QLogic Fibre Channel Advantages in Microsoft Hyper-V Environments

QLogic Adapters Outperform Emulex, Providing Reduced CAPEX and OPEX

QLogic 16Gb Gen 5 Fibre Channel Adapters from Cavium deliver scalable performance for high-density virtualized environments.

KEY FINDINGS

QLogic® 16Gb Gen 5 Fibre Channel adapters from Cavium™ deliver superior scalability for Microsoft Hyper-V environments. Extensive testing showed that for virtual machine scalability:

- QLogic 2600 Series Adapters outperform the Emulex LPe16000 Series in small block transactions—server capital expenditures (CAPEX) reduced as much as 14 percent.

- QLogic 2600 Series Adapters consume up to 42 percent less power than the Emulex LPe16000 Series contributing to reduced operating expenses (OPEX).

EXECUTIVE SUMMARY

With the current trajectory of multi-core processor progression and the continued evolution of Hyper-V virtualization software by Microsoft, the drive for greater virtual machine density and application performance will continue with an unquenchable thirst. IT administrators must design and implement wisely to minimize bottlenecks and implement Fibre Channel ecosystems that support required performance levels, growth plans, and economic challenges. To meet these challenges, Cavium provides scalable, high-performance QLogic adapter architectures that can address the simultaneous demands placed by multiple virtual machines (VMs) and applications in virtualized Hyper-V environments.

To aid the IT administrator in making the best possible adapter choice for migrating their Fibre Channel infrastructure from 4Gb or 8Gb to the latest 16Gb technology, Cavium performed a series of head-to-head performance benchmarks. The results showed the I/O performance, scalability, and power consumption advantages of the QLogic Fibre Channel Adapters over Emulex. These advantages can be summarized in relationship to the data center budget's bottom line: lower server costs, reduced power bills, lower cooling costs, and reduced operational expenses associated with server management.

INDUSTRY CHALLENGES

Given the space consumption, power, cooling as well as procurement and ongoing costs associated with servers in the data center, IT administrators try to maximize the use of resources as efficiently as possible. Under utilization of multi-core CPU hardware resources, the need to control overall hardware expenses, green initiatives and controlling IT staffing levels are driving virtualization of physical server resources to new heights.

The number of virtual machines (VMs) can vary depending on the application type where databases like SQL and Oracle will be much more resource intensive than less demanding application services like file or web. CPU, memory, and storage I/O all play important roles in answering questions regarding how to best maximize the server consolidation effort.

This paper reveals how the storage I/O impacts virtualization in a data center full of servers. Its reported test results let you examine how the scalability of storage I/O at the physical server level affects VM density.

16GB FIBRE CHANNEL TEST CONFIGURATION

The test bed was comprised of an IBM x3650 M4 server installed with Microsoft Windows Server 2012 R2 Hyper-V. The server contained a QLogic QLE2672 16Gb Gen 5 Fibre Channel Adapter and an Emulex LPe16002B 16Gb Fibre Channel Adapter. Both were the latest dual-port 16Gb adapters available and were running on the latest commercially-available drivers. All measurements were made using out-of-the-box settings. Each adapter was connected to dual Brocade DS-6505B 16Gb fabrics. Each fabric was connected to two active ports (one per controller) on an IBM Flash Array 820.
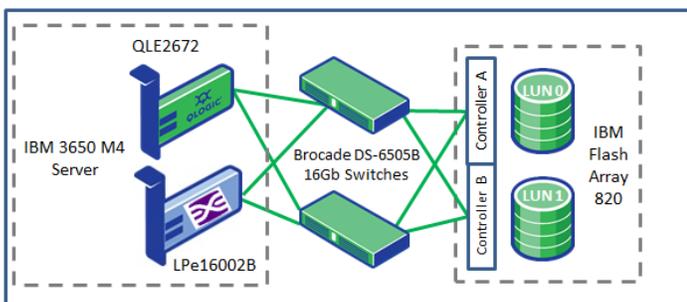

Figure 1: Test Configuration

For each setup, the adapter and all storage array ports were zoned together over the switches. Two test LUNs were created on the array and configured with one LUN mapped to the QLogic adapter and the other one mapped to the Emulex adapter. Only the VMs mapped through a given vendor's Host Bus Adapter were powered on during its portion of the test. The tests compared the I/O performance of the QLogic and Emulex Fibre Channel Adapters in a Microsoft 2012 R2 Hyper-V virtualized environment.

