BROADCOM

Solution Brief

Emulex®-Branded Fibre Channel HBA Product Line

Emulex®-branded Fibre Channel (FC) Host Bus Adapters (HBAs) from Broadcom are designed to address the demanding performance, reliability, security, and management requirements of today's enterprises.

The product line offers a variety of performance and feature options such as Zero Trust, encryption with post-quantum cryptography (PQC) for autonomous in-flight encryption, diagnostics, congestion management, and troubleshooting features to meet the needs of a wide range of enterprise applications.

Additionally, Emulex's newest Gen 7 SecureHBA delivers a the highest level of security and a Zero Trust platform that includes the following features:

- PQC Security Protocol and Data Model (SPDM) authentication of endpoints
- PQC silicon root of trust hardware-based firmware authentication
- Secure boot, digitally signed drivers, T10-DIF, and more

Emulex fully supports industry standards that further enhance Broadcom® Autonomous SAN innovations to self-learn, self-optimize, and self-heal in order to proactively keep the SAN running at maximum speed and avoid downtime. 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 Dual Port (Bidirectional)	NVMe Over FC	Mission-Critical Features
Gen 7 64GFC	LPe38100 **SecureHBA**	Over 12M	25,600 MB/s	Yes	• PQC Zero Trust Architecture: – PQC for autonomous in-flight encryption – PQC Silicon root of trust (RoT) firmware authentication – PQC Security Protocol and Data Model (SPDM) – Includes all Gen 7 features listed below
Gen 7 32GFC	LPe37100 **SecureHBA**	Over 6M	12,800 MB/s	Yes	
Gen 7 64GFC	LPe36000	Up to 10M	25,600 MB/s	Yes	• PCIe 4.0 bus for the latest AMD and Intel servers • 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) • Support for the Brocade® Fabric Vision® suite of features including ClearLink™ (D_port), Link Cable Beaconing, Host Name Registration, Read Diagnostic Parameters, VMID, BB_Credit Recovery, FC-Trace, FC-Ping, REST APIs, and more • T10-PI data integrity offload • Emulex HBA Capture • Hot-plug optics • LPe37100/LPe35000 series can be upgraded from 32GFC to 64GFC with hot-plug optics kits[a]
Gen 7 32GFC	LPe35000	Up to 5M	12,800 MB/s	Yes	

a. 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 over 12 million IOPS on Emulex Gen 7 SecureHBAs.

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 lower latency than SCSI over Fibre Channel and support NVMe over Fibre Channel and SCSI over Fibre Channel with a single driver that supports both protocols 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. Having earned an "It Just Works" reputation is based on over 17 million installed ports with proven industry-leading reliability of 10 million hours field mean time between failures (MTBF).

Emulex SecureHBAs introduce a cost-effective, easy-to-manage solution that encrypts all data in flight (also known as EDIF), protecting data as it moves from databases/applications between servers and storage. Emulex SecureHBAs integrate PQC algorithms to ensure that encrypted data remains encrypted even as quantum computing and AI put legacy encryption at risk. The session-based key management solution, based on the ANSI/INCITS FC-SP-3 standard, does not require complex and prohibitively expensive key management software.

The Zero Trust platform features Security Protocol and Data Model (SPDM), which provides cryptographic authentication of endpoints, and Silicon Root of Trust, a hardware-based firmware authentication that enables compliance with the NIST 800-193 framework. 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.

InterNational Committee for Information Technology Standards (INCITS) 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 an INCITS Fibre Channel 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 FC HBAs support the Brocade Fabric Vision suite of features including ClearLink (D_Port), Link Cable Beaconing, Host Name Registration, and Read Diagnostic Parameters.

The Emulex SAN Manager application (available separately) reduces the cost and complexity of managing enterprise-class SANs via the following:

- Centralized in-band access to 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.
- Provides a fabric-wide view of encryption capabilities and policies, as well as detailed port-level information on encrypted connections and deployment of post-quantum cryptography.

Emulex 64G SecureHBAs Versus Other 64G HBAs

HBA IOPS Achieved Compared to 64G Fibre Channel IOPS Maximum

Testing shows that the Emulex HBA exceeds the product performance specification of 10M IOPS at 2K block size.

