Increasing FC HBA Ports in Virtualized Servers Accelerates Application Performance

Enabling Denser Server Consolidation in VMware® Environments

Reduces Total Cost of Ownership

Executive Summary

Server consolidation is the primary reason for enterprise data centers to deploy server virtualization technologies. As more virtual servers are consolidated onto a single physical server, there is an increased demand on the scalability and performance of the server CPU, memory, host bus interfaces, and I/O subsystems storage networking. IT managers must ensure that none of these subsystems become a bottleneck for successful deployment of a virtualized and consolidated data center.

Introduction of 64-bit, multi-core processors; PCI Express host bus; and improved memory architectures have greatly benefited server consolidation and its rapid adoption in the virtualized data center. Processor vendors and server OEMs have demonstrated that scaling from a dual-core to a quad-core processor, adding additional memory, and moving to a faster host bus results in a higher degree of server consolidation in virtualized environments. **It is imperative that enterprise IT managers deploy a scalable, high performance Host Bus Adapter (HBA) architecture; this HBA architecture must be able to address the demands of multiple Virtual Machines (VMs) and applications running simultaneously on a single physical server with multiple CPUs.**

This paper explores best practices for accelerating the levels of server consolidation, especially in blade servers like the IBM BladeCenter® and HP BladeSystem, specifically as it relates to Fibre Channel (FC) HBAs. Tests were run in a multiple-VM environment to determine the following:

- Impact of additional HBA ports on application performance in virtualized environments

To help IT managers make an informed HBA choice for virtualized environments using VMware® ESX Server, this paper presents configuration recommendations and benchmarks.

Key Findings
- QLogic HBAs lower the total cost of ownership in virtualized environments.
- Virtualized servers need more FC HBA ports.
  - Additional ports triple throughput in VMware environments.
- Virtualized servers require half the number of QLogic HBAs (compared to number of HBAs of its competitor) to drive the same amount of application workload.
  - Two ports of QLogic HBAs deliver 68 percent higher application throughput than four ports of Emulex® HBAs.
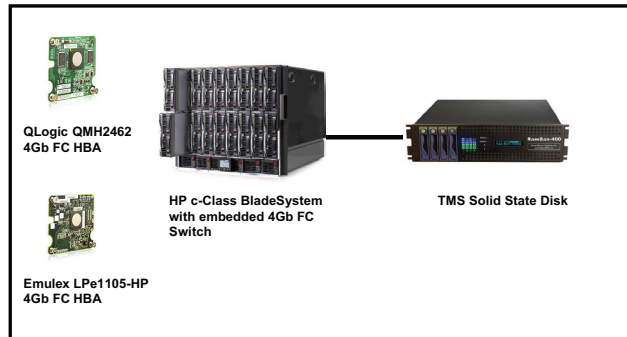
Overview

The objective of the performance benchmark was to compare the I/O performance of QLogic® and Emulex® 4Gb Fibre Channel HBAs while scaling the number of physical HBA ports in a single blade running VMware ESX Server.

The goal of the performance testing was to measure:

- **Impact of additional HBA ports on application performance in virtualized environments**
  - Measured throughput for HBAs for 1, 2, and 4 physical HBA ports installed on the same physical server.

Test Setup

The test setup consisted of the latest QLogic QMH2462 and Emulex LPe1105-HP series HBAs running with the default HBA drivers provided with VMware ESX Server. The HBAs were installed in an HP c-Class BladeSystem running VMware ESX Server 3.0.1. More details on the test setup can be found in Appendix A. All tests were run using the HBA default settings from both companies.

QLogic QMH2462
4Gb FC HBA

HP c-Class BladeSystem
with embedded 4Gb FC
Switch

TMS Solid State Disk

Emulex LPe1105-HP
4Gb FC HBA

Impact of Additional HBA Ports on Application Performance in Virtualized Environments

Testing demonstrated the following results:

- **QLogic FC HBAs continued to drive scalable wire speed throughput** as the number of HBA ports were increased from 1 to 2 to 4 from the same physical server.