SQLIO was used to simulate and benchmark the OLTP-type workloads on up to 20 virtual machines; this is where higher IOPS performance is generally valued. A batch script was used to launch SQLIO concurrently across all VMs and the sum of the performance from each individual VM was then calculated to provide aggregate performance. The VMs were running Windows Server 2008 R2.

TEST PARAMETERS

- SQLIO v1.5.SG
- Thread count = 2
- Outstanding I/O's = 8
- Target DB size = 30GB
- Block sizes = 1K, 2K, 4K, 8K

QLOGIC ADAPTERS DELIVER HIGHER LEVELS OF VM DENSITY

The test results indicate superior scalability of performance by the QLogic QLE2672 over the Emulex LPe16002B Adapter. Both adapters perform well at I/O sizes of 16KB and above. However, the performance differences at the smaller I/O sizes (popular with database and metadata accesses) shows an appreciable advantage when using the QLogic QLE2672 adapter.

The performance indicators shown in figure 2 shows that the QLE2672 has up to a 15 percent advantage with 1KB, 2KB, 4KB, and 8KB I/O random read data patterns.
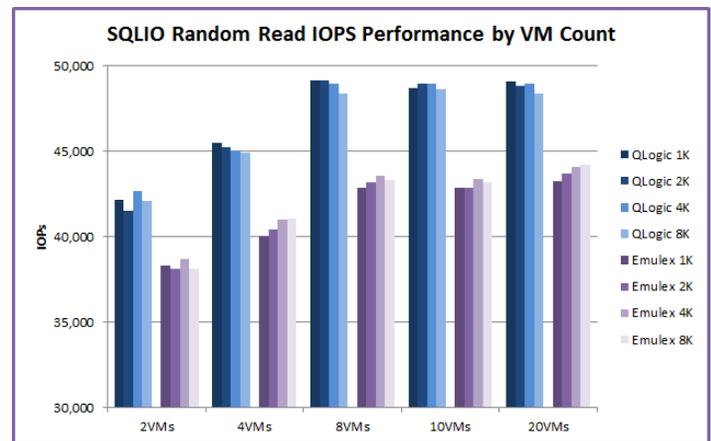

Figure 2: SQLIO Random Read

Figure 3 shows that the Random Write results of the QLE2672 provides up to 13 percent better performance than the Emulex adapter.
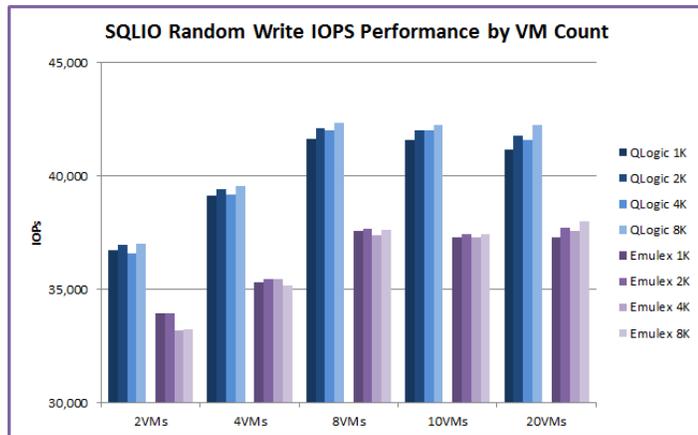

Figure 3: SQLIO Random Writes

Note: The performance captured in the above figures is limited due to the test environment and not indicative of each adapter's maximum performance.

LOWER TOTAL COST OF OWNERSHIP – QLOGIC REDUCES IT CAPEX & OPEX

As IT professionals design and scale virtualized environments, scalable architectures are critical for maximum resource efficiency. QLogic adapters deliver performance advantages that correlate with a reduction in the number of physical server resources required to meet the performance levels demanded by popular virtualized application workloads.

The following table shows the number of physical servers required to achieve 1M IOPS using a random read workload.

Using QLogic QLE2672 adapters enables IT administrators to meet their performance requirements and maintain quality of service more efficiently, which result in up to a 14% reduction in capital expenditures for new server equipment.

