

Product Brief

Intel® Ethernet Converged Network Adapters X710
With Support for SFP+ Connections
Network Connectivity



Intel® Ethernet Converged Network Adapters X710 10 GbE



Extending Intel® Virtualization Technology beyond Server Virtualization to the Network with Hardware Optimizations and Offloads for the Rapid Provisioning of Networks in an Agile Data Center

Key Features

- Dual- and quad-port 10 GbE adapters
- PCI Express* (PCIe) 3.0, x8
- Exceptional Low Power Adapters
- Network Virtualization offloads including VXLAN, NVGRE, Geneve, Network Service Headers (NSH)²
- Intel® Ethernet Flow Director for hardware based application traffic steering
- Data Plane Developer Kit (DPDK) optimized for efficient packet processing
- Excellent small packet performance for network appliances and Network Function Virtualization (NFV)
- Intelligent offloads to enable high performance with Intel® Xeon® processor-based servers
- I/O virtualization innovations for maximum performance in a virtualized server
- Unified networking providing a single wire support for LAN and storage: NAS (SMB, NFS) and SAN (iSCSI)¹

Overview

Intel continues its legacy of Ethernet leadership by introducing a 10/40 gigabit family of adapters powered by the Intel® Ethernet X710 Controller code-named Fortville.

The X710 adapter family addresses the demanding needs of the next-generation agile data center by providing unmatched features for both server and network virtualization, flexibility for LAN and SAN networks and proven, reliable performance.

Leading 10/40 GbE Performance

The X710 adapter family delivers superior performance with a theoretical throughput of 80 Gb/s (40Gb/s Tx; 40Gb/s Rx) bidirectional throughput (quad-port adapter required), in a PCI Express v3.0 x8 slot. Optimized performance vectors and key uses include:

- **Small Packet Performance:** Achieves wire-rate throughput on smaller payload sizes (>128 Bytes for 40 GbE and >64 Bytes for 10 GbE)
- **Bulk Transfer Performance:** Delivers line-rate performance with low CPU usage for large application buffers
- **Virtualized Performance:** Alleviates hypervisor I/O bottlenecks by providing flow separation for Virtual Machines (VMs)
- **Network Virtualization:** Network virtualization overlay offloads including VXLAN, NVGRE, Geneve, Network Service Headers (NSH)²

- **Storage Performance:** Enables competitive performance with native OS drivers and intelligent offload for NAS (NFS, SMB), and SAN (iSCSI)

A Complete, Unified Networking Solution

Converging data and storage onto one fabric eliminates the need for multiple adapters, cables and switches. Furthermore both 10 and 40 gigabit Ethernet provides the bandwidth to converge these multiple fabrics onto a single wire. A key capability that makes all this possible is traffic class separation provided by Data Center Bridging (DCB)¹—providing a one-wire solution with virtual pipes for the different classes of traffic:

- **Data:** Best effort delivery of standard LAN traffic
- **Storage:** Lossless network for iSCSI
- **Management:** Guaranteed connectivity of data center IP management

One Adapter, One Price

With the Intel's adapters, iSCSI support is included in the price of an adapter. There is no need to purchase multiple adapters or additional licensing for an X710 adapter. It's simple and easy. Everything you need to unify your networking is included in a single SKU. One Adapter, One Price.

Power Savings

Power efficiency is critical to IT specialists as energy consumption is a real OpEx concern.

• **Lowest Power Consumption**

The new generation of X710 adapters are power misers. They deliver double the throughput with only half the power of the previous X520 generation.

• **Energy Efficient Ethernet (EEE)**

Reduces power consumption during periods of low data activity. Energy is used to maintain the physical layer transmitters in a "ready state" to transmit data on the wire. During periods of low data traffic, EEE sends a low-power-idle signal to put the transmitters into a "low power state" saving power and cost. When data needs to be sent, EEE sends a normal idle signal to wake up the transmit system before data is due to be sent so there is no degradation of performance.

Server Virtualization

With Intel® Virtualization Technology (VT), the X710 family of adapters deliver outstanding I/O performance in virtualized server environments. They reduce I/O bottlenecks by providing intelligent offloads for networking traffic per virtual machine (VM), enabling near-native performance and VM scalability. The host-based virtualization technologies supported by Intel® VT include:

- **VMDq for Emulated Path:** Adapter-based VM Queue sorting enabling efficient hypervisor-based switching

- **SR-IOV for Direct Assignment:** Adapter-based isolation and switching for various virtual station instances enabling optimal CPU usage in virtualized environments

Additionally, X710 adapters provide Virtual Bridging¹ support that delivers both host-side and switch-side control and management of virtualized I/O as well as the following modes of virtualized operation:

- **VEPA¹:** IEEE 802.1Qbg support for Virtual Ethernet Port Aggregator¹
- **VEB:** Virtual Ethernet Bridge support via Intel® VT

Network Virtualization

Network virtualization is the next big trend in creating an agile data center. The family of X710 adapters are ready to help you take that next step.

