

## Product Brief

**Intel® Ethernet X520 Server Adapters**  
**with Support for SFP+ Connections**  
Network Connectivity

# Intel® Ethernet X520 Server Adapters

**Dual- and Single-Port 10 Gigabit SFP+ Ethernet Server Adapters Provide Ultimate Flexibility and Scalability in Virtual and Unified Storage Environments**

Intel's family of Intel® Ethernet X520 Server Adapters with SFP+ connectivity are the most flexible and scalable Ethernet adapters for today's demanding data center environments. Data center networks are being pushed to their limits. The escalating deployments of servers with multi-core processors and demanding applications such as High Performance Computing (HPC), database clusters, and video-on-demand are driving the need for 10 Gigabit connections. Customers require flexible and scalable I/O solutions to meet the rigorous requirements of running mission-critical applications in virtualized and unified storage environments.

Powered by Intel's third-generation 10 GbE network controller, the Intel® Ethernet 82599 10 Gigabit Ethernet Controller, the X520 server adapter family addresses the demanding needs of the next-generation data center by providing unmatched features for virtualization, flexibility for LAN and SAN networking, and proven, reliable performance.

### Best Choice for Virtualization

The explosive growth in virtualization is leading to an increasing demand for network performance. With more Virtual Machines (VMs) running on each multi-core server, networking traffic is dramatically increased with each VM competing for available I/O bandwidth. Intel's family of Intel Ethernet X520 Server Adapters addresses networking bottlenecks in virtualized environments. These adapters enable network-intensive applications to achieve the performance expected in a virtualized environment.

The Intel Ethernet X520 family of server adapters provides the best networking performance available in the industry, whether the physical port is configured in an emulation mode using the virtual switch in the Virtual Machine Monitor (VMM), or is directly assigned to a virtual machine. In the emulation mode, Intel's I/O technology, Virtual Machine Device queues<sup>1</sup> (VMDq) optimizes network performance by offloading data sorting and copying from the software Virtual Switch in the VMM to the Intel Ethernet 82599 10 Gigabit Controller. This configuration is best suited for a large number of VMs running standard applications that have limited bandwidth and latency requirements.



For mission-critical applications, where dedicated I/O is required for maximum network performance, users can assign a dedicated virtual adapter port to a VM. Using the PCI-SIG SR-IOV capability on an Intel Ethernet X520 server adapter provides direct VM connectivity and data protection across VMs. SR-IOV technology allows the data to bypass the software virtual switch and provides near-native performance. It assigns either physical or virtual I/O ports to individual VMs directly. This technology is best suited for applications that demand the highest I/O throughput and lowest latency performance such as database, storage, financial and other applications.

PCI-SIG SR-IOV is a mechanism for devices to advertise their ability to be directly assigned to multiple virtual machines. SR-IOV allows for the partitioning of a PCI function into many virtual interfaces for the purpose of sharing the resources of a PCI Express\* (PCIe) device in a virtual environment. These virtual interfaces are called Virtual Functions. Each virtual function can support a unique and separate data path for I/O-related functions within the PCI Express hierarchy. Use of SR-IOV with a networking device, for example, allows the bandwidth of a single port (function) to be partitioned into smaller slices that may be allocated to specific VMs, or guests, via a standard interface.

The Intel Ethernet X520 family of server adapters delivers the same functionality and throughput as ten dual-port, one gigabit

adapters, saving cost, power, and complexity. For more information on virtualization please go to [www.intel.com/go/vtc](http://www.intel.com/go/vtc).

## Unified Networking and Storage

The family of Intel Ethernet X520 server adapters lowers your data center total cost of ownership (TCO) by providing the ability to route LAN and SAN traffic over a single fabric.

