Product Brief

Intel® Ethernet Network Daughter Card X520/I350

Network Connectivity

Key Features

- Low cost, low power, 10 Gigabit (10GbE) and Gigabit Ethernet (GbE) performance for the entire data center
- Twinaxial cabling with Direct Attach SFP+ or SR Fiber Optic connectors
- Backward compatibility with existing 1000BASE-T networks simplifies the transition to 10GbE
- Flexible I/O virtualization for port partitioning and quality of service (QoS) of up to 32 virtual ports
- Unified networking delivering LAN, iSCSI, and FCoE in one low-cost CNA
- Reliable and proven 10 Gigabit Ethernet technology from Intel

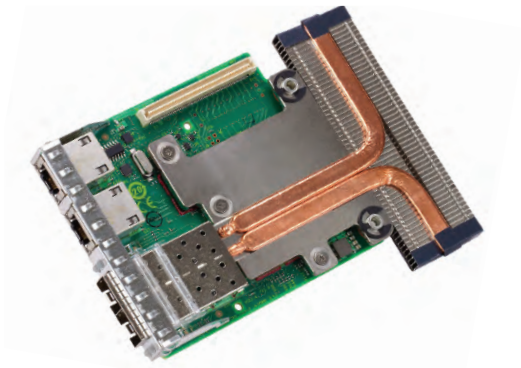
Intel® Ethernet Network Daughter Card X520-DA2 and I350-T2

Two ports of SFP+ and two ports of 1000BASE-T make this LAN on Motherboard option one of the most flexible and scalable within the Dell™ PowerEdge™ Select Network Adapter Family

The Right Adapter for Today's Most Demanding Data Centers

This Intel® Ethernet Network Daughter Card combines two ports of X520 with SFP+ connectivity and two ports of I350 1000BASE-T connectivity as one of the most flexible and scalable Ethernet adapters for today's demanding data center environments. Data center networks are being pushed to their limits. The dramatic growth in bandwidth requirements has led to the increasing use of higher performance servers. The escalating deployments of high performance servers and demanding applications such as High Performance Computing (HPC), database clusters, and video-on-demand are driving the need for 10 Gbps 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 10GbE network controller, the Intel® 82599 Controller, the X520 adapter family addresses the demanding needs of the next-generation data center by providing unmatched features for virtualization, flexibility for LAN and SAN networking, reliable and proven performance.

The Intel® Ethernet Network Daughter Card X520/I350 is the latest innovation in Intel's leadership bringing 10 Gigabit Ethernet into the broader server market. This unique Network Daughter Card hosts Intel's latest silicon, both the Intel® Ethernet Controller X520 and the Intel® Ethernet Controller I350 providing 2Gbs of GbE and 20Gbs of 10GbE. This "2+20" adapter can be used in multiple port configurations, giving the customer the ultimate flexibility in choosing between Gigabit and 10 Gigabit network configurations on a single adapter.



Simplify the Transition to 10GbE

The new Intel® Ethernet Network Daughter Card X520/I350 offers the flexibility of direct-attach twinaxial cables or short/long range fiber optics in a single adapter. The X520 family of products also works with existing GbE optical networks today. Using SR optics in the two SFP+ cages allows this adapter to work with existing legacy Gigabit Ethernet (GbE) optical switches, something unheard of with other adapter vendors. Install the X520 NDC into a server and the auto-negotiation between 1GbE and 10GbE provides the necessary backward compatibility that customers require for a smooth transition and easy migration to 10GbE. Whether at 1GbE or 10GbE, using fiber optics gives you the greatest reach possible whether you are going to the top of the rack or across town 10 kilometers away.

If you want to use direct-attach copper (twinaxial cables) instead of fiber, you have chosen the right adapter. The two SFP+ cages also support direct-attach copper (10GBASE-DAC). SFP+ DAC only operates at 10GbE speeds but gives you all the reach you need for top-of-rack (ToR) applications. The twinaxial cables come in 3, 5, and 7 meter lengths, which simplifies the network by reducing the length of extra cable.

Whatever your network configuration today, the Intel Ethernet Network Daughter Card X520/I350 meets your networking needs today. However you choose to configure the two 10GbE ports, the network card also sports two additional GbE ports to be used as you need. One popular option is to use these as dedicated management ports to increase your data center administrative efficiencies.

Exciting New Data Center Use Models

More than simply a 10x increase in performance, with 10GbE there are exciting new use models now possible, including Unified Networking (iSCSI, FCoE & LAN), Virtualization (VMDq & SR-IOV), and now Flexible Port Partitioning (FPP).

Best Choice for I/O Virtualization

Virtualization changes server resource deployment and management by running multiple applications and operating systems independently on a single server.

The Intel Ethernet Network Daughter Card X520/I350 includes Intel® Virtualization Technology for Connectivity (Intel® VT-c) to deliver I/O virtualization and Quality of Service (QoS) features designed directly into the X520 and I350 controllers on the Network Daughter Card. Intel® I/O virtualization technologies, including VMDq and SR-IOV, advance network connectivity efficiency by providing Flexible Port Partitioning (FPP), multiple Rx/Tx queues, and on-controller QoS functionality used in both virtual and non-virtual server deployments.

