



WHITE PAPER

Emulex LPe12002 and LPe12004 8GFC PCIe 2.0 Fibre Channel HBAs

- Superior Dual-Channel and Quad-Channel Performance for Business Critical Applications





■ Introduction

When a territory manager runs a query on today's sales or a factory manager plans tomorrow's production flow, they expect an instantaneous response from their information systems. When a CEO reviews his or her IT spending for the year, he or she wants to see lower capital and operating costs (CAPEX and OPEX), improved utilization and a more agile, consolidated IT infrastructure.

For all these reasons, every component in the modern data center must work at full capacity, all the time. Today's enterprise cannot afford down time or products that deliver anything but the highest performance in real business conditions.

Among the applications that have the highest need for data throughput are online transaction processing, database applications and server virtualization. Server virtualization, in particular, greatly reduces IT CAPEX and data center space requirements. The Fibre Channel HBA that links servers to storage networks is a critical link in the flow of data. Determining which HBAs deliver the best performance is essential, especially in a world of high-density blade servers and virtualized server deployments. To most accurately evaluate HBA performance, it is important to understand the actual workloads the HBA will handle, as well as those elements of HBA design that determine its real-world performance.

Dual-channel and Quad-channel Popularity

Dual-channel and quad-channel Fibre Channel HBAs are increasingly popular, together representing nearly 85% of the market for Fibre Channel connectivity. Drivers of dual-channel and quad-channel adoption include:

- Dual-channel is “the standard” for blade servers
- Increased performance of the PCI Express I/O bus
- Applications that either require or facilitate multiple channels
- The fact that I/O slots are limited
- Building for redundancy

I/O buses are getting faster and PCI Express bus performance can drive I/O activity to meet the capacity of two, and even four, Fibre Channel ports.

Customers are leveraging multipathing I/O software, creating one or more physical paths between the system and storage. When using dual and quad channel HBAs with multipathing software, should one path fail, the software can transparently reroute I/O through another channel. Multipathing software layers can leverage the redundant paths to increase performance and availability for VMware®, Oracle® and disaster recovery applications.

At a Glance

Emulex 8Gb/s Fibre Channel (8GFC) dual-channel and quad-channel Host Bus Adapters (HBAs) significantly outperform the nearest competitor. The dual-channel HBAs boast better throughput, 37% better transaction rates, 33% more effective central processing unit (CPU) utilization and 127% greater second-channel input/output operations per second (IOPS) versus the competition, while the quad-channel delivers 58% better total IOPS with all four channels in use, 94% better read throughput and 147Mbps more bandwidth utilization. This paper describes the data characteristics associated with business critical applications and the advantages of Emulex LightPulse® dual-channel and quad-channel 8Gbps Fibre Channel HBAs for those applications.

Products

- Emulex LightPulse LPe12002
- Emulex LightPulse LPe12004

Applications

- Online transaction processing, database and backup environments

Key Messages

Emulex LPe12002 dual-channel 8GFC HBAs offer the highest performance for critical business applications over the QLogic QLE2562:

- 127% better second channel scalability as measured in IOPS
- 37% greater total IOPS when saturating both channels
- 33% more effective CPU utilization
- 15% greater transaction performance
- 115Mbps more throughput

Emulex LPe12004 quad-channel 8GFC HBAs offer the highest performance for critical business applications over the QLogic QLE2564:

- 58% greater total IOPS when using four channels
- 94% better read throughput
- 33% more throughput on read/write operations



With application requirements for multiple Fibre Channel ports and PCI slots at a premium, especially in blade servers, data centers are choosing to deploy dual-channel and quad-channel HBAs. Many of today's business critical enterprise applications demand the performance that can be provided only by the latest dual-channel and quad-channel 8GFC HBA technology.

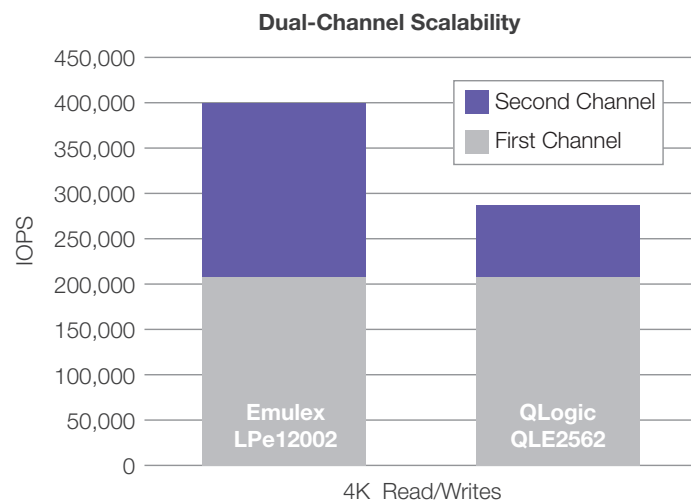
Emulex LightPulse dual-channel and quad-channel Fibre Channel HBAs are the clear leaders when it comes to real-world performance and scalability. Emulex dual-channel and quad-channel 8GFC HBAs boast better throughput and transaction rates compared to QLogic. Combined with Emulex's superior quality, reliability and manageability, it's no wonder that Emulex HBAs remain the deployment leader in the world's largest enterprises.

