Emulex®-branded Fibre Channel HBA Product Line

Emulex-branded Fibre Channel (FC) Host Bus Adapters (HBAs) by Broadcom are designed to address the demanding performance, reliability and management requirements of today's enterprises that are deploying low latency all-flash and NVMe networked storage arrays.

Emulex HBAs are available in Gen 7 (64/32GFC), and Gen 6 (32/16GFC) models. All 32G/16GFC HBAs are available in single, dual and quad-port configurations. The product line offers a variety of performance and feature options such as diagnostics and advanced security, and troubleshooting features to meet the needs of a wide range of enterprise applications.

Emulex fully supports new industry standards that further enhance Broadcom's Autonomous SAN innovations to self-learn, self-optimize, and self-heal in order to proactively keep the SAN running at maximum speed and avoid down-times. The new industry standards supported by Emulex around Fabric Performance Impact Notifications (FPIN) function include Link Integrity Notification (FPIN-LI), Congestion notification (FPIN-CN), Peer Congestion notification (FPIN-PN), and Delivery notification (FPIN-DN). The Emulex SAN Manager application is the first application in the industry to automatically identify, minimize and mitigate application performance problems caused by SAN congestion utilizing the FPIN-CN standard.

With a common driver model supporting all Emulex HBAs for each operating system, upgrading to next generation Emulex HBAs guarantees seamless migration.

Additionally, Fibre Channel technology is backward compatible with the two previous generations. For example, Gen 7 64GFC Fibre Channel switches, HBAs and optics (transceivers) are backward compatible with 32GFC and 16GFC equipment. This provides a smooth upgrade path and investment protection for enterprises.

Emulex Fibre Channel HBA Portfolio

Models	Series	IOPS Per Single-Port	Bandwidth Per Single Port (read/write, bi-directional)	NVMe Over FC	Mission-Critical Features
Gen 7 64GFC	LPe36000	Up to 10M	12,800 MB/s	Yes	• 3x better latency than LPe31000/32000-series • Silicon Root of Trust: hardware-based firmware authentication • PCIe 4.0 bus for latest AMD and Intel servers • 128GFC Trunking • LPe35000-series can be upgraded from 32GFC to 64GFC with hot-plug optics kits[1] • + features below
Gen 7 32GFC	LPe35000	Up to 5M	6,400 MB/s	Yes	
Gen 6 32GFC	LPe32000	1.6M	6,400 MB/s	Yes	• Registration and support for Fabric Performance Impact Notifications (FPINs) and congestion signaling • Buffer-to-buffer (BB) credit recovery - automatic buffer credit loss detection and recovery for reliable performance • Forward Error Correction (FEC) • Secure Firmware Updates • Brocade® I/O Insight • ClearLink(D_port), Link Cable Beaconing, Host Name Registration, Read Diagnostic Parameters, VMID, BB_Credit Recovery, Fabric-assigned Boot LUN, Fabric-assigned PWWN, FC-Trace, FC-Ping, Rest APIs & more • T10-PI data integrity offload • Emulex HBA Capture • Hot plug optics
Gen 6 16GFC	LPe31000	1.6M	3,200 MB/s	Yes	

1 - With Emulex approved optics kits

Accelerate

The unique Emulex Dynamic Multi-core Architecture introduced on Gen 5 HBAs delivers unparalleled performance and more efficient port utilization than other HBAs, providing up to 10 million IOPS on Emulex Gen 7 FC HBAs.

NVMe provides substantially lower latency for storage I/O operations and significantly higher IOPS per device. NVMe will scale-up the number of devices it can address by adopting NVMe over Fabrics technology. Fibre Channel is one of the fabric technologies that is supported by NVMe over Fabrics. Emulex NVMe-enabled HBAs deliver 55% lower latency than SCSI over Fibre Channel and support NVMe over Fibre Channel and SCSI over Fibre Channel concurrently. Concurrency provides data centers the ability to run SCSI and NVMe all-flash arrays at the same time for a seamless transition to an NVMe all-flash data center.

Protect

Emulex HBAs are renowned for reliability, ensuring maximum SAN uptime. Their "It Just Works" reputation is based on 17 million installed ports with proven industry-leading reliability of 10 million hours field Mean Time Between Failures (MTBF).

Emulex Gen 7 HBAs provide unmatched security for Fibre Channel environments. LPe36000/35000-series feature Silicon Root of Trust security embedded into the hardware itself. Firmware digital signatures are verified each time the system is booted as well as before installing any new firmware, providing a tamper proof solution.

Emulex's digitally signed drivers are integrated with all the major enterprise operating systems. Drivers are digitally signed and are verified to be authentic code written by Broadcom before they can be installed.