LOWER POWER CONSUMPTION

Dynamic Power Management techniques, such as Intelligent Link Training (ILT), save power on the QLogic 2600 Series (16Gb) Fibre Channel Adapters. Intelligent Link Training forces the PCIe bus to use the minimum number of lanes needed for maximum throughput. As an example, in PCIe Gen2 slots, the QLogic QLE2672 uses all 8 PCIe lanes; however, when the same adapter is plugged into a PCIe Gen3 slot, it uses only four lanes, which saves power.

In a PCI Express Gen3 slot, the Dynamic Power Management feature from QLogic demonstrates 42% greater power savings over Emulex, as shown in the following table.

QLOGIC 16GB GEN 5 FIBRE CHANNEL ADAPTER POWER CONSUMPTION ADVANTAGES[1]

Table 1: Adapter Power Consumption		
Dual Port Adapter	Idle State	Active State (with I/O)
LPe16002B	10.85W	11.64W
QLE2672	7.63W	8.20W
QLogic Advantage	3.2W (42%)	3.4W (42%)

1. For a detailed description of the power testing methodology, see the technology brief, "QLogic Platform and Methodology for Product Evaluations."

Table 2: Example of Number of Physical Servers Required to Achieve 1 Million IOPS Using a Random Read Workload						
Virtual Machines	I/O Size	QLogic IOPS	Emulex IOPS	Server Requirements using QLogic	Server Requirements using Emulex	Cavium's QLogic Advantage
4	1K	45,510	40,030	22	25	14%
	2K	45,272	40,428	22	25	14%
	4K	45,073	40,980	23	25	9%
	8K	44,935	41,058	23	25	9%
10	1K	48,734	42,895	21	24	14%
	2K	48,967	42,854	21	24	14%
	4K	48,981	43,353	21	24	14%
	8K	48,611	43,202	21	24	14%

Table 3: Example of Number of Physical Servers Required to Achieve 1 Million IOPS Using a Random Write Workload						
Virtual Machines	I/O Size	QLogic IOPS	Emulex IOPS	Server Requirements using QLogic	Server Requirements using Emulex	Cavium's QLogic Advantage
4	1K	39,120	35,304	26	29	12%
	2K	39,405	35,477	26	29	12%
	4K	39,185	35,446	26	29	12%
	8K	39,568	35,196	26	29	12%
10	1K	41,589	37,283	24	27	13%
	2K	42,034	37,436	24	27	13%
	4K	41,999	37,300	24	27	13%
	8K	42,255	37,436	24	27	13%

In a PCI Express Gen3 slot, Dynamic Power Management automatically reduces power consumption without IT administrator interaction, using the minimum number of PCI Express lanes to accommodate the maximum Fibre Channel bandwidth.

REAL CAPEX BENEFITS
- **Lower Server Costs.** QLogic Fibre Channel Adapters achieve the same level of performance and VM density with up to 14 percent fewer physical servers.

REAL OPEX BENEFITS
- **Reduced Power Bills.** QLogic Fibre Channel Adapters consume as much as 42 percent less power for significant cost savings.

- **Lower Cooling Costs.** Reduced power consumption results in generating less heat.

- **Reduced Operating Expenses.** Fewer software licenses to purchase and maintain, less servers to maintain.

SUMMARY AND CONCLUSION
Improving server processor utilization is a key component of server consolidation ultimately virtualizing the enterprise data center. Embracing virtualization to reduce server count delivers real savings to both capital and operational costs. IT professionals are continuously challenged on a cost/performance model required to get the best performance for the smallest investment, both with initial capital expenditure and after the sale when operating expenses are under the microscope.

IT professionals have a choice when migrating their Fibre Channel infrastructure from 4Gb or 8Gb to the latest 16Gb Gen 5 technology. The comparisons made in this paper show that QLogic Fibre Channel Adapters from Cavium are the right choice when customers want superior, scalable performance and the lowest power consumption available to achieve the highest density Hyper-V environment.

ABOUT CAVIUM
Cavium, Inc. (NASDAQ: CAVM), offers a broad portfolio of infrastructure solutions for compute, security, storage, switching, connectivity and baseband processing. Cavium's highly integrated multi-core SoC products deliver software compatible solutions across low to high performance points enabling secure and intelligent functionality in Enterprise, Data Center and Service Provider Equipment. Cavium processors and solutions are supported by an extensive ecosystem of operating systems, tools, application stacks, hardware reference designs and other products. Cavium is headquartered in San Jose, CA with design centers in California, Massachusetts, India, Israel, China and Taiwan.

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