

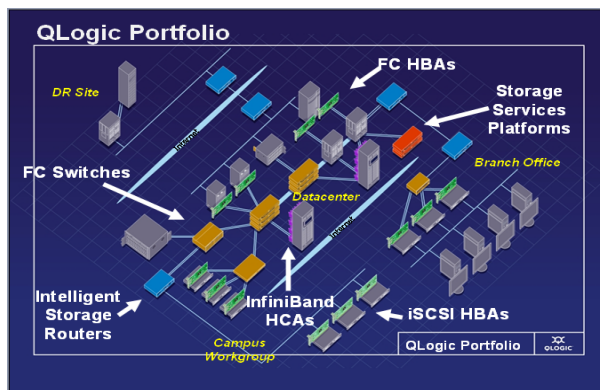
11 Reasons to Choose QLogic Over Emulex (FC HBA)

QLogic 4Gb Fibre Channel (FC) HBAs Outperform Emulex in Performance, Scalability and Reliability



Executive Summary

The success of an enterprise depends on the speed and quality of the service it offers. From financial institutions, to airlines, credit-card companies, on-line auction or merchandisers, to large retail-chains, they all have increased demands on the dependability and scalability of their IT/SAN infrastructure. CIOs and SAN administrators are increasingly being challenged to review and evaluate complex components.



This paper provides an evaluation between QLogic and Emulex FC HBAs, with a focus on factors that matter to CIOs and SAN administrators; **performance, scalability and reliability**.

QLogic provides a seamless path to future scalability with a commitment and investment to building next-generation FC, iSCSI, InfiniBand adapters, FC switches, FC storage solutions and multi-protocol bridges/routers.

11 Key Findings: Choosing QLogic FC HBAs over Emulex provides:

- **Higher Performance:**
 - Highest IOPs and Throughput in real-world applications
- **Superior Scalability:**
 - Broadest product offering for standard HBAs
 - Broadest product offering for blade servers
 - Broadest OS support
 - Virtualization leadership
 - Ease-of-use and serviceability (including unified firmware/drivers)
 - Pervasive interoperability
 - Global Tech Support and 30 minute response time
- **Enhanced Reliability:**
 - Highest product reliability backed by 5-year warranty
 - Highest data reliability offered through end-to-end data protection
 - Highest reliability of supply chain

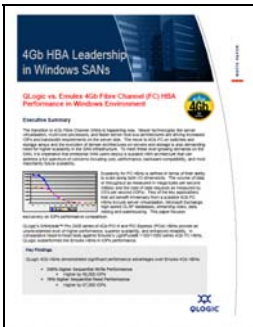
Introduction

Newer technologies like server virtualization, multi-core processors, and faster server host bus architectures are driving increased bandwidth requirements on the server side. To meet these ever-growing demands on the SAN, it is imperative that enterprise SAN users deploy a scalable HBA architecture that can address a full spectrum of concerns, including cost, performance, backward compatibility, and most importantly, future scalability.

Performance Comparison

Reason #1: Highest IOPs and Throughput in Real-World Applications

QLogic 4Gb HBAs deliver the industries highest performance as documented in a series of white-papers highlighting findings in Windows, MS-Exchange and Oracle environments. Each of the papers provides **complete details of the test-environments**. Furthermore, **QLogic results were validated by independent 3rd party, OpenBench Labs**.



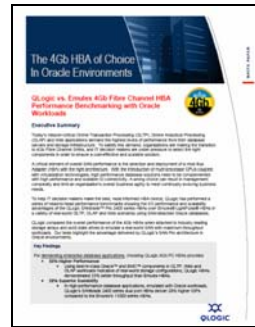
Windows Highlights:

- QLogic HBAs displayed **246% higher Sequential Write Performance than Emulex**. Higher by 95,000 IOPs.
- QLogic HBAs displayed **79% higher Sequential Read Performance than Emulex**. Higher by 67,000 IOPs.



Exchange Highlights:

- QLogic HBAs scaled **13% better than Emulex** with an increase in the numbers of disk drives.
- Simulating MS Exchange, QLogic HBAs supported **84% higher data throughput** and **78% more transactions than Emulex** while maintaining a **45% faster response rate**.



