Emulex Engine™ XE201

I/O Controller

Highly Scalable, Multi-fabric, Comprehensive Management



One Product, One SKU, Multiple I/O Connectivity Options

In a market landscape that has more I/O options to choose from than ever before, the XE201 PCI Express (PCIe) 3.0 I/O controller (IOC) provides best-of-breed Fibre Channel (FC) connectivity, along with Ethernet and multiple Ethernet-based storage protocols, providing unique connectivity combinations on a single ASIC.

The XE201 delivers the industry's first native Gen 5 Fibre Channel (16GFC /8GFC) and 10Gb Ethernet (10GbE) product that enables you to choose a combination of up to four ports of native Gen 5 8GFC and 16GFC, Fibre Channel over Ethernet (FCoE), iSCSI (software), RDMA over Converged Ethernet (RoCE), 10GbE and 40GbE for the ultimate in design flexibility. The XE201 delivers a low-power, single-chip solution that may be incorporated into industry-standard PCI Express (PCIe) expansion cards, custom format mezzanine cards, special-purpose storage target controllers, daughter cards or integrated directly into a system motherboard (e.g., LOM).

Breakthrough Scalability Powers More Virtual Machines, More Workload

With its unique eight processor core architecture, the XE201 takes convergence and scalability to a new level, supporting ever expanding virtualization and cloud initiatives. The XE201 implements in hardware what was previously designed into firmware to deliver optimum performance. The controller design took a holistic system approach with Emulex vEngine™ technology, offloading more I/O onto the XE201 ASIC, thereby lowering the CPU burden on the host server. In terms of scalability, the XE201 supports up to 255 Virtual Functions (VFs),* 1024 Message Signal Interrupts (MSI-X), 8192 concurrent logins and open exchanges for Fibre Channel and FCoE, and 2048 queue pairs for Ethernet. Emulex vScale™ dynamic resource pooling enables unmatched workload scalability across protocols.

EMULEX Gen 5 Fibre Channel

Key Benefits

- Attain the ultimate in connectivity flexibility with multi-network protocol options—Fibre Channel, FCoE, iSCSI (software), RoCE and Ethernet connectivity
- Achieve extreme application acceleration performance for Fibre Channel with more than 1.2 million I/O operations per second (IOPS), as well as dramatic improvements in application response times, plus MSI-X support, enabling multi-threaded interrupt support for multi-core servers
- PCIe 3.0 bus interface provides increased performance to match the capabilities of PCIe 3.0 capable servers
- Unique quad-port density and high-availability combo configurations
- Advanced data integrity protects against silent data corruption
- Lower overall capital expenditures (CAPEX) and operational expenditures (OPEX) costs by 50% through support of new network convergence strategies
- Meet slot and board real estate constraints with feature-rich multi-fabric Fibre Channel and Ethernet support
- Differentiate in virtualization and cloud markets with support for leading-edge virtualization features, such as support for N_Port ID Virtualization (NPIV), Single Root I/O Virtualization (SRIOV), VMQ, Netqueue and the ability to assign quality of service (QoS) at the virtual machine (VM) level

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Breakthrough Features for Unique Product Differentiation

Beyond unmatched multi-protocol functionality and performance, the XE201 supports a wide range of new features for both server initiator and storage target modes, including:

- End-to-end data integrity with BlockGuard™ T10 Protection Information (T10 PI) offload eliminates silent data corruption as data traverses the system from the operating system (OS) all the way to the disk array. The XE201 features high performance, hardware offload of data integrity checks, eliminating the performance penalty of software-enabled T10 PI implementations
- Virtualization and Cloud Scalability:
  - vScale™ workload-based performance and scalability—multi-core ASIC engine with eight cores, running a combination of standard protocols and specialized functions
  - Eight independent processing cores enable dramatic improvement in application response time, accelerating most applications by more than 50% through the IOC
  - All eight cores can work with each port. The XE201 will automatically apply all required processing power and cores to any port, which can significantly improve the performance of single port implementations
  - vScale resource pooling—dynamically allocates resources to multiple protocols, enabling scale-up of up to 255 VFs* + 1 physical function (PF) per ASIC
  - vEngine™—I/O offload lowers CPU burden on host server, enabling support for more VMs
  - vPath™—supports emerging I/O standards including SR-IOV, Virtual Ethernet Port Aggregator (VEPA) and Virtual Ethernet Bridge (VEB), all of which are supported by an internal Emulex Ethernet switch that allows data to be forwarded between VMs, which are collocated on same adapter, without travelling to an external switch, for higher performance and ensuring traffic isolation
- Comprehensive management support:
  - Internal thermal and power instrumentation
  - Administer multiple protocols from a single, integrated interface with OneCommand® Manager
  - Common driver architecture—the same device drivers work across all generations of Emulex Fibre Channel and networking adapters and ensures in-box and in-distribution driver support with leading OS vendors