Measuring Actual Performance

The performance of a Fibre Channel HBA is often measured using two common metrics. One is the number of I/O transactions that can be performed per second, referred to as IOPS. The second way to measure performance is the number of bytes of data that can be moved per second, which is measured in MBps.

When considering the performance of a Fibre Channel HBA, it really makes the most sense to understand its performance characteristics at the working data size used by the applications it will need to support. Consider, for example, databases such as Oracle and Microsoft® SQL Server, which support enterprise applications, such as SAP or on-line transactional applications that generate revenue. Or consider the datastore used by Microsoft Exchange, the backbone of many companies' e-mail and messaging systems. The Emulex LPe12002 delivers up to 37% more IOPS in the data range most used by these applications compared to the competition (Chart 1), while the LPe12004 delivers over 50% more IOPS (Chart 2).

Chart 1*
Scalable I/O transaction demonstrates that Emulex delivers up to 127% greater IOPS on the second channel and 37% overall.

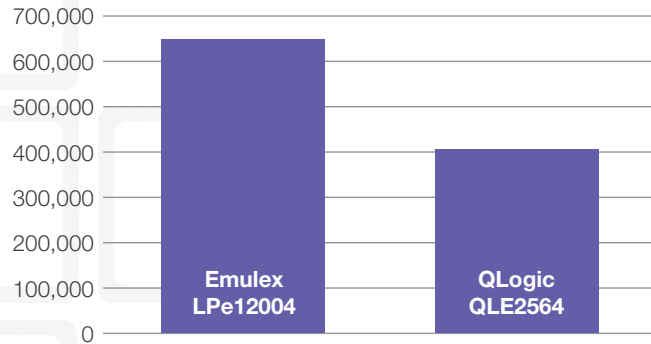


* All performance results used in these comparisons were made on commonly available server and storage hardware.



The Emulex LPe12004 delivered over 50% more IOPS for 4K reads in a test comparing the LPe12004 with the QLogic QLE2564.

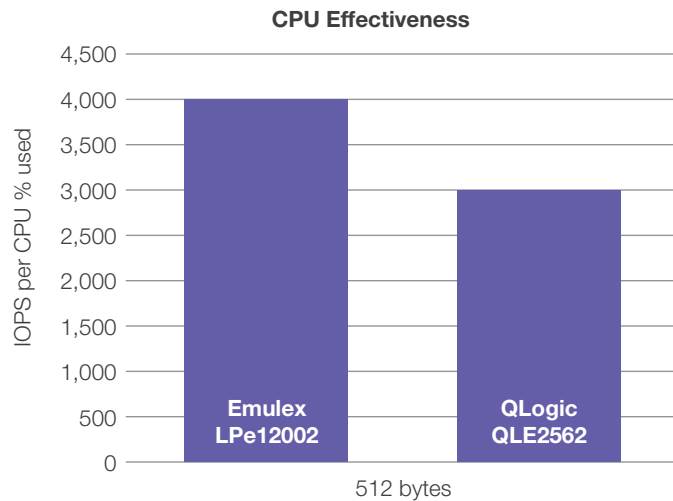
Chart 2
Emulex quad-channel delivers consistently greater IOPS overall—over 50% more.



CPU Efficiency

HBAs can offload the server CPU from managing I/O, thereby increasing the number of server CPU cycles available for application processing. The Emulex LPe12002 excels at offloading transactional I/O workloads (typified by Microsoft Exchange) by providing 33% greater CPU efficiency over the competition. This CPU efficiency advantage translates into increased CPU cycles for server applications and cost savings on server configurations (Chart 3).

Chart 3
CPU effectiveness shows Emulex LPe12002 HBA with 33% greater efficiency.