Virtual Machine Device Queues (VMDq) improve traffic management within the server by offloading traffic sorting and routing from the hypervisor's virtual switch to the Intel Ethernet controller. Working in conjunction with VMware NetQueue* or Microsoft Virtual Machine Queues*, VMDq enables traffic steering and balanced bandwidth allocation across the Intel Ethernet Controller's multiple hardware queues.

PCI-SIG Single Root I/O Virtualization (SR-IOV) allows partitioning of a single Intel Ethernet server adapter port into multiple virtual functions. IT administrators can use these virtual ports to create multiple isolated connections to virtual machines.

Flexible Port Partitioning (FPP) takes advantage of the PCI-SIG SR-IOV specification. With FPP, virtual controllers can be used by the Linux* host directly and/or assigned to virtual machines. FPP enables you to assign up to 63 Linux host processes or virtual machines per port to virtual. A network administrator can then control the partitioning of their 10 GbE bandwidth across multiple dedicated network resources, ensuring balanced QoS by giving each assigned virtual controller equal access to 10Gbs of bandwidth. Network administrators may also rate limit each of these services to control how much of the 10GbE pipe is available to each process.

Unified Networking

Unified Networking solutions on the new Intel Ethernet Network Daughter Card X520/I350 enable the combining of traffic of multiple data center networks like LAN and SAN onto a single efficient network fabric. Now with Intel and Dell, our single LAN on Motherboard option provides NFS, iSCSI, or FCoE to carry both network and storage traffic at speeds of up to 10 GbE. The Network Daughter Card X520/I350 combines support for these traffic types in one adapter at no additional cost with no additional licensing fees for the adapter.

Intel's Unified Networking solutions are enabled through a combination of standard Intel Ethernet products along with trusted network protocols integrated in the operating systems. Thus, Unified Networking is available on every server either through LAN-on-Motherboard (LOM), Network Daughter Card implementation or via an add-in Network Interface Card (NIC) or Converged Network Adapter.

Intel has delivered high quality Ethernet products for over 30 years and our Unified Networking solutions are built on the same founding principles that made us successful in Ethernet.

1. Open Architecture integrates networking with the Dell PowerEdge server allowing IT managers to reduce complexity and overhead while enabling a flexible and scalable data center network.

2. Intelligent offloads lower cost and power while delivering the application performance that customers expect.

3. Proven Ethernet Unified Networking is built on trusted Intel Ethernet technology, enabling customers to deploy FCoE or iSCSI while maintaining the quality of their traditional Ethernet networks.

iSCSI Simplifies SAN Connectivity

iSCSI uses Ethernet to carry storage traffic, extending the familiarity and simplicity of Ethernet to storage networking, without the need for SAN-specific adapters or switches. Intel Ethernet X520 is the easiest, most reliable, and most cost-effective way of connecting servers to iSCSI SANs.

Intel Ethernet server adapters include hardware-based iSCSI acceleration features that do not require offloading to a proprietary TCP/IP stack. iSCSI acceleration uses large send offload, Receive Side Coalescing and transmit send offloads to help reduce latency and lower CPU utilization. To improve efficiency, MSI-X, Receive-side Scaling and Intel Ethernet Flow Director scale I/O processing across multiple CPU cores. Direct memory access (DMA), direct cache access (DCA) and header splitting improve network data processing efficiency, and data center bridging (DCB) supports multiple traffic classes that can be prioritized for iSCSI traffic.

Open FCoE Consolidates LANs and Legacy SANs

Intel's Open FCoE solution enables Intel Ethernet 10 Gigabit products (LOM or NICs) to support Fibre Channel payload encapsulated in Ethernet frames. There is no upgrade charge for Open FCoE on the adapter. Just as iSCSI, now customers can easily connect to an FCoE network with Intel 10GbE solutions.

The Open FCoE architecture uses a combination of FCoE initiators in Microsoft Windows* and Linux* operating systems and in the VMware ESXi* hypervisor to deliver high-performance FCoE solutions over standard 10GbE Ethernet adapters.

This approach allows IT managers to simplify the data center and standardize on a single adapter for LAN and SAN connectivity. The Intel Ethernet Network Daughter Card X520/I350 is designed to fully offload the FCoE data path to deliver full-featured converged network adapter (CNA) functionality without compromising on power efficiency and interoperability.

Data Center Bridging (DCB) Delivers Lossless Ethernet

Conventional Ethernet does not guarantee successful data delivery, which is not acceptable for SAN traffic. Ethernet enhancements such as Data Center Bridging (DCB) overcome that limitation with technologies that guarantee lossless delivery, congestion notification, priority-based flow control, and priority groups.

Intel is driving Data Center Bridging (DCB), a new collection of standards-based end-to-end networking technologies that make Ethernet the unified fabric for multiple types of traffic in the data center.

The combination of 10GbE and unified networking helps organizations overcome connectivity challenges and simplify the data center infrastructure. 10GbE provides a simple, well-understood fabric for virtualized data centers, one that helps reduce cost and complexity as the number of virtual machines continues to grow.