- **A 300-percent increase in throughput was observed with the addition of three HBA ports.**

With the assurance of QLogic HBA's ability to scale at wire-speed and deliver the highest application performance, IT managers can now plan higher levels of SAN workload consolidation on the same physical server simply by deploying additional HBA ports.
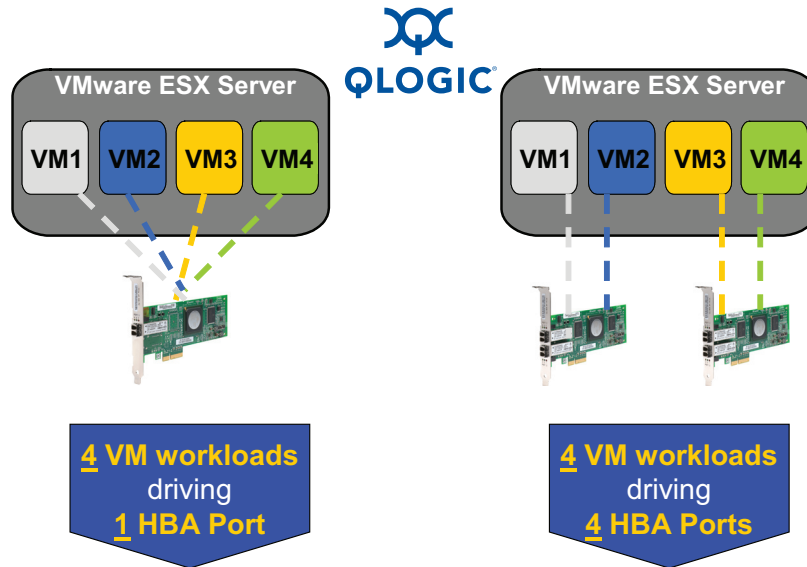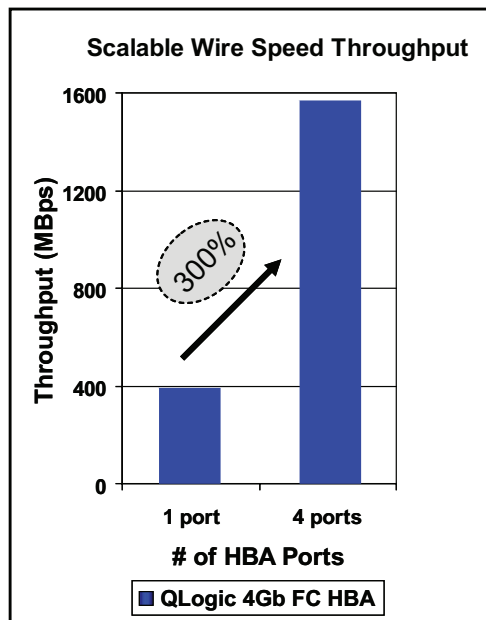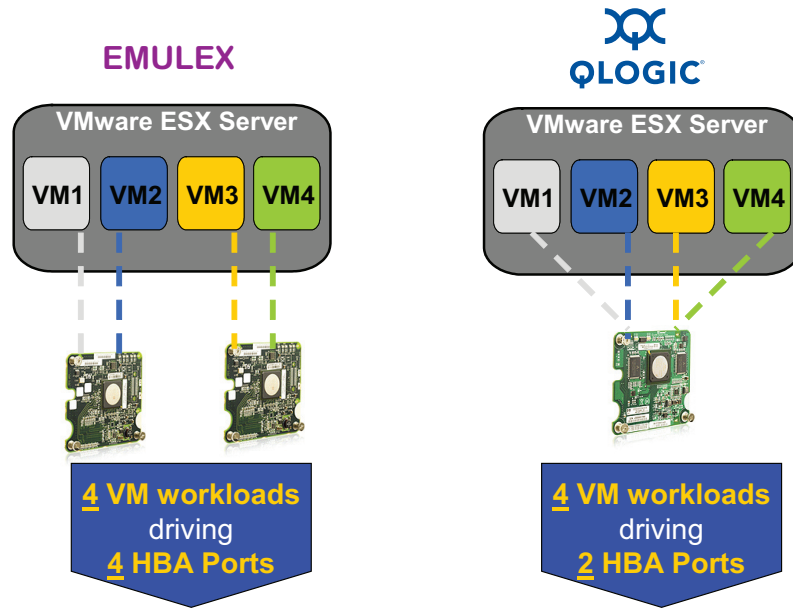
Enabling Denser Server Consolidation in VMware Environments **Reduces Total Cost of Ownership**
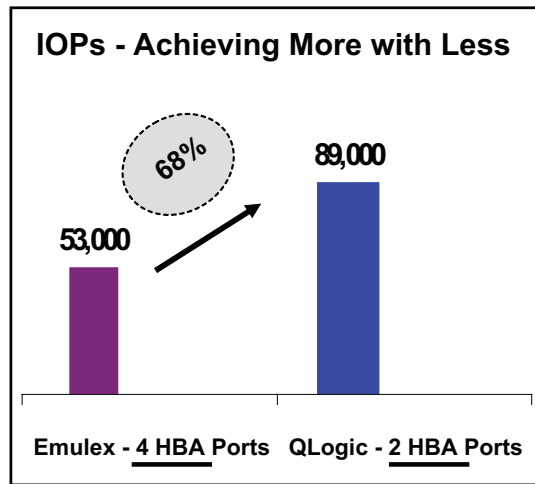
Comparison of HBA Port Performance Scalability