### Support for Fiber Channel over Ethernet (FCoE)

FCoE encapsulates Fiber Channel frames over standard Ethernet networks, enabling Fiber Channel to take advantage of 10 GbE networks while preserving its native protocol. The X520 server adapters offer FCoE hardware acceleration to provide performance comparable to FC HBAs. The server adapters support Data Center Bridging, also known as Converged Enhanced Ethernet (CEE), which allows customers to configure traffic classes and priorities to deliver a lossless Ethernet fabric. An Intel Ethernet X520 server adapter reduces TCO by eliminating redundant fabrics and saves the cost of expensive FC HBAs and FC switch ports.

### Support for iSCSI

The server adapters provide complete support for proven native OS and VMM iSCSI initiators as well as iSCSI boot. Historically, CRC32C computation has degraded system performance, but now with the CRC instruction set included in the latest Intel® Xeon® processors, CRC validation is possible with minimal impact to network throughput while delivering superior data integrity.

The Intel Ethernet family of X520 server adapters do it all: 10 Gigabit LAN, FCoE, and iSCSI; truly delivering on the promise of unified networking.

## Reliable Performance

The family of X520 server adapters include a number of advanced features that allow it to provide industry-leading performance and reliability.

### Security Optimizations

The adapters support IPsec offload for Microsoft's Network Access Protection (NAP), Active Directory,\* and future security capabilities in Windows\* 7. An X520 server adapter allows customers to run a secure network environment without sacrificing performance.

### PCIe v2.0 (5 GT/s)

PCIe v2.0 (5 GT/s) support enables customers to take full advantage of 10 GbE by providing a maximum of 20 Gbps bi-directional throughput per port on a single dual port card.

### Designed For Multi-core Processors

Support for technologies such as multiple queues, receive-side scaling, multiple MSI-X vectors, and Low Latency Interrupts allow the X520 server adapters to provide high-performance, 10 Gigabit connectivity in multi-core server blades. These technologies distribute network processing across multiple CPU cores, improving overall performance.

## Features

## Benefits

### General

Intel® 82599 10 Gigabit Ethernet Controller	<ul style="list-style-type: none"> <li>Industry-leading, energy-efficient design for next-generation 10 Gigabit performance and multi-core processors</li> </ul>
SFP+ Connectivity	<ul style="list-style-type: none"> <li>X520 Server Adapters with SFP+ connections support 10GBASE-SR, 10GBASE-LR and SFP+ Copper Direct Attach physical media.</li> </ul>
Low-profile	<ul style="list-style-type: none"> <li>Enables higher bandwidth and throughput from standard and low-profile PCIe slots and servers</li> </ul>
Load balancing on multiple CPUs	<ul style="list-style-type: none"> <li>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*</li> </ul>
iSCSI remote boot support	<ul style="list-style-type: none"> <li>Provides centralized storage area network (SAN) management at a lower cost than other iSCSI solutions</li> </ul>
Fibre Channel over Ethernet (FCoE) Support	<ul style="list-style-type: none"> <li>Includes FCoE Boot and Data Center Bridging</li> </ul>
Support for most network operating systems (NOS)	<ul style="list-style-type: none"> <li>Enables widespread deployment</li> </ul>
RoHS-compliant <sup>2</sup>	<ul style="list-style-type: none"> <li>Complies with the European Union directive 2002/95/EC to reduce the use of hazardous materials</li> </ul>
Intel® PROSet Utility for Windows* Device Manager	<ul style="list-style-type: none"> <li>Provides point-and-click management of individual adapters, advanced adapter features, connection teaming, and virtual local area network (VLAN) configuration</li> </ul>
Time Sync (IEEE 1588, 802.1as)	<ul style="list-style-type: none"> <li>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</li> </ul>