- **VXLAN, NVGRE, GENEVE, NSH Offloads²:** These stateless offloads preserve application performance for overlay networks. With these offloads it is possible to distribute network traffic across CPU cores.

At the same time X710 offloads LSO, GSO, and checksum from the host software reducing CPU overhead.

Intel® Ethernet Flow Director

Flow Director is an advanced traffic steering capability built into the X710 controller. It consists of a large number of flow affinity filters that direct receive packets by their flows to queues for classification, load balancing, and matching between flows and CPU cores. It eliminates context switching required within the CPU. As a result, Flow Director significantly increasing the number of transactions per second and reduces latency for cloud applications like Memcached.

Intelligent Offloads

The Intel® Xeon® processor family has demonstrated increased computing performance and increased integration of key server subsystems generation after generation. To offload is to leverage the ever-escalating computing power of the Xeon processor where appropriate and implementing complementary accelerations in the network controller—this is what Intel refers to as "intelligent offloads." By employing a balanced hybrid of compute and offload, intelligent offloads are able to achieve the optimized point of performance and efficiency. This is most notably observed in the following usage models:

- **TCP Stateless Offloads:** Demonstrates leading performance vs. TOE solutions without restricting feature usage (TOE usage usually requires that key features be disabled). Supported stateless offloads include Checksum, TSO, VMDq, and RSS.
- **Host iSCSI Initiator:** Provides exceptional performance without the need for full-offload HBA2 methods.

- **Flow Classification:** Trafficking data flows across multiple consumers and connections

Manageability

The X710 family of adapters also incorporate the manageability required by IT personnel for remote control and alerting. Communication to the Board Management Controller (BMC) is available either through an on-board SMBus port or the DMTF-defined NC-SI, providing a vari-

ety of management protocols, including IPMI, BMC Pass-thru, OS2BMC, and MCTP/SMBus and MCTP/PCIe.

World-Class Intel Support

Intel Customer Support Services offers a broad selection of technical and customer support programs. For more information, contact your local Intel representative. Service and availability may vary by country.

FEATURES	BENEFITS
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General

Intel® X710 10 Gigabit Ethernet Controller	<ul style="list-style-type: none"> • Industry-leading, energy-efficient design for next-generation 10 Gigabit performance and multi-core processors
SFP+ Connectivity	<ul style="list-style-type: none"> • X710 adapters with SFP+ connections support 10GBASE-SR, 10GBASE-LR and SFP+ Direct Attach Copper (DAC) physical media.
Low-profile	<ul style="list-style-type: none"> • Enables higher bandwidth and throughput from standard and low-profile PCIe* slots and servers
Low-profile (non-compliance)	<ul style="list-style-type: none"> • Intel does offer a 4x10 SFP+, low profile, non-PCI complaint version of the Intel® Ethernet Converged Network Adapter X710-DA4 FH. Please contact your Intel representative for information about this adapter.
Full-height	<ul style="list-style-type: none"> • Intel® Ethernet Converged Network Adapter X710-DA4 FH requires a full height slot for PCIe compliance
Load balancing on multiple CPUs	<ul style="list-style-type: none"> • Increases performance on multi-processor systems by efficiently balancing network loads across CPU cores when used with Receive-Side Scaling (RSS) from Microsoft or Scalable I/O on Linux*
iSCSI remote boot support	<ul style="list-style-type: none"> • Provides centralized storage area network (SAN) management at a lower cost than other iSCSI solutions • No additional cost for iSCSI support, included in standard adapter
Support for most network operating systems	<ul style="list-style-type: none"> • Enables widespread deployment
RoHS-compliant	<ul style="list-style-type: none"> • Complies with the European Union directive 2011/65/EU to reduce the use of hazardous materials
Intel® PROSet Utility for Windows* Device Manager	<ul style="list-style-type: none"> • Provides point-and-click management of individual adapters, advanced adapter features, connection teaming, and virtual local area network (VLAN) configuration
Time Sync (IEEE 1588*, 802.1as)	<ul style="list-style-type: none"> • Enables networked Ethernet equipment to synchronize internal clocks according to a network master clock; endpoint can then acquire an accurate estimate of the master time by compensating for link latency