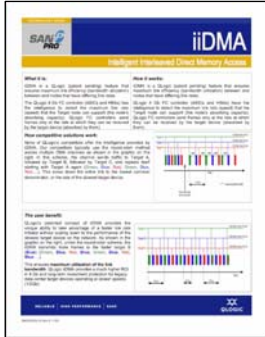
Oracle Highlights:

- QLogic HBAs demonstrated **31% better throughput** than Emulex.
- On Oracle workloads, QLogic's dual port HBAs **delivered 28% more IOPs** than Emulex.

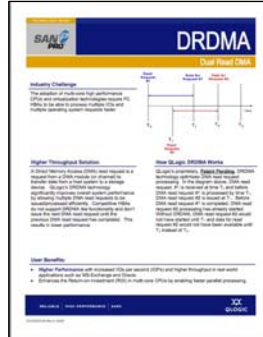
Please refer to the URL below for White Papers on performance in real-world applications. http://www.qlogic.com/knowledgecenter/briefs_papers.asp

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QLogic's **SAN Pro architecture** provides the foundation for implementing high-performance SAN solutions. Some of the key innovations (patents pending) that help deliver the highest performance include:



Intelligent Interleaved Direct Memory Access (iiDMA) – ensures maximum bandwidth utilization between end nodes in environments supporting different FC speeds.



Dual Read DMA (DRDMA) – optimizes DMA read request processing by allowing multiple DMA read requests to be serviced.



Out of Order Frame Reassembly (OoOFR) – reassembles the frames within an exchange in the correct order, even though they may have been received out of order, thus eliminating the need for retransmission.

Please refer to the URL below for Technical Briefs on the foundations of the SAN Pro architecture.

http://www.qlogic.com/knowledgecenter/tech_briefs.asp

Scalability Comparison

Enterprise datacenters build their infrastructures to not only meet immediate needs, but also to plan for future scalability. Major considerations for CIOs and SAN administrators are stability of the vendor/partner’s technology, commitment to develop next generation products that are backward compatible, support for current and future server/OS platforms, ease-of-use and service of the products, guaranteed interoperability and global support.

Reason #2: Broadest Product Offering of Standard Form Factor HBAs

QLogic offers a complete product offering for both PCI-X 2.0 (backward compatible with PCI-X 1.0 systems) and PCI Express 4Gb SAN Pro FC HBAs as shown in the following table.

4Gb FC HBAs	QLogic: 2400 Series	Emulex: 11000
Single/Dual Port: PCI-X 1.0	√	√
Single/Dual Port: PCI-X 2.0	√	√
Single/Dual Port: PCI Express	√	√
Quad Port: PCI Express	√	No
ExpressModule: PCI Express	√	No

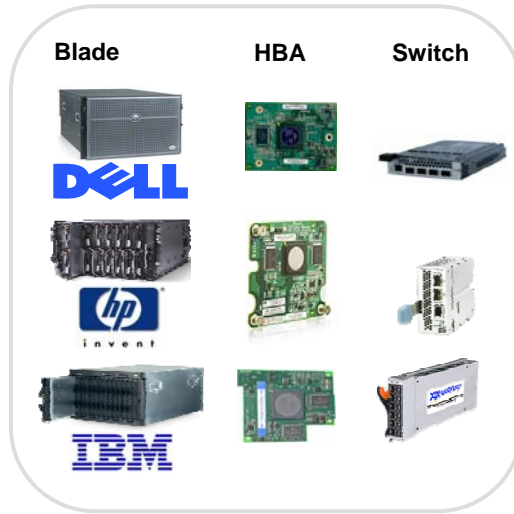
Reason #3: Broadest Product Offering for Blade Servers

QLogic developed the world's first embedded SAN infrastructure for bladed servers and is the leading supplier of Fibre Channel embedded switches and HBAs for bladed servers. In 2005, QLogic shipped its 500,000th blade server HBA port and 20,000th blade server Switch.

Products designed for blade server environments are more complex than standard HBA and Switch products in that they require the lowest possible power consumption, smallest possible form factor, operation with limited airflow and the highest level of signal integrity to ensure robust connections with the high speed electrical backplanes of a blade server.