For the essential database block sizes of 4K and 8K, Emulex SecureHBA is able to drive IOPs at over 92.4% of the 64G FC link maximum, reinforcing the importance of its 10M IOPS product specification to get full value from 64G Fibre Channel.

QLogic's 2M IOPs spec was only able to drive maximum IOPS of 32% and 58% of the theoretical Fibre Channel maximum, respectively.

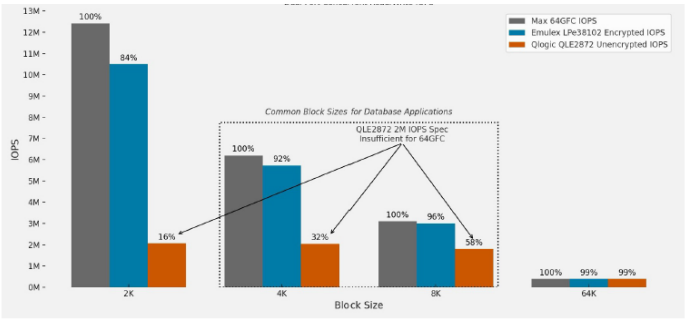


Figure 1: Emulex SecureHBA Encryption Enabled, Dual-Link IOPS vs. QLogic Unencrypted, vs. 64G Link Maximum (as Reported by FIO). Tolly Test Report #225146; click here to read the report.

HBA MB/s Achieved Compared to 64G Fibre Channel Bandwidth Maximum

Testing shows Emulex SecureHBA LPe38102 with encryption pushes the bandwidth maximum at 4k and 8k block sizes, extracting the full value of 64G Fibre Channel.

The QLogic QLE2872 without encryption throughput is far below both Emulex performance and the maximum bandwidth for 64G Fibre Channel.

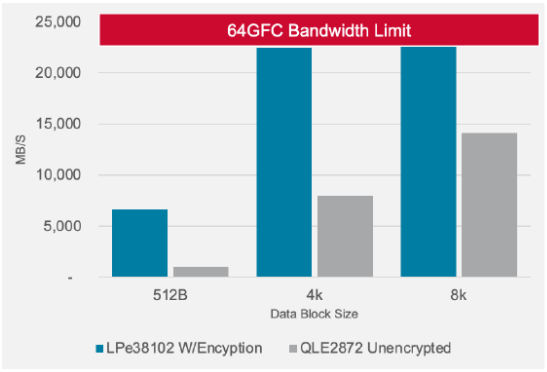


Figure 2: FIO Performance 2x64G Fibre Channel Read/Write (as Reported by FIO). Tolly Test Report #225146; click here to read the report.

Encrypted vs. Non-encrypted Performance: Oracle 19c Database

The transactions per minute (TPM) results for Emulex SecureHBA with encryption are 51% greater than QLogic without encryption.

Similarly, the CPU efficiency (TPM/server CPU) was 67% better for the Emulex SecureHBA.

Finally, the 95th percentile stored procedure latency was 46% lower (better) than QLogic.

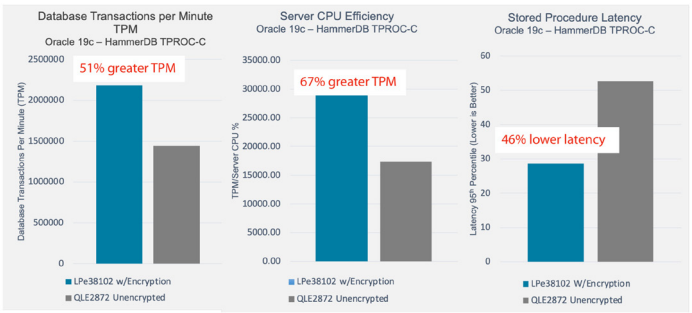


Figure 3: Emulex SecureHBA Encrypted vs. QLogic Non-Encrypted Performance (as Reported by HammerDB). Tolly Test Report #225146; click here to read the report.

