled 60.7 percent more at four VMs and 79.3 percent more at eight VMs compared to the Brocade 815 adapter.

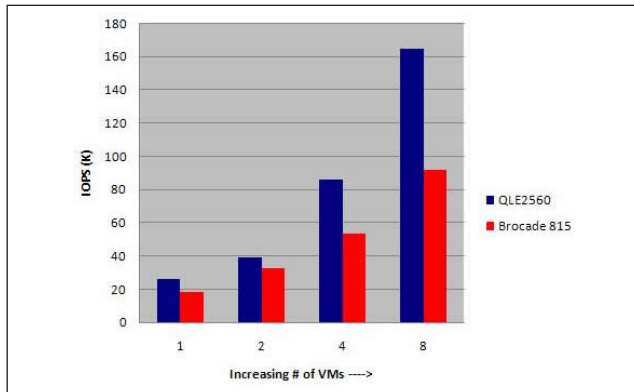


Figure 5. Scalability of Read Performance

- **Write IOPS Scalability at 512 Block Size.** As illustrated in Figure 6, QLogic scaled better than Brocade when going from one to eight VMs. QLogic scaled 39.8 percent more at four VMs and 70.3 percent more at eight VMs compared to the Brocade 815 adapter.

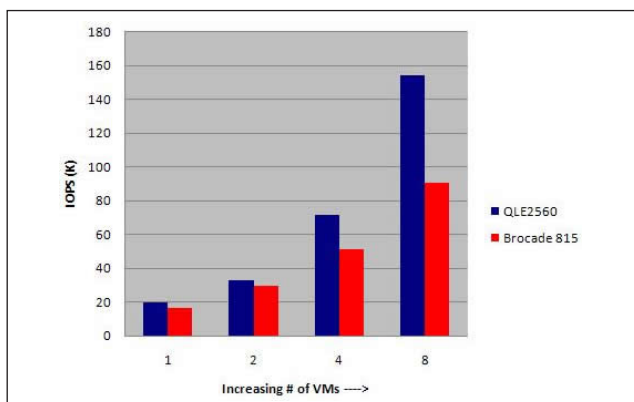


Figure 6. Scalability of Write Performance

The QLogic 2500 Series 8Gb Fibre Channel Adapter continues to provide scalability and performance as demonstrated in the aforementioned benchmarks. IOmeter was configured to place the maximum possible load on the QLogic and Brocade 8Gb adapters in the vSphere 4 environment. As customers purchase 8Gb adapters and integrate them into 8Gb SANs and infrastructure, they expect optimum throughput and IOPS, as demonstrated by the QLogic 2500 Series 8Gb Fibre Channel Adapter.

Summary and Conclusion

QLogic continues to be the industry leader in delivering high-performance I/O solutions to data center customers. The IOPS and throughput of the QLogic 2500 Series 8Gb Fibre Channel Adapter are best-in-class and provide an unprecedented level of high performance, superior scalability, and enhanced reliability that exceed the requirements for next-generation data centers. The results of the benchmark tests shown in this paper demonstrate the I/O performance and scalability advantages of the QLogic 2500 Series 8Gb Fibre Channel Adapter over the Brocade 8Gb Fibre Channel Adapter in vSphere 4 virtualized environments.

Virtualization is an important element of today's enterprise data centers. A majority of today's virtualization deployments are based on software hypervisor-based solutions. Despite the benefits of these solutions, challenges remain with respect to I/O performance and system reliability. QLogic adapters support server virtualization platforms from VMware, Microsoft®, and Linux®. The QLogic 2500 Series 8Gb Fibre Channel Adapter technology provides extensive support and experience in server and adapter virtualization technology, making QLogic the clear choice to support 8Gb Fibre Channel in virtualization environments.

Appendix A

Server Configuration

Intel Server	
Processor type and speed	Intel Tylersburg: dual socket, quad core, total of eight cores
Memory	12GB RAM
OS type	VMware vSphere 4
Version	ESX 4.0
Guest OS	Windows Server 2008 R2

Fibre Channel Adapter Hardware

Fibre Channel Adapters	
QLogic	QLE2560
Brocade	815

Fibre Channel Adapter Configuration

QLogic and Brocade Fibre Channel Adapters	
QLogic driver	831.k1.23vmw
Brocade driver	2.1.0.0

External Storage Configuration

Storage	
Solid state disk	RamSan-325 solid state storage
LUNs	Four LUNs, four target ports for micro-benchmark Eight LUNs, eight target ports for scalability

Fibre Channel Switch Hardware

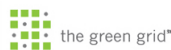
Switch	
8Gb switch	Brocade 300

Disclaimer

Reasonable efforts have been made to ensure the validity and accuracy of these performance tests. QLogic Corporation is not liable for any error in this published white paper or the results thereof. Variation in results may be a result of change in configuration or in the environment. QLogic specifically disclaims any warranty, expressed or implied, relating to the test results and their accuracy, analysis, completeness or quality.



Corporate Headquarters QLogic Corporation 26650 Aliso Viejo Parkway Aliso Viejo, CA 92656 949.389.6000 www.qlogic.com
Europe Headquarters QLogic (UK) LTD. Quatro House Lyon Way, Frimley Camberley Surrey, GU16 7ER UK +44 (0) 1276 804 670



© 2010 QLogic Corporation. Specifications are subject to change without notice. All rights reserved worldwide. QLogic and the QLogic logo are registered trademarks of QLogic Corporation. Brocade is a registered trademark of Brocade Communications Systems, Inc. VMware and vSphere are trademarks or registered trademarks of VMware, Inc. IDC is a registered trademark of International Data Group. Microsoft and Windows Server are registered trademarks of Microsoft Corporation. RamSan and Texas Memory Systems are trademarks or registered trademarks of Texas Memory Systems, Inc. Dell is a registered trademark of Dell Inc. Linux is a registered trademark of Linus Torvalds. All other brand and product names are trademarks or registered trademarks of their respective owners. Information supplied by QLogic Corporation is believed to be accurate and reliable. QLogic Corporation assumes no responsibility for any errors in this brochure. QLogic Corporation reserves the right, without notice, to make changes in product design or specifications.