T10 Protection Information (T10-PI) data integrity provides data protection from the server to the storage array. As one of the founders of the Data Integrity Initiative, Emulex, along with Oracle and Seagate, was instrumental in defining the T10-PI standard, which, along with the Data Integrity Extensions standard, delivers full end-to-end data integrity.

Forward Error Correction (FEC) is a Fibre Channel standard feature for HBAs and switches that provides enhanced data reliability and performance by automatically detecting and recovering from bit errors. It is especially useful in diverse and complex user environments such as blade server system implementations. FEC is a digital signal processing technique that introduces redundant data, called an error correcting code, prior to data transmission or storage. FEC then provides the receiver with the ability to correct errors without a reverse channel to request the retransmission of data, thereby improving performance. FEC is standard on Gen 7/6 at 32GFC and higher speeds. It can be enabled on Gen 7/6 at 16GFC speed.

Control

The flagship Emulex HBA Manager enterprise-class management application features a multiprotocol, cross-platform architecture that provides centralized management of all current and previous generations of Emulex FC HBAs.

This enables IT administrators to manage network connectivity with one tool for maximum efficiency.

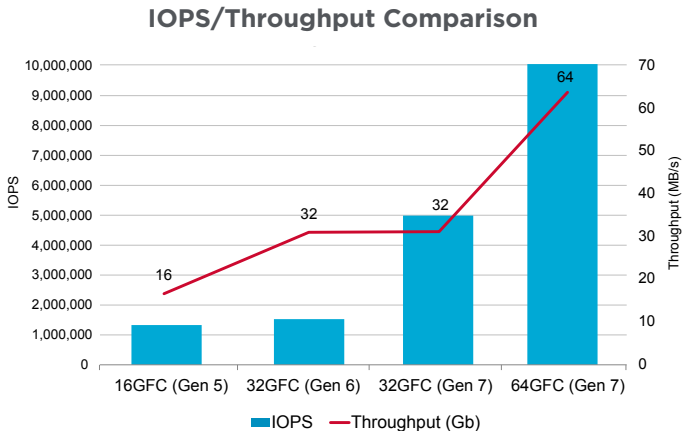
Troubleshooting Emulex HBAs is simplified with Emulex HBA Capture, an Emulex device driver utility that gathers system, adapter, device driver, and applications information. Data collected by Emulex HBA Capture is compressed into a single file and can be sent to Broadcom Technical Support for analysis when debugging system issues or for diagnostic purposes.

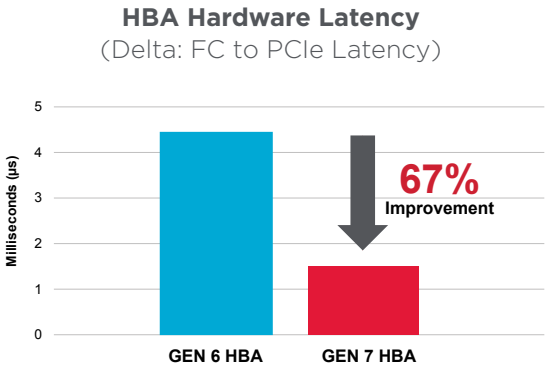
Additionally, Emulex-branded Gen 7 and Gen 6 FC HBAs support a range of Brocade features including Brocade I/O Insight, ClearLink (D_Port), Link Cable Beaconing, Host Name Registration and Read Diagnostic Parameters and more.

Emulex Gen 7 and Gen 6 HBAs are managed HBAs—intelligent adapters designed to work with the Emulex SAN Manager application (available separately) to reduce the cost and complexity of managing enterprise-class SANs via the following:

- Centralized in-band access to managed HBAs across the SAN including access to optical transceiver statistics that can be downloaded for analysis to help detect optic degradation; lists queue depths by port.
- Visibility into the endpoints of the fabric, including complete SAN HBA host inventory, host names, and OS, software, and firmware versions; identifies multipath misconfiguration errors.
- Automatic identification and mitigation of application performance problems with direct communication between Emulex HBAs and Brocade fabric switches and directors.