The ability of Emulex and QLogic HBAs to handle workloads generated from VMs on a per-port basis was also tested.

The test results are shown in the following figures.

Summary and Conclusion

The key findings from the various benchmarks performed are described in the following paragraphs.

To enable higher levels of server consolidation from the same physical server, without compromising on application performance, IT managers should:

- Add additional QLogic HBAs and spread the VM workload across the HBA ports, resulting in a three-fold increase in throughput and improved application performance.

As demonstrated in benchmarks between the QLogic SANblade® 2400 series and Emulex LightPulse™ 11000 series 4Gb FC HBAs in VMware ESX Server 3.0.1 environments, IT managers should:

- Standardize the deployment of QLogic 4Gb FC HBAs in virtualized environments, which reduces the total cost of ownership by over 50 percent.

Using QLogic 4Gb HBAs translates to a clear performance benefit, enabling enterprises to do more with less and obtain more value from the SAN infrastructure investments through enhanced levels of server consolidation.

In summary, deploying QLogic FC HBAs in VMware environments helps:

- Lower operational costs (power, cooling, and space)
- Lower software licensing, provisioning, and maintenance costs
- Deliver higher Service Level Agreements (SLAs)

Appendix A

Server Configuration

Intel Server	
Type and Speed of Processor	2 Quad Core Intel Xeons @ 2.66 GHz
Memory	32GB SDRAM
Operating System (OS)	VMware ESX Server 3.0.1 and Microsoft Windows Server 2003 Enterprise Server SP1 (guest OS)
System Model	HP c-Class BladeSystem

FC HBA Hardware

FC HBAs	
QLogic	QMH2462 – 4Gb dual-port FC HBA
Emulex	LPe1105-HP – 4Gb dual-port FC HBA

Drivers

VMWare ESX Server
VMware ESX Server 3.0.1 drivers (inbox) for QLogic and Emulex 4Gb FC HBAs

VM Configuration

Windows Server 2003 Virtual Machine	
Operating System	Windows Server 2003 Enterprise Server SP1
CPU	2 virtual CPUs
Memory	3.75GB SDRAM
LUN Capacity	500MB RDM
Iometer Configuration	2 workers, 2 physical disks, 12 I/Os outstanding

Switch Configuration

Switch Configuration	
Switch	Brocade® Embedded 4Gb FC and HP 4Gb FC Pass-thru Module
Total Number/Speed of Ports	16/4Gb
Firmware Version	V5.0.1.10

Storage Configuration

RamSan Storage	
Model	RamSan 400
Total Storage Capacity	32GB
Number of Ports Used	1/2/4 Ports

Disclaimer

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