Key Features

- Combinations of Gen 5 16GFC/8GFC and/or 10GbE, or a single 40GbE port
- PCIe 3.0 bus interface
- Virtualization and cloud scalability features to support up to 255 VFs,* 2048 queue pairs for Ethernet and lower CPU overhead
- End-to-end enhanced data integrity with ECC, parity and support of Emulex-patented BlockGuard® offload implements the T10 PI standard to prevent silent data corruption
- GreenState™ power efficiency—4 times better IOPS performance per watt
- Compatible with short- and long-wave optics
- Supports Emulex Service Level Interface (SLI 4) to enable driver compatibility with standard Emulex common drivers
- FC/FCoE Linux, FreeBSD Target mode driver software development kit to speed deployment
- Extensive boot code, such as support for network boot, FCoE Boot and Universal Boot
- Supports both initiator and target modes

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General Specifications

- The host system interface of XE201 converged fabric controller consists of an eight-lane (x8) PCIe 3.0 (backward compatible with PCIe 2.0) bus. The XE201 supports up to four physical interfaces (ports) that may use either the native Fibre Channel (physical layer) protocol at speeds up to 16GFC, or the Ethernet protocol up to 40GbE.

Key Features

- 8-lane (x8) PCIe 3.0 host interface
- Backward compatible with PCIe 2.0
- Up to 2 network interfaces at Gen 5 Fibre Channel (16GFC)
- Up to 4 network interfaces at Gen 5 (8GFC)
- Up to 4 network interfaces at 10GbE (2 ports max. for KX4 interfaces)
- Up to 1 network interface at 40GbE
- Individually configurable network interfaces allow mixing Fibre Channel and 10GbE/DCB ports
- Unused network ports may be powered off to reduce power consumption
- Executes over 1.2M IOPS
- Supports Initiator and Target modes
- Multiple Upper Level Protocol (ULP) engines minimize host CPU demands
- T10 PI support assures data integrity and compliance
- PCIe SR-IOV compliant for up to 256 VMs* (255 VFs + 1 PF)
- 8 PCIe PFs configurable across all network ports
- MSI-X support for 1024 messages/vector
- Configurable PCIe SerDes settings
- Configurable network port SerDes settings

Diagnostics Supported

- JTAG Boundary Scan
- Memory Built-in Self Test (BIST)
- Embedded Trace Monitor
- Embedded Trace Buffer
- Firmware based test suite
- Digital Diagnostics Management Interface (DDMI) support through I2C interface

Reliability, Availability and Serviceability (RAS)

- Provides debug capabilities for descriptor processing, data handling and assist functions
- Supports Promiscuous mode
- Error injection support for diagnostics
- Functional firmware is field upgradeable across the PCIe bus
- Support for updating firmware even if previous update failed (de-bricking)
- Completes POST testing in less than 2 seconds after power on
- Reset/recovery on one port does not affect other ports
- Reset/recovery on one function does not affect other functions
- Reset/recovery on one I/O queue does not affect other queues
- Internal loopback functions supported
- Nonvolatile error logging support
- Byte parity/ECC error checking for all internal registers, data structures and busses
- End-to-end overlapping data integrity coverage using CRC, parity and ECC
- Temperature management with four independent monitoring points

Interface

- Supports direct attached copper (twisted pair) and optical interfaces

Fibre Channel Specifications

Industry Standards

- Current ANSI/IETF Standards: Point-to-point (N_Port); FC-PI-4; FC-PI-5; FC-FS-2 with Amendment 1; FC-AL-2 with amendments 1 and 2; FC-LS-2; FC-GS-6; FC-DA; FCP-4; FC-MJS; FC-SB-4; SPC-4; SBC-3; SSC-3; RFC4338
- Legacy ANSI/IETF standards: FC-PH; FC-PH-2; FC-PH-3; FC-PI; FC-PI-2; FC-FS; FC-AL (2GFC,4GFC,8GFC); FC-GS-2/3/4/5; FCP; FCP-2; FC-SB-2; FC-FLA; FC-HBA; FC-PLDA; FC-TAPE; FC-MI; SPC-3; SBC-2; SSC-2; RFC2625

Architecture

- Supports 16GFC, 8GFC and 4GFC link speeds, automatically negotiated
- Supports up to 2 FC ports at 16GFC max., or
- Supports up to 4 FC ports at 8GFC max.

Fibre Channel Resources

- Concurrent Logins (RPI): 8192 per ASIC
- Open Exchanges (XRI): 8192 per ASIC
- Buffer to Buffer credits: Supports 10KM link at 16GFC

Emulex OS Driver Support

- Illumos (through Nexenta)
- Red Hat Enterprise Linux (RHEL)
- Solaris
- SUSE Linux Enterprise Server (SLES)
- VMware vSphere
- Windows Server including Hyper-v
- Custom driver development supported via Emulex exclusive Service Level Interface (SLI) API

Remote Boot Support

- Network Boot (PXE), UEFI and OpenBoot support including PXE, iBFT, FCoE and Fibre Channel

Data Integrity

- Supports Protection Information/Data Integrity Field standard per T10 working group (T10 PI) with high performance offload
  - Simultaneous 512-Byte and 520-Byte block support
  - Simultaneous 4096-Byte and 4104-Byte block support
  - DIF Error Reporting
- End-to-End CRC (ECRC) support per PCIe 3.0 specification
- GMAC support