Performance Comparisons of Emulex Fibre Channel HBA Generations

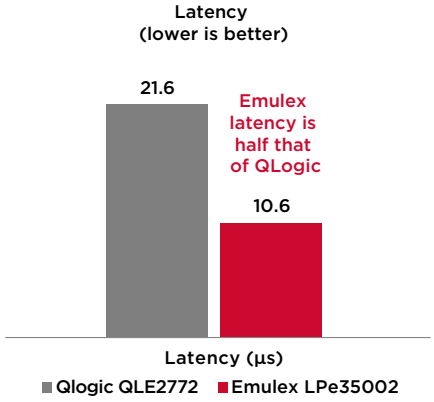


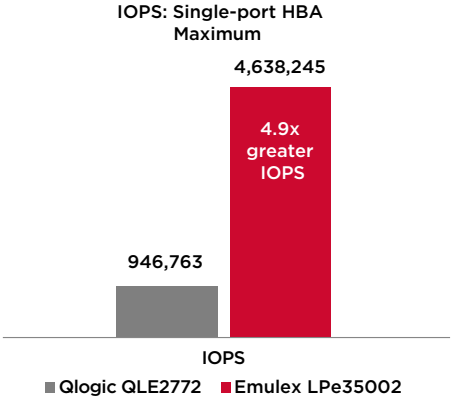


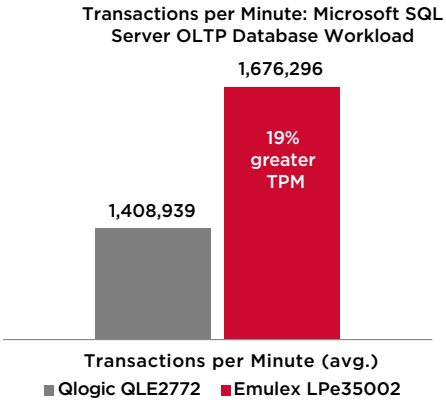
- Emulex Gen 7 HBAs deliver an industry leading 10 million IOPS[2]
  - Up to 5x more than the competitors best performing 32GFC HBA

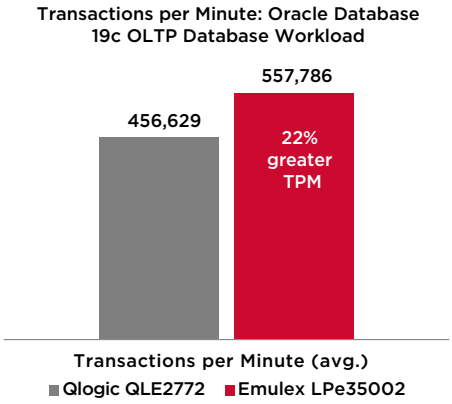
Emulex Gen 7 HBAs were designed to address the revolution of low storage communication latency in modern NVMe datacenters. The fast path hardware architecture design **reduces average hardware latency to one third** of the latency seen in the previous generation Emulex Gen 6 HBA[3]

Emulex Gen 7 32GFC Performance vs. Other 32GFC HBAs[4]









2 - The Tolly Group, Emulex LPe36000-series Performance, 5-2021

3 - Demartek testing 12-2018

4 - The Tolly Group, Emulex LPe35002 HBA 32G performance versus Marvell QLogic QLE2772, 4-2020

Maximum performance and superior management efficiency for the broadest range of data center environments

Feature	Description	PCIe 4.0 HBAs		PCIe 3.0 HBAs	
		LPe36000 LPe36002	LPe35000 LPe35002 LPe35004	LPe32000 LPe32002 LPe32004	LPe31000 LPe31002 LPe31004
Link speed support	4GFC				•
	8GFC		•	•	•
	16GFC	•	•	•	•
	32GFC	•	• Upgradeable to 64GFC[1] (except 4-port model)	•	• Upgradeable to 32GFC (except 4 port model)
	64GFC	•			
Ports	Number of Fibre Channel connections on one HBA	1, 2	1, 2, 4	1, 2, 4	1, 2, 4
Throughput per model (MB/s, full duplex)	Large block transfer speed	LPe36000: 12,800 LPe36002: 25,600	LPe35000: 6,400 LPe35002: 12,800 LPe35004: 25,600	LPe32000: 6,400 LPe32002: 12,800 LPe32004: 25,600	LPe31000: 3,200 LPe31002: 6,400 LPe31004: 12,800
IOPS	Input/output operations per second per port	10M	5M	1.6M (total)	1.6M (total)
PCIe bus		4.0	4.0[5]	3.0	3.0
HBA port virtualization	N_Port ID Virtualization (NPIV)	•	•	•	•
NVMe over Fibre Channel (NVMe/FC)	Supports NVMe/FC and SCSI over FC concurrently.	•	•	•	•
Emulex SAN Manager (ESM) compatible	Automatic congestion management, transceiver health statistics, inventory feature, and multi-path misconfiguration reporting.	•	•	•	•
Fabric Performance Impact Notifications (FPIN)	Supports FPINs including Link Integrity Notification (FPIN-LI), Congestion notification (FPIN-CN), Peer Congestion notification (FPIN-PN), and Delivery notification (FPIN-DN).	•	•	•	•
Dynamic Multi-core Architecture	Unparalleled performance and port utilization with eight processing cores that dynamically apply ASIC resources to any port.	•	•	•	•
Buffer Credit Recovery (B2B credit recovery)	Maintains maximum performance between ports under marginal link conditions.	•	•	•	•
T10-PI with offload	T10-PI end-to-end data integrity support with hardware offload	•	•	•	•
ClearLink diagnostics port (D_Port)	Optical and signal integrity for optics and cables	•	•	•	•
Forward Error Correction	Enhanced data reliability and performance by automatically detecting and recovering from bit errors.	•	•	•	•
Secure Firmware Updates (software-based solution)	Protects the integrity of firmware with compliance to NIST SP 800-193 standards			•	•
Silicon Root of Trust (hardware-based solution)	Hardware-based protection against malicious firmware downloads. Complies to NIST SP 800-193 standards.	•	•		
Brocade I/O Insight, Link Cable Beaconing, Host Name Registration, Read Diagnostic Parameters	Advanced I/O monitoring and diagnostics.	•	•	•	•
Trunking (port aggregation)	Aggregates physical ports to form a single, logical, high-bandwidth port up to 128GFC.	•	•		
HBA resources	Exchanges and logins	12,288	12,288	12,288	12,288
	Virtual functions	32	32	32	32
Message-Signaled Interrupts support	MSI	•	•	•	•
	MSI-X	•	•	•	•
	Number of MSI-X vectors supported	1,024	1,024	1,024	1,024