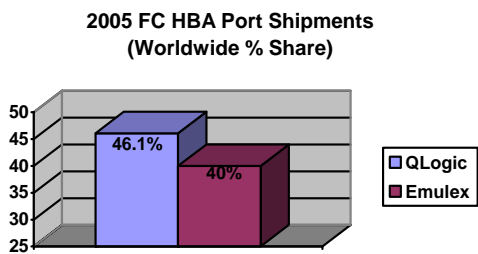
QLogic has worked with all major OEMs over three generations of blade-servers and have developed over 20+ HBAs and embedded Switch modules for blade servers. This wide exposure across systems and products enables QLogic to deliver the most reliable products for this rapidly growing market segment.

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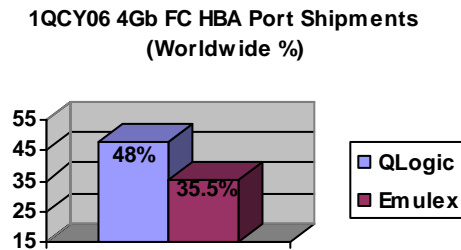


QLogic attention and commitment to both standard and Blade Server form factors has resulted in QLogic's #1 position. Dell'Oro Group's 2005 Worldwide FC Port market share data shows that **QLogic's HBAs are the number one choice of users for all generations of FC technologies** with 46% of the worldwide FC HBA port shipments.

An even more resounding statement from users is the number of 4Gb FC HBA port shipments. Dell'Oro's most recent numbers show that QLogic shipped 48% of the 4Gb FC HBA ports in the first quarter of 2006 compared to Emulex which shipped only 35.5%.



Source: Dell'Oro Group 2005



Source: Dell'Oro Group 1Q CY06

Reason #4: Broad and In-Time OS Support

QLogic offers support for multiple operating systems including Windows 2000/2003, Windows XP, Linux, Solaris, Netware and Mac across hardware platforms (IA32, IEM64T, IA64, and PPC). HP-UX and AIX support is also offered through OEMs.

The strong partnership between QLogic’s software team and each OS vendor helps ensure that driver support is aligned with each new OS release. In addition, this sharp focus enables QLogic driver architecture to take advantages of the features and functionality offered in the OS. For example, QLogic was the first to offer x64 drivers for the Windows platform.

QLogic has recently extended its support to the Mac OS by offering drivers, applications and utilities. Also of significance is that QLogic’s Linux driver was the foundation (gold standard) for VMware’s FC HBA driver.











VMware Advantage – QLogic’s VMware solutions offer the broadest support, simplified management and highest performance.



No Solaris Reboot – QLogic enables zero-downtime in Solaris environments.

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In today's heterogeneous operating system environment, SAN Pro's extensive operating system support allows IT personnel to scale their SAN infrastructure without operating system compatibility restrictions.

	QLogic	Emulex
Mac OS X 	√	No
Windows 	√	No Windows XP
Solaris 	√	√
Netware 	√	√
Linux 	√	√
VMware 	√	√
HP-UX 	√*	√
AIX 	√*	√

√* - Developed by OEM

Reason #5: Virtualization Leadership

QLogic is a leader in supporting server and storage virtualization initiatives that will help enterprises scale their operations, provide the lowest cost of ownership and maximize hardware and software investments. QLogic is deeply engaged with next generation initiatives from Intel and AMD with respect to processor technology, virtualization software providers such as XENsource and VMware, and several other key virtualization community partners. This close relationship has helped QLogic to offer key features such as:





Virtualization – N-Port Virtualization allows a single physical Fibre Channel (FC) HBA port to function as multiple logical ports, each with its own identity.

VSAN – provides the ability to create completely isolated network islands, each with its own set of fabric services. QLogic is the only FC HBA to offer HW based VSAN tagging capability.

VSAN is a standard that was pioneered by Cisco. In November 2004, the T11 committee of the International Committee for Information Technology Standards selected Cisco's Virtual SAN (VSAN) technology for approval by the American National Standard Institute (ANSI) as the industry standard for deploying **virtual fabrics**, defined as the ability to segment a single, physical SAN fabric into many logical, completely independent SANs.

Please refer to the URL below for Technical Briefs on the foundations of the SAN Pro architecture. http://www.qlogic.com/knowledgecenter/briefs_papers.asp

In summary, QLogic offers support for emerging virtualization technologies as shown in the following table.

	QLogic	Emulex
VMware 	✓	✓
Xen Hypervisor 	✓	✓
Hardware-based VSAN	✓	No
NPIV + Hardware-based VSAN	✓	No



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Reason #6: Ease-of-Use and Serviceability

QLogic continues to incorporate customer feedback into its FC HBA products to make them easier to install and use.