Ethernet Networking Specifications

Industry Standards

- IEEE 802.3ba 40GBASE Ethernet ports (40GBASE-KR4/40GBASE-CR4)
- IEEE 802.3ae 10GBASE Ethernet ports (10GBASE-KR/10GBASE-KX4/XAUI)
- IEEE 802.3boot 1000BASE Ethernet ports (1000BASE-KX/SGMII)
- IEEE-802.3ap Backplane Ethernet Interfaces
  - 1000BASE-KX (1GbE copper connection)
  - 10GBASE-KX4 (10GbE over 4 lanes)
  - 10GBASE-KR (10GbE over 1 copper lane)
  - 40GBASE KR4 (40GbE over 4 lanes)
- IEEE 802.3x Flow control with Pause frames
- IEEE 802.1p QoS tagging
- IEEE 802.1Qbg Edge Virtual Bridging
- IEEE 8021Qbh Bridge Port Extension
- IEEE 802.3ad Link Aggregation Control Protocol (LACP)

Architecture

- Supports up to four 10GbE network ports, or one 40GbE port
- Supports SFP+ optical interface devices
- IEEE 802.3 Clause 49 (10GBASE-SR)

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Data Center Bridging Support

- IEEE 802.1Qau Ethernet congestion management
- IEEE 802.1Qaz Enhanced Transmission Selection (ETS)
- IEEE 802.1Qbb Priority Flow Control (PFC)

System Level Design

- System Management Interface bus (SMbus)
- RMII DMTF NC-SI system management interface
- I^2C management interface support
- IPMI pass-through from 10Gb Ethernet to SMBus or RMII interface
  - IPMI support independent of other network operations (PXE, system state, etc.)
- Serial over LAN (SoL) pass-through from 10Gb Ethernet to SMBus or RMII interface
  - SoL support independent of other network operations (PXE, system state, etc.)
  - SoL failover for multi-port applications
- Integrated Thermal Sensor works with management utilities

Ethernet Network Interface Card (Layer 2 NIC) and TCP/IP Specifications

- NDIS 5.2, 6.0 and 6.2 compliant Ethernet functionality
- IPv4/IPv6 TCP, UDP checksum offload
- IPv4/IPv6 Receive Side Scaling (RSS)
- IPv4/IPv6 Large Send Offload (LSO)
- Supports 2K offloaded connections
- 2K Tx and 2K Rx queues
- Programmable MAC addresses
- 2048 unicast MAC addresses with hardware filtering
- Wire speed on-chip CAM for packet filtering and steering
- Support for s-channels
- Multicast MAC address filtering
- Broadcast frame filtering per port
- VLAN insertion and extraction
- Jumbo packet support up to 9000 Bytes
- Support for NIC teaming including failover load balancing and Virtual LAN (VLAN) creation
- Wake-On LAN (WOL): D3 cold support
- Support for 4 Magic Packets

Software iSCSI Specifications

- Software iSCSI target and Initiator support
- Software iSCSI Boot (iBFT)
  - Legacy BIOS and UEFI support

Fibre Channel over Ethernet (FCoE) Specifications

- ANSI T11 FC-BB-5 support
- Programmable World Wide Name (WWN)
- Support for FC Fabric and Point-to-Point topologies
- Support for FC Class 3
- FCP Initiator and Target modes
- FC-TAPE
- Class 3 Error Recovery (REC-SRR)
- Support for FICON extensions
- Concurrent Logins (RPI): 8192 per ASIC
- Open Exchanges (XRI): 8192 per ASIC
- 16K concurrent logins per Target port
- FC-2 Priority Bit support
- 255 N_Port IDs per physical N_Port
- Common HBA API (cHBA API) support
- Virtual Storage Area Network (T11 VSAN) support
- SR-IOV compliant FCoE interfaces for VMs with 255 virtual functions*

Remote Direct Memory Access (RDMA) Specifications

- Direct data placement in application buffers without CPU intervention
- Supports IBTA RoCE specifications
- Linux Open Fabrics Enterprise Distribution (OFED) support

I/O Virtualization (IOV) Support

- Complies with PCI-SIG specifications for I/O virtualization (IOV)
  - SR-IOV
- PCI-SIG Address Translation Service (ATS) v1.1
- Virtual Switch Port Mirroring for diagnostic purposes
- Virtual Network Tagging (VNTag) support
- Virtual Ethernet Bridging (VEB)
- Support for up to 255 VFs*
- QoS for controlling and monitoring bandwidth assigned to and used by virtual entities
- Configurable control of bandwidth by physical port, virtual entity and protocol
- Traffic Shaping and QoS across each VF and PF:
- NIC fine-grain QoS 10 Mbps to 10 Gbps in 10 Mbps increments
- HBA fine-grain QoS in 1000 IOPS increments

Electrical Specifications

- Power supply 1.8V, 1.2V, 0.9V

Package Type

- 29mm x 29mm 762-ball grid array
- RoHS (lead free) compliant, including China RoHS

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