5 - LPe35004 supports PCIe 3.0 x16

Maximum performance and superior management efficiency for the broadest range of data center environments

Feature	Description	PCIe 4.0 HBAs		PCI 3.0 HBAs	
		LPe36000 LPe36002	LPe35000 LPe35002 LPe35004	LPe32000 LPe32002 LPe32004	LPe31000 LPe31002 LPe31004
Operating system	Windows	•	•	•	•
	Linux	•	•	•	•
	VMware	•	•	•	•
	Solaris	•	•	•	•
FC-Tape		•	•	•	•
All topologies	Auto detect — P To P; FC-AL; fabric	• No auto detect for FC-AL	• No auto detect for FC-AL	• No auto detect for FC-AL	• No auto detect for FC-AL
Fibre Channel fabric boot	X86 BootBIOS	•	•	•	•
	UEFI	•	•	•	•
	OpenBoot	•	•	•	•
FC-SP-2 compliance	Fibre Channel Security Protocol with DH-CHAP authentication (host to switch)	•	•	•	•
Common management interface (FDMI)	Industry-standard interface across all operating system environments	•	•	•	•
Firmware upgrade	Upgradeable features on installed base	•	•	•	•
Firmware independent drivers	Update F/W or drivers separately simplifies SAN management	•	•	•	•
End-to-end Parity/CRC	Data protection	•	•	•	•
Host PCI slot compatibility	Short length (standard height)	•	•	•	• 4 port low profile model available
	Low profile compatible	•	• 4-port is full-height	•	•
Media interface	LC multi-mode/short wave	•	•	•	•
	Digital diagnostics	•	•	•	•
	Long-wave optics (optional kits)	•	•	•	•

Options

Part number	Description
LPe16100-OPT	16GFC optic (short wave laser with LC connector SFP+ optic) — 1 pack
LPe16100-OPTx2	16GFC optics (short wave laser with LC connector SFP+ optic) — 2 pack
LP16-LW-OPT-1	16GFC long wave optic (long wave laser with LC connector SFP+ optic) — 1 pack
LP16-LW-OPT-2	16GFC long wave optics (long wave laser with LC connector SFP+ optic) — 2 pack
LP32-SW-OPT-1	Gen 6 (32GFC) spare optic (short wave laser with LC connector SFP+ optic) — 1 pack
LP32-SW-OPT-2	Gen 6 (32GFC) spare optics (short wave laser with LC connector SFP+ optic) — 2 pack
LP32-LW-OPT-1	32GFC long wave optic (long wave laser with LC connector SFP+ optic) — 1 pack
LP32-LW-OPT-2	32GFC long wave optics (long wave laser with LC connector SFP+ optic) — 2 pack
LP64-SW-OPT-1	64GFC shortwave optic (short wave laser with LC connector SFP+ optic) — 1 pack
LP64-SW-OPT-2	64GFC shortwave optics (short wave laser with LC connector SFP+ optic) — 2 pack
LP64-LW-OPT-1	64GFC long wave optic (long wave laser with LC connector SFP+ optic) — 1 pack
ECD-ESM-EN1Y	Emulex SAN Manager, Enterprise Product, 1 YR

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