The following table shows QLogic's ease-of-use and serviceability features for 4Gb FC HBAs offerings, including Quick Start Guides, HTML- based easy-to-read and navigate read-me and release-notes, and brackets with detailed information such as the WWPN, type of host bus interface, port number identification and separate link speed LEDs.

Emulex's 4Gb FC HBAs do not provide the user with nearly as much information, and that which is provided is significantly less comprehensive, elegant and intuitive when compared with QLogic. **QLogic's attention to detail differentiates the user experience and makes it extremely easy and intuitive to use its FC HBAs.**

	QLogic	Emulex
Quick Start Guide	√	No
HTML Read Me & Release Notes	√	No
CD/Management ToolS	√	√
Command Line Interface (CLI)	√	√
Unified Firmware/Driver	√	No
Bracket	See picture below	See picture below
Spare Low Profile Bracket	√	√
Host Bus Identification	√	No
WWPN	√	No
Beacon Support	√	√
Separate LED for 4/2/1 Gb Speed	√	No
		

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QLogic's OS drivers have the firmware embedded. Embedding the firmware in the OS driver reduces the number of software loads and ensures that both the driver and the firmware have been thoroughly tested. A unified firmware/driver eliminates the need to guess which combination of firmware and OS driver have been tested.



Ease of Use – simplifying the tasks of installing, configuring, managing and upgrading storage solutions.



Unified Driver – QLogic uniquely delivers matched sets of FC HBA driver and firmware within a unified file.

Please refer to the URL below for Technical Briefs on the scalability benefits of the SAN Pro architecture.




http://www.qlogic.com/knowledgecenter/competitive_briefs.asp

Reason #7: Pervasive Interoperability

QLogic’s 4Gb SAN Pro FC HBA solutions are continually tested for interoperability with previous generation products, as well as with the latest servers, storage and networking products from major manufacturers including: ADIC, Brocade, Computer Associates, Dell, EMC, HDS, HP, IBM, Engenio, Quantum, StorageTek, Sun, VERITAS (Symantec), and others. **QLogic’s Interoperability Guide is updated monthly with the latest information.**

SAN administrators can enjoy peace of mind when deploying a QLogic 4Gb SAN Pro FC HBA knowing that it will work with not only their existing SAN infrastructure, but with any equipment added to the SAN at a later date.

QLogic’s SANtrack Partner Program ensures that QLogic HBAs are interoperable with the most extensive list of equipment in the SAN marketplace. Over the years, QLogic has invested more than \$100M in equipment to test and certify for interoperability.

	QLogic	Emulex
Certification Partner Program	http://www.qlogic.com/alliances/our_partners.asp 	√
Orderable Hard Copy Certification Guides	http://www.qlogic.com/interopguide/   Interoperability Guide Quick Reference	No

Reason #8: Global Tech Support and 30-Minute Response Times






In our continuing commitment to bring best-in-class pre- and post-sales support to customers, QLogic has the broadest support, fastest response times and the most extensive geographic coverage of any HBA supplier in the industry today.

QLogic offers extensive self-service web support options including natural language knowledge-base queries and user forums at <http://support.qlogic.com>. In addition, access to standardized global support is available via email and telephone **in the customer's preferred language**.

QLogic support personnel are focused on QLogic products, have extensive industry experience, receive uniform training and are committed to responding to phone inquiries within 30 minutes during normal business hours. QLogic support personnel are also authorized to provide advanced replacement products as needed.

QLogic's **comprehensive support services are offered at no additional charge** for products that are covered by warranty.

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	QLogic	Emulex
Comprehensive Global Support Services		No
Products Supported	FC HBAs, iSCSI HBAs, InfiniBand HCAs, FC switches, FC storage solutions and multi-protocol bridges/routers.	No
Support Knowledgebase and User Forums	 http://support.qlogic.com	No
Advanced Product Replacement		No
30-Minute Response Time		No
In Country Support		
North America	support@qlogic.com +1-952-932-4040	
Europe, Middle East and Africa (EMEA)	emeasupport@qlogic.com +353 1 6924960 – English +353 1 6924961 – Français +353 1 6924962 – Deutsch +353 1 6924963 – Español +353 1 6924964 – Portuguese +353 1 6924965 – Italiano	No 800-854-7112 or 714-885-3402 Only
Asia Pacific Region (APAC)	apacsupport@qlogic.com +63-2-885-6712 – English +63-2-885-6713 – 汉语 (Mandarin) +63-2-885-6714 – 日本語 (Japanese) +63-2-885-6715 – 한국어 (Korean)	No 800-854-7112 or 714-885-3402 Only
Central and Latin America Region	calasupport@qlogic.com +52 55 5278 7016 – English +52 55 5278 7017 – Español +52 55 5278 7015 – Portuguese	No 800-854-7112 or 714-885-3402 Only