### I/O Features for Multi-core Processor Servers

Intel® Direct Cache Access (DCA):	<ul style="list-style-type: none"> <li>Enables the adapter to pre-fetch the data from memory, avoiding cache misses and improving application response time</li> </ul>
MSI-X support	<ul style="list-style-type: none"> <li>Minimizes the overhead of interrupts</li> <li>Allows load-balancing of interrupt handling between multiple cores/CPU's</li> </ul>
Low Latency Interrupts	<ul style="list-style-type: none"> <li>Based on the sensitivity of the incoming data, the adapter can bypass the automatic moderation of time intervals between the interrupts</li> </ul>
Header Splits and Replication in Receive	<ul style="list-style-type: none"> <li>Helps the driver focus on the relevant part of the packet without the need to parse it</li> </ul>
Multiple Queues: 128 Tx and Rx queues per port	<ul style="list-style-type: none"> <li>Network packet handling without waiting or buffer overflow providing efficient packet prioritization</li> </ul>

## Features

## Benefits

### I/O Features for Multi-core Processor Servers

Tx/Rx IP, SCTP, TCP, and UDP checksum offloading (IPv4, IPv6) capabilities	<ul style="list-style-type: none"><li>• Lower processor usage</li><li>• Checksum and segmentation capability extended to new standard packet type</li></ul>
Tx TCP segmentation offload (IPv4, IPv6)	<ul style="list-style-type: none"><li>• Increased throughput and lower processor usage</li><li>• Compatible with large-send offload feature (in Microsoft Windows* Server operating systems)</li></ul>
Receive and Transmit Side Scaling for Windows environment and Scalable I/O for Linux* environments (IPv4, IPv6, TCP/UDP)	<ul style="list-style-type: none"><li>• This technology enables the direction of the interrupts to the processor cores in order to improve the CPU utilization rate</li></ul>
IPsec Offload	<ul style="list-style-type: none"><li>• Offloads IPsec capability onto the adapter instead of the software to significantly improve I/O throughput and CPU usage (for Windows* 2008 Server, Vista*, Windows* 2008 Server R2, and Windows* 7)</li></ul>
MacSec	<ul style="list-style-type: none"><li>• IEEE spec: 802.1ae</li><li>• Layer 2 data protection that provides encryption and authentication ability between two individual devices (routers, switches, etc.)</li><li>• MacSec is designed into the network adapter hardware. These adapters are prepared to provide MacSec functionality when the ecosystem is ready to support this new technology</li></ul>

### Virtualization Features

VMDq	<ul style="list-style-type: none"><li>• Offloads the data-sorting functionality from the Hypervisor to the network silicon, improving data throughput and CPU usage</li><li>• Provides QoS feature on the Tx data by providing round-robin servicing and preventing head-of-line blocking</li><li>• Sorting based on MAC addresses and VLAN tags</li></ul>
Next-Generation VMDq <sup>1</sup> (64 queues per port)	<ul style="list-style-type: none"><li>• Enhanced QoS feature by providing weighted round-robin servicing for the Tx data</li><li>• 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</li><li>• Supports replication of multicast and broadcast data</li></ul>
PC-SIG SR-IOV Implementation (64 virtual functions per port)	<ul style="list-style-type: none"><li>• 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.</li><li>• 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</li></ul>
Virtual Machine Load Balancing (VLMB)	<ul style="list-style-type: none"><li>• 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.</li></ul>
Advanced Packet Filtering	<ul style="list-style-type: none"><li>• 24 exact-matched packets (unicast or multicast)</li><li>• 4096-bit hash filter for unicast and multicast frames</li><li>• Lower processor usage</li><li>• Promiscuous (unicast and multicast) transfer mode support</li><li>• Optional filtering of invalid frames</li></ul>
VLAN support with VLAN tag insertion, stripping and packet filtering for up to 4096 VLAN tags	<ul style="list-style-type: none"><li>• Ability to create multiple VLAN segments</li></ul>

### Manageability Features

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

### Intel Backing

Backed by an Intel\* limited lifetime warranty, 90-day money-back guarantee (U.S. and Canada), and worldwide support

## 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](http://support.intel.com/support/go/network/adapter/home.htm). Service and availability may vary by country.