Software Tools and Management

Intel Ethernet server and converged network adapters support Dell's Lifecycle Controller. The Lifecycle Controller is coupled with the Dell DRAC service processor to provide embedded system management. The Lifecycle Controller enables both local and remote access to manage initial setup and configuration of the BIOS settings on the platform, setup and configuration of Intel Ethernet adapters, update of all the platform firmware, and the deployment of the operating systems.

Intel® Advanced Network Services (Intel® ANS) include new teaming technologies and techniques such as Virtual Machine Load-Balancing (VMLB) for Hyper-V environments. Intel ANS also provides a variety of teaming configurations for up to eight ports, and support for teaming mixed vendors' server adapters. Intel ANS includes support for 802.1Q VLANs, making Intel ANS one of the most capable and comprehensive tools for supporting server adapter teaming.

Additionally, Intel® PROSet for Windows* Device Manager (DMIX) and PROsetCL extend driver functionality to provide additional reliability and Quality of Service features and configuration.

Companion Products

Consider these Intel® products in your server and network planning:

- Intel® Ethernet Server Adapter X520 Series for 10GbE SFP+ PCIe v2.0 (5 GT/s) performance
  - Copper or fiber-optic network connectivity, up to four ports per card
  - Solutions for PCI Express, PCI-X,* and PCI interfaces
- Intel® Xeon® Processors
- Intel® Server Boards

Manageability

Features	Benefits
Intel® Ethernet Controller I350	• Non-bridged PCIe with new power management technologies
Intel® Ethernet Controller X520	• Delivering flexible media support giving customers a choice in network deployments
Low-profile	• Enables higher bandwidth and throughput from standard and low-profile PCIe slots and servers
Intel® Ethernet Controller I350 supports IEEE 802.3az – Energy Efficient Ethernet (EEE)	• Power consumption of the PHY is reduced by approximately 50% link transitions to low power Idle (LPI) state as defined in the IEEE 802.3az (EEE) standard
Intel® Ethernet Controller I350 DMA Coalescing	• Reduces platform power consumption by coalescing, aligning, and synchronizing DMA • Enables synchronizing port activity and power management of memory, CPU and RC internal circuitry
Load balancing on multiple CPUs	• Increases performance on multi-processor systems by efficiently balancing network loads across CPU cores when used with Receive-Side Scaling from Microsoft* or Scalable I/O on Linux*
iSCSI remote boot support	• Provides centralized Storage Area Network (SAN) management at a lower cost than competing iSCSI solutions
Intelligent offload for iSCSI and FCoE	• Hardware offload delivers application performance while the software initiator provides platform scalability and OS integration.
Support for most Network Operating Systems (NOS)	• Enables widespread deployment
RoHS compliant, lead-free technology	• Compliant with the European Union directive (effective as of July 2006) to reduce the use of hazardous materials
Lifecycle Controller	• Local and remote access to BIOS setup and configuration on the platform and adapter

I/O Features for Multi-core Processor Servers

MSI-X support	• Minimizes the overhead of interrupts • Allows load balancing of interrupt handling between different cores/CPUs
Low latency	• Based on the sensitivity of the incoming data, the adapter can bypass the automatic moderation of time intervals between the interrupts
Header Splits and Replication in Receive	• Helps the driver focus on the relevant part of the packet without the need to parse it
Multiple Queues: 16 queues per port	• Network packet handling without waiting or buffer overflow providing efficient packet prioritization
Tx/Rx IP, SCTP, TCP, and UDP checksum offloading (IPv4, IPv6) capabilities	• Lower processor usage • Checksum and segmentation capability extended to new standard packet type
Tx TCP segmentation offload (IPv4, IPv6)	• Increased throughput and lower processor usage • Compatible with large-send offload feature (in Microsoft Windows* Server operating systems)
IPsec Offload	• Offloads IPsec capability onto the adapter instead of the software to significantly improve through-put and CPU usage (for Windows* 7, Windows* 2008 Server R2, Windows* 2008 Server, and Vista*)
MACSec	• IEEE spec: 802.1ae • Layer 2 data protection with encryption/authentication ability between devices (e.g, routers, switches) • 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
Compatible with x8 and x16 standard and low-profile PCI Express* slots	• Allows each PCI Express* slot port to operate without interfering or competing with the other
Receive and Transmit Side Scaling for Windows environment and Scalable I/O for Linux* environments (IPv4, IPv6, TCP/UDP)	• Enables the direction of the interrupts to the processor cores in order to improve the CPU utilization rate
Intel® PROSet Utility for Microsoft Windows* Device Manager	• Provides point-and-click power over individual adapters, advanced adapter features, connection teaming, and Virtual Local Area Network (VLAN) configuration
Intel backing	• Backed by an Intel limited lifetime warranty, 90-day money-back guarantee (U.S. and Canada), and worldwide support

Virtualization Features

Virtual Machine Device queues (VMDq)[1]	• 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
PC-SIG SR-IOV Implementation (64 virtual functions per port)	• 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