Reliability Comparison

Today's enterprise environment demands an IT infrastructure that provides maximum up-time. By ensuring the most reliable products, with the highest accuracy and protection of data, as well as ensuring continuity of supply, QLogic FC HBAs are the leaders with respect to this commitment.

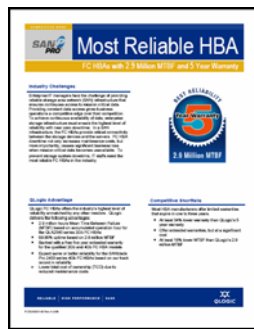
Reason #9: Highest Product Reliability Backed by 5-Year Warranty

Traditionally, most FC HBA suppliers offer 1 to 3-year warranties on their products. For example, Emulex offers the traditional 3-year warranty on their HBAs. QLogic SAN Pro FC HBAs are unmatched in the category of reliability with the highest Mean Time Between Failure (MTBF) and is the only FC HBA supplier to back-up its high reliability claim by offering a FREE 2-year extension to the standard 3-year QLogic limited warranty coverage. ***This FREE program gives you an unprecedented 5 years total coverage on SAN Pro -CK and -E models, more protection than you can get from any other HBA provider!***

	QLogic: QLx246x	Emulex: LP1100x LPe1100x
Standard 3-Years	√	√
Free 5-Year Option	 http://webnet.qlogic.com/extendwarranty	No



MTBF – the highest MTBF backed by an industry leading free 5-year warranty offer.



Most Reliable HBA – offers the highest level of reliability.

Reason #10: Highest Data Reliability offered through End-to-End Data Protection

Increasingly, enterprises want to ensure data is protected not only when it is at rest, but also as the data travels between the fibre channel network and the server host bus interface. QLogic's (patent pending) implementation of Overlapping Protection Domains (OPD) ensures data is protected at all times and provides complete end-to-end protection.



Overlapping Protection Domains (OPD) – ensures data is protected at all times as it passes through the FC controller.

Please refer to the URL below for Technical Briefs on the reliability benefits of the SAN Pro architecture.

http://www.qlogic.com/knowledgecenter/briefs_papers.asp

Reason #11: Highest Reliability of Supply Chain Solutions

As the world leader in FC HBA port shipments, QLogic recognizes the need for having **multiple production facilities and multiple fulfillment centers** in order to meet the demands of customers and to prevent line-down situations in the event of an unfortunate disaster at any single facility and at any given time. QLogic's Global Supply Chain Optimization Program (GSCOP) represents a direction and dedication to provide a truly global, flexible and resilient supply chain solution set to service customer demand.

QLogic production facilities and partners are located in Guadalajara, Mexico; Penang, Malaysia; and within the US (Florida and California). QLogic also has fulfillment centers in the USA, Europe and Asia which ensure the fastest delivery of products just-in-time for our OEMs and customers. Through this diversified geo-centric fulfillment chain, QLogic can consistently deliver the right product mix to meet variable customer demand from within each geography.



Summary and Conclusion

IT managers know that choosing the right HBA for their SAN infrastructure can have a significant impact on the performance, scalability and reliability of their enterprise storage environments. The results of this comparison between QLogic's and Emulex's 4Gb FC HBAs demonstrate that QLogic's 4Gb FC HBAs are distinctly superior to Emulex's offering, and represent best-in-class in virtually every category.