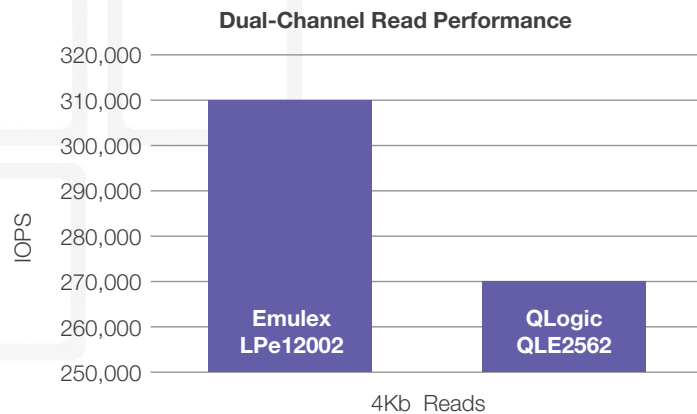




Making Every Port Count

When customers purchase a dual-channel or quad-channel HBA, they expect that they will get the advertised throughput through both ports. Some competing 8GFC HBAs deliver optimum throughput through only one port, with performance degrading significantly through the additional ports. This cripples the performance of the server in which they are placed, as well as wasting space, electrical power and cooling capacity. The performance difference between a product that takes advantage of all ports and one that doesn't can be seen clearly in the following charts.

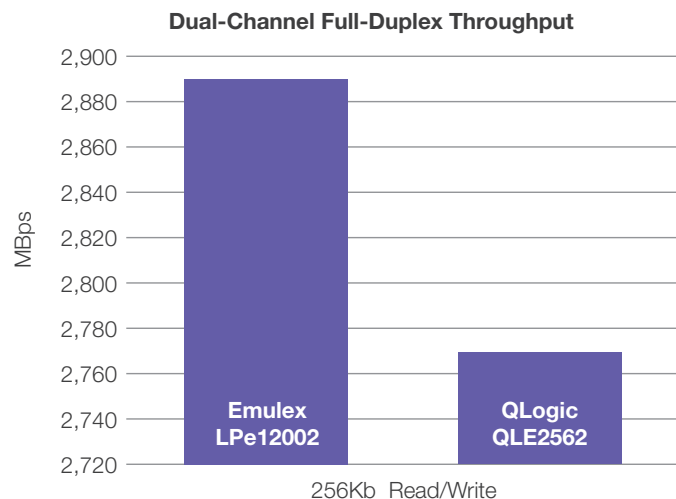
Chart 4
A 4Kb read I/O test shows 15% greater transaction performance with the Emulex dual-channel Fibre Channel HBA.



These performance charts show that the Emulex LPe12002 and LPe12004 provide throughput that most closely utilizes the full performance of 8GFC and the PCI Express bus. In fact, they exceed the competition—the dual-channel adapter by over 140K IOPS in read transactions (Chart 4), and by 115MBps in full-duplex operations (Chart 5), when measured at the data sizes most often used by business applications. The Emulex full-duplex performance in Chart 5 is significant since it is accomplished at 256Kb data block size, the large block data size used frequently by data backup applications.

When required to perform full duplexing, in fact, the competitor's 8GFC HBA delivers no full duplex throughput advantage over a single-channel HBA. The Emulex dual-channel LPe12002 8GFC HBA offers the highest data throughput performance available for high performance Fibre Channel storage computing needs.

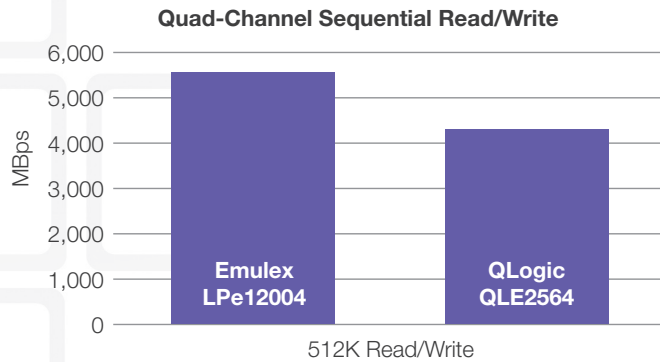
Chart 5
Concurrent full duplex throughput of 8GFC dual-channel HBAs shows 115MBps more bandwidth with Emulex LPe12002.