Maximum Performance, Security, and Superior Management Efficiency for the Broadest Range of Data Center Environments

Feature	Description	PCIe 4.0 HBAs	
		LPe38100 LPe38102 LPe36000 LPe36002	LPe37100 LPe37102 LPe35000 LPe35002 LPe35004
Link Speed Support	8GFC		•
	16GFC	•	•
	32GFC	•	• Upgradable to 64GFCb (except 4-port model)
	64GFC	•	
Ports	Number of Fibre Channel connections on one HBA	1, 2	1, 2, 4
Throughput per Model (MB/s, Full Duplex)	Large block transfer speed	LPe36000: 12,800 LPe36002: 25,600 LPe38100: 12,800 LPe38102: 25,600	LPe35000: 6400 LPe35002: 12,800 LPe35004: 25,600 LPe37100: 6400 LPe37102: 12,800
IOPS	Input/output operations per second per port	LPe38102: over 12M LPe36002: up to 10M	LPe37102: over 6M LPe35002: up to 5M
PCIe Bus		4.0	4.0[b]
HBA Port Virtualization	N_Port ID Virtualization (NPIV)	•	•
Post-Quantum Cryptography	Quantum-resistant algorithms meet CNSA 2.0, DORA and NIS2 mandates	LPe38102, LPe38100	LPe37102, LPe37100
PQC Autonomous In-Flight Encryption (AES-GCM-256)	Encrypts all data in flight (EDIF), protecting data as it moves from databases/applications between servers and storage, and simplified session-based key management (FC-SP-3)	LPe38102, LPe38100	LPe37102, LPe37100
Silicon Root of Trust (Hardware-Based Solution)	Hardware-based protection against malicious firmware downloads. Complies to NIST SP 800-193 standards. (PQC uses the Leighton-Micali signature (LMS))	PQC: LPe38000 series Non-PQC: LPe36000 series	PQC: LPe37000 series, LPe37100 Non-PQC: LPe35000 series
NVMe over Fibre Channel (NVMe/FC)	Supports NVMe/FC and SCSI over FC concurently	•	•
Emulex SAN Manager (ESM) Compatible	Automatic congestion management, transceiver health statistics, inventory feature, and multipath 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	•	•
Brocade I/O Insight, Link Cable Beaconing, Host Name Registration, Read Diagnostic Parameters	Advanced I/O monitoring and diagnostics	•	•
HBA Resources	Exchanges (XRI) and logins (RPI)	6000 XRI 2048 RPI	6000 XRI 2048 RPI
Message-Signaled Interrupts Support (per HBA)	MSI	•	•
	MSI-X	•	•
	Number of MSI-X vectors supported	1024	1024

b. LPe35004 supports PCIe 3.0 x16.

Feature	Description	PCIe 4.0 HBAs	
		LPe38100 LPe38102 LPe36000 LPe36002	LPe37100 LPe37102 LPe35000 LPe35002 LPe35004
Operating System	Windows	•	•
	Linux	•	•
	VMware	•	•
FC-Tape		•	•
All Topologies	Auto detect: P To P; FC-AL; fabric	• No autodetect for FC-AL	• No autodetect for FC-AL
Fibre Channel Fabric Boot	X86 BootBIOS UEFI	• •	• •
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	Upgradable 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) 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
LP32-SW-OPT-1	Gen 6 (32GFC) spare optic (short-wave laser with LC connector SFP+ transceiver) — 1 pack
LP32-SW-OPT-2	Gen 6 (32GFC) spare optics (short-wave laser with LC connector SFP+ transceiver) — 2 pack
LP32-LW-OPT-1	32GFC long-wave optic (long-wave laser with LC connector SFP+ transceiver) — 1 pack
LP32-LW-OPT-2	32GFC long-wave optics (long-wave laser with LC connector SFP+ transceiver) — 2 pack
LP64-SW-OPT-1	64GFC short-wave optic (short-wave laser with LC connector SFP+ transceiver) — 1 pack
LP64-SW-OPT-2	64GFC short-wave optics (short-wave laser with LC connector SFP+ transceiver) — 2 pack
LP64-LW-OPT-1	64GFC long-wave optic (long-wave laser with LC connector SFP+ transceiver) — 1 pack
ECD-ESM-EN1Y	Emulex SAN Manager, Enterprise Edition, 1 year

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