I/O Features for Multi-core Processor Servers

Intel® Flow Director	<ul style="list-style-type: none"> • An advanced traffic steering capability increases the number of transactions per second and reduces latency for cloud applications like Memcached
MSI-X support	<ul style="list-style-type: none"> • Minimizes the overhead of interrupts • Load-balancing of interrupt handling between multiple cores/CPU's
Multiple Queues: 1,536 Tx and Rx queues per port	<ul style="list-style-type: none"> • Network packet handling without waiting or buffer overflow providing efficient packet prioritization • Actual number of queues will vary depending upon software implementation
Tx/Rx IP, SCTP, TCP, & UDP checksum offloading (IPv4, IPv6) capabilities	<ul style="list-style-type: none"> • Lower processor usage • Checksum and segmentation capability extended to new standard packet type

Virtualization Features

Next-Generation VMDq	<ul style="list-style-type: none"> • Up to 256 maximum VMDq VMs supported • Enhanced QoS feature by providing weighted round-robin servicing for the Tx data • Offloads the data-sorting functionality from the Hypervisor to the network silicon, improving data throughput and CPU usage • Provides QoS feature on the Tx data by providing round-robin servicing and preventing head-of-line blocking • Sorting based on MAC addresses and VLAN tags • Provides loopback functionality, where data transfer between the virtual machines within the same physical server need not go out to the wire and come back in, improving throughput and CPU usage • Supports replication of multicast and broadcast data
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FEATURES	BENEFITS
PCI-SIG SR-IOV Implementation (128 per device)	<ul style="list-style-type: none"> • Provides an implementation of the PCI-SIG standard for I/O Virtualization. The physical configuration of each port is divided into multiple virtual ports. Each virtual port is assigned to an individual virtual machine directly by bypassing the virtual switch in the Hypervisor, resulting in near-native performance. • Integrated with Intel® VTI for Directed I/O (VT-d) to provide data protection between virtual machines by assigning separate physical addresses in the memory to each virtual machine. • 64/port for dual port • 32/port for quad port
Virtual Machine Load Balancing (VLMB)	<ul style="list-style-type: none"> • Virtual Machines Load Balancing (VMLB) provides traffic load balancing (Tx and Rx) across Virtual Machines bound to the team interface, as well as fault tolerance in the event of switch, port, cable, or adapter failure.
Advanced Packet Filtering	<ul style="list-style-type: none"> • 1536 exact matched packets (unicast or multicast) • 512 hash entries each for unicast and multicast • Lower processor usage • Promiscuous (unicast and multicast) transfer mode support • Optional filtering of invalid frames
VLAN support with VLAN tag insertion, stripping and packet filtering for up to 4096 VLAN tags	<ul style="list-style-type: none"> • Ability to create multiple VLAN segments
VXLAN and NVGRE Support	<ul style="list-style-type: none"> • Preserves application performance in network virtualized environments

Manageability Features

Preboot eXecution Environment (PXE) Support	<ul style="list-style-type: none"> • Enables system boot up via the LAN (32-bit and 64-bit) • Flash interface for PXE image
Simple Network Management Protocol (SNMP) and Remote Network Monitoring (RMON) Statistic Counters	<ul style="list-style-type: none"> • Easy system monitoring with industry-standard consoles
iSCSI Boot ¹	<ul style="list-style-type: none"> • Enables system boot up via iSCSI • Provides additional network management capability
Watchdog Timer	<ul style="list-style-type: none"> • Gives an indication to the manageability firmware or external devices that the chip or the driver is not functioning

Adapter Product Features

Intel® PROSet Utility	For easy configuration and management
Plug and play specification support	Standard
Receive Side Scaling	Multiple Rx queues enable the efficient distribution of network receive processing across multiple CPUs in multiprocessor systems

Advanced Software Features—All Adapters

Adapter fault tolerance (AFT)
Switch fault tolerance (SFT)
Adaptive load balancing (ALB)
Teaming Support
IEEE 802.3ad (link aggregation control protocol)
PCIe Hot Plug*/Active peripheral component interconnect (PCI)
IEEE 802.1Q* VLANs
IEEE 802.3 2005* flow control support
Tx/Rx IP, TCP, & UDP checksum offloading (IPv4, IPv6) capabilities (Transmission control protocol (TCP), user datagram protocol (UDP), Internet protocol (IP))
IEEE 802.1p*
TCP segmentation/large send offload
MSI-X supports Multiple Independent Queues
Interrupt moderation
IPv6 offloading—Checksum and segmentation capability extended to new standard packet type