## For Product Information

To speak to a customer service representative, please call 1-800-538-3373 (U.S. and Canada) or visit [support.intel.com/support/go/network/contact.htm](http://support.intel.com/support/go/network/contact.htm) for the telephone number in your area. For additional product information on Intel Networking Connectivity products, visit [www.intel.com/go/ethernet](http://www.intel.com/go/ethernet).

# Specifications

## General

Product codes	<b>Configuration</b> Intel® Ethernet Server Adapter X520-SR1 Intel® Ethernet Server Adapter X520-SR2 Intel® Ethernet Server Adapter X520-LR1 Intel® Ethernet Server Adapter X520-DA2 Intel® Ethernet SFP+ SR Optics Intel® Ethernet SFP+ LR Optics	<b>Code</b> E10G41BFSR E10G42BFSR E10G41BFLR E10G42BTDA E10GSFSPR E10GSFPLR
Connectors	One or two LC fiber-optic connectors SFP+ Direct Attach cables (E10G42BTDA)	
Network Standards Physical Layer Interface	IEEE 802.3: 10GBASE-SR (E10G41BFSR, E10G42BFSR) 10GBASE-LR (E10G41BFLR)  SFF-8431: 10GSFP+Cu (a.k.a. Direct Attach) (E10G42BTDA)	

## 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
Direct Cache Access (DCA)	The I/O device activates a pre-fetch engine in the CPU that loads the data into the CPU cache ahead of time, before use, eliminating cache misses and reducing CPU load

## Advanced Software Features

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	▪

\*VMDq requires a virtualization operating system that supports VMDq.

<sup>2</sup>Lead and other materials banned in EU RoHS Directive are either (1) below all applicable substance thresholds or (2) an approved exemption applies.

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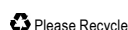
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## Technical Features

Data rate supported per port:	▪ Optical: 1 GbE/10 GbE ▪ Direct Attach: 10 GbE	
Bus type	PCI Express 2.0 (5 GT/s)	
Bus width	4-lane PCI Express and 8-lane PCI Express	
Interrupt levels	INTA, MSI, MSI-X	
Hardware certifications	FCC B, UL, CE, VCCI, BSMI, CTICK, KCC	
Controller-processor	Intel® 82599	
Power consumption		
<b>SKU</b>	<b>Maximum Power</b>	<b>Typical Power</b>
Dual-port 10GBASE-SR/1000BASE-SX	6.8 W	6.5 W
Dual-port 10GBASE-LR/1000BASE-LX	7.0 W	6.6 W
Dual-port direct attached twinax	6.2 W	5.8 W
Single-port 10GBASE-SR/1000BASE-SX	4.8 W	4.5 W
Single-port 10GBASE-LR/1000BASE-LX	4.8 W	4.5 W
Single-port direct attached twinax	4.6 W	4.3 W
Operating temperature	0° C to 55° C (32° F to 131° F)	
Air Flow	Minimum of 100 LFM required	
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 = 10G / yellow = 1G)	

## Physical Dimensions

Low-profile PCI Express	5.73 inches long, measured without PCI bracket
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## Network Operating Systems (NOS) Software Support

Operating System	IA32	X64	IPF
Windows 7	▪	▪	N/A
Windows Server 2008 R2	N/A	▪	▪
Windows Server 2008 R2 Core	N/A	▪	▪
Linux SLES 11 SP1	▪	▪	▪
Windows Vista* SP2	▪	▪	N/A
Windows Server* 2003 SP2	▪	▪	▪
Windows Server 2008 SP2	▪	▪	▪
Windows Server 2008 SP2 Core	▪	▪	N/A
Linux* Stable Kernel version 2.6	▪	▪	▪
Linux RHEL 4.8	▪	▪	N/A
Linux RHEL 5.5	▪	▪	▪
Linux SLES 10 SP3	▪	▪	▪
Linux SLES 11	▪	▪	▪
FreeBSD* 8.0	▪	▪	▪
EFI* 1.1	N/A	N/A	▪
UEFI* 2.1	N/A	▪	▪