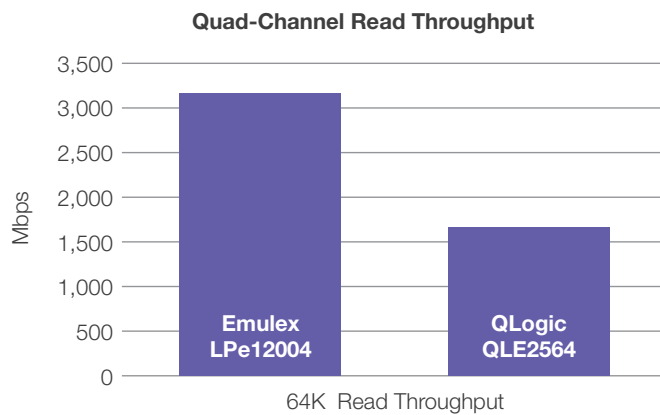
Taking a closer look at the quad-channel adapter test results, we see that a similar story is told. Chart 6 shows the LPe12004 outperforms the competition by almost doubling the sequential reads, measured in MB/second.

Chart 6
Throughput of 8GFC quad-channel HBA shows 1,414MBps, or 33%, more sequential reads with the LPe12004.



Furthermore, at 64K, read throughput for the Lpe12004 is 94% better than the QLE2564, as shown in Chart 7.

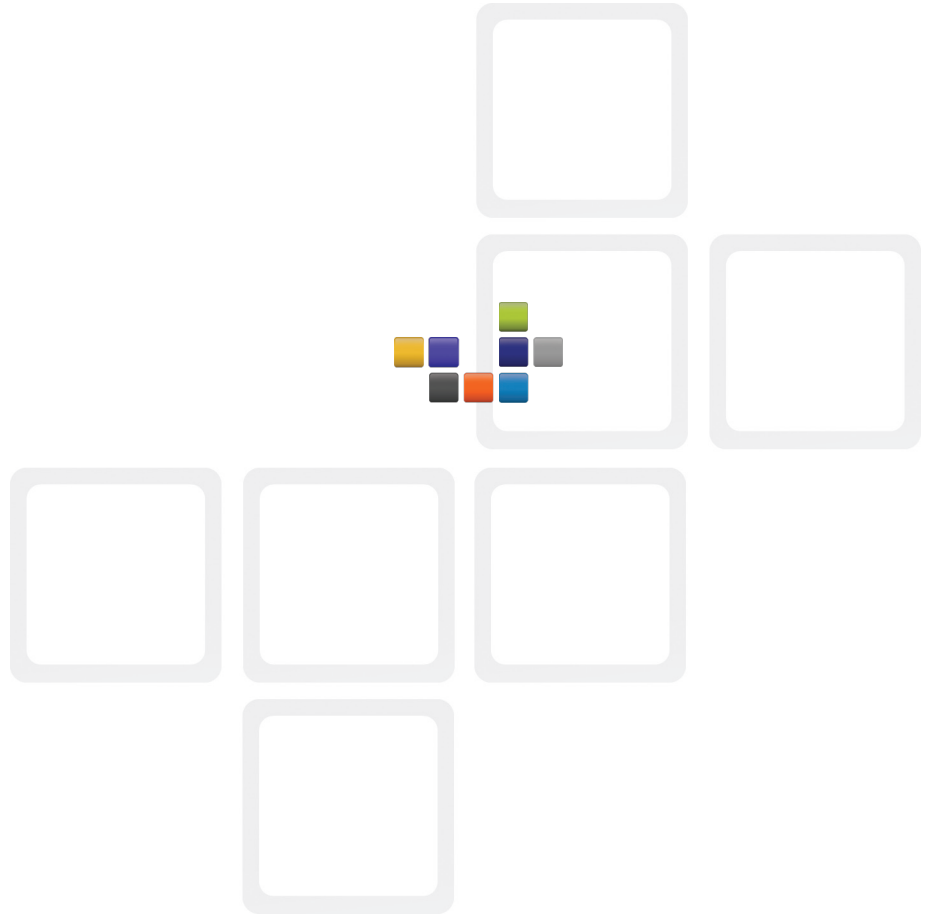
Chart 7
The LPe12004 has 94% more read throughput at 64K than the QLE2564.



Conclusion

When evaluating HBAs for a demanding data center environment, customers need to carefully examine how the HBAs will perform under business conditions, running actual business applications. Customers should carefully evaluate the conditions under which performance tests are run, as well as the design characteristics of the HBA, to ensure the HBA delivers the throughput needed for their applications.

The Emulex LPe12002 and LPe12004 provide greater IOPS, significant transactional performance advantages, superior multi-channel scalability and better CPU efficiency and effectiveness compared to the competition. The Emulex dual-channel LP12002 and quad-channel LPe12004 8GFC HBAs offer the highest data throughput performance required for today's high performance Fibre Channel storage computing needs.



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