Network Operation System (NOS) Support—All Adapters

Operating System	IA-32	X86-64	IA-64
Windows Server* 2012 R2	N/A	X	N/A
Windows Server 2012 R2 Core	N/A	X	N/A
Windows Server 2012	N/A	X	N/A
Windows Server 2012 Core	N/A	X	N/A
Windows Server 2008 R2	N/A	X	N
Windows Server 2008 R2 Core	N/A	X	N
Linux* Stable Kernel version 2.6.32/3x	X	X	X
Linux* RHEL 6.5 and RHEL 7.0	X	X	X
Linux* SLES 11 SP3 and SLES 12	X	X	X
FreeBSD* 9 and FreeBSD* 10	X	X	X
UEFI* 2.1	N/A	X	X
UEFI* 2.3	N/A	X	X
VMware ESXi 5.1 ¹ (Limited Functionality)	N/A	X	N/A
VMware ESXi 5.5 ¹	N/A	X	N/A

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Specifications

General

Connections	Dual or Quad SFP+ cages for: <ul style="list-style-type: none"> • SFP+ SR fiber-optic transceivers • SFP+ LR fiber-optic transceivers • SFP+ Direct Attach cables
Network Standard	IEEE 802.3:
Physical Layer Interface	10GBASE-SR <ul style="list-style-type: none"> • (E10G41BFSR, 10G42BFSR) 10GBASE-LR <ul style="list-style-type: none"> • (E10G41BFLR) SFF-8431: 10GSFP+ DAC (Direct Attach Copper) <ul style="list-style-type: none"> • (E10G42BTDA)

Intel® Ethernet Converged Network Adapter X710 Product Codes

Configuration	Product Code	Adapter Height
X710-DA2	X710DA2	Low Profile
X710-DA4	X710DA4FH	Full Height
X710-DA4	X710DA4G1P5	Low Profile, NC

Intel® Ethernet SFP+ Twinaxial Cables

Cable Length (m)	Product Code
1	XDACBL1M
3	XDACBL3M
5	XDACBL5M

Intel® Ethernet SFP+ Optic Product Codes

Cable Length (m)	Product Code
SR Optic	E10GSFPSR
LR Optic	E10GSFPLR

Technical Features

Data rate supported per port	<ul style="list-style-type: none"> • Optical: 1 GbE/10 GbE • Direct Attach: 10 GbE
Bus type	PCI Express* 3.0 (8 GT/s)
Bus width	x8 PCI Express
Interrupt levels	INTA, MSI, MSI-X
Hardware certifications	FCC B, UL, CE, VCCI, BSMI, CTICK, KCC
Controller-processor	Intel® Ethernet Controller X710-AM2

Power Consumption

SKU	Typical Power	Maximum Power
Dual-port 10GBASE-SR	4.3W	4.8W
Dual-port 1000BASE-SX	4.0W	4.3W
Dual-port 10GBASE-LR	4.5W	5.1W
Dual-port Direct Attach (Twinax)	3.3W	3.7W
Quad-port 10GBASE-SR	6.2W	6.6W
Quad-port 1000BASE-SX	5.5W	6.0W
Quad-port 10GBASE-LR	6.9W	7.4W
Quad-port Direct Attach (Twinax)	3.6W	3.8W
Air Flow	Minimum of 1 50 LFM required	
Operating temperature	0 °C to 55 °C (32 °F to 131 °F)	
Storage temperature	-40 °C to 70 °C (-40 °F to 158 °F)	
Storage humidity	Maximum: 90% non-condensing relative humidity at 35 °C	
LED Indicators	LINK (solid) and ACTIVITY (blinking) LINK SPEED (green=10 Gbps; yellow=1 Gbps)	

Physical Dimensions

X710-DA2 Low-profile PCIe	6.578 x 2.703 inches
X710-DA4 Full-height PCIe	6.578 x 4.372 inches
X710-DA4 Low-profile NC PCIe	6.578 x 2.703 inches

For Product Information

To see the full line of Intel Network Adapters for PCI Express* visit www.intel.com/go/ethernet.

To speak to a customer service representative regarding Intel products, please call 1-800-538-3373 (U.S. and Canada) or visit support.intel.com/support/go/network/contact.htm for the telephone number in your area.

Warranty

Limited lifetime hardware warranty within 90 days of purchase. See the support document for complete warranty information at www.intel.com/support/network/sb/cs-009721.htm.

Customer Support

Intel® Customer Support Services offers a broad selection of programs including phone support and warranty service. For more information, contact us at support.intel.com/support/go/network/adapter/home.htm.

(Service and availability may vary by country.)

Platform Validation

Architected and validated with Intel® Xeon® processor E5 v3 platform to deliver a balanced platform for data center and cloud infrastructures.

1. Feature to be enabled in Post-Launch Release.

2. Network Virtualization Offload availability may vary please check both Intel® Ethernet X710 10/40 GbE Controller Feature Software Support Matrix <https://www-ssl.intel.com/content/dam/www/public/us/en/documents/release-notes/xl710-ethernet-controller-feature-matrix.pdf> and Operating System Vendor enablement schedules.

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