- **Higher Performance**
 - Highest performance in Windows, MS-Exchange and Oracle environments.
 - Innovative technologies to enhance link-speeds in mixed environments (iiDMA), multi-threaded memory access (DRDMA) and optimizing meshed switch environments (OoOFR).
- **Superior Scalability**
 - Broadest product portfolio of single, dual and quad port HBAs with native PCIe or PCI-X 2.0 support.
 - Forward compatible firmware and drivers for ease of adoption of next-generation FC speeds.
 - Broadest OS support.
 - Innovative solutions supporting virtualization technologies (Hardware-based VSAN, N-Port/Multi-ID, VMWare/Xen).
 - Focus on ease-of-use and serviceability.
 - Pervasive interoperability.
 - Single vendor global support for FC HBAs, iSCSI HBAs, FC Switches, FC/iSCSI routers, FC appliances and InfiniBand HCAs.
 - Tested and certified for global market acceptability.
- **Enhanced Reliability**
 - Highest product reliability backed by a 5-year warranty.
 - Highest data reliability offered through end-to-end data protection.
 - Highest reliability of supply chain solutions by ensuring multiple HBA production and fulfillment centers.

The QLogic FC HBA features listed above translates into tangible benefits to any enterprise (and OEMs):

- **Lower hardware total cost of ownership (TCO).** Especially with emerging, high-performance applications that will be used in conjunction with emerging server virtualization technologies and high-performance Grid-computing. QLogic HBAs provide significant head-room for speed and throughput to meet the growing needs of enterprise SANs.
- **Investment protection.** A product that provides guaranteed support for emerging host-buses, FC speeds, operating systems and hardware platforms with a commitment to deliver backward-compatible next-generation products.
- **Deliver highest ROI.** Continuous innovation helps deliver the highest level of product and data reliability.

Standardizing and deploying QLogic 4Gb HBAs translates to clear and tangible benefits, enabling enterprises to drive more value from their SAN infrastructure investments.

Appendix: Quick Reference Sheet

QLogic Excels over Emulex: 11 Reasons to Choose QLogic FC HBAs over Emulex		
Category	Reason	Benefit
Performance	# 1: Highest IOPs and Throughput in Real-World Applications	<ul style="list-style-type: none"> • 246% higher Sequential Writes in Windows environment. • 84% higher throughput in MS Exchange environment. • 31% higher throughput in Oracle environment. • SAN Pro architecture innovations like iiDMA (intelligent interleaved direct memory access) for Link-optimization; DRDMA (dual-read DMA) for faster request completion and OoOFR (out-of-order frame reassembly) for faster transmission.
Scalability	# 2: Broadest Product Portfolio of standard form-factor HBAs	<ul style="list-style-type: none"> • Single vendor to support single, dual, quad and Express-Module HBAs.
	# 3: Broadest Product offering for blade servers	<ul style="list-style-type: none"> • Single vendor support for FC blades and switches for blade-servers ensuring the most robust design.
	# 4: Broadest OS Support with highest integration	<ul style="list-style-type: none"> • Single vendor to support multiple OSes including Windows XP and Apple Mac. • No reboot Solaris drivers. • Broadest HBA support in VMware.
	# 5: Virtualization Leadership	<ul style="list-style-type: none"> • Only HBA with NPIV and hardware based VSAN support.
	# 6: Ease of Use & Serviceability	<ul style="list-style-type: none"> • Quick Start Guides, HTML-based read me's/release notes. • Unified FW and Driver (eliminates need to test and ensure interoperability between various FW and Driver versions. Simplifies upgrade process) • WWPN on brackets and 3 LEDs to provide HBA status.

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QLogic Excels over Emulex: 11 Reasons to Choose QLogic FC HBAs over Emulex		
Category	Reason	Benefit
	# 7: Pervasive Interoperability	<ul style="list-style-type: none"> Orderable hardcopy certification guides, ensures highest level of interoperability.
	# 8: Global Tech Support	<ul style="list-style-type: none"> 30-minute response time. Local language telephone and email support. Advance replacement. Knowledge base/support forums.
Reliability	# 9: Highest Product Reliability	<ul style="list-style-type: none"> Most reliable HBA - only one backed with 5 years of warranty.
	# 10: Highest Data Reliability	<ul style="list-style-type: none"> Patent pending OPD (Overlapping Protection Domains) technology provides seamless data protection.
	# 11: Highest Supplier Reliability	<ul style="list-style-type: none"> Multiple product and fulfillment centers around the globe backed by GSCOP (Global Supply Chain Optimization Program).

Disclaimer

Reasonable efforts have been made to ensure the validity and accuracy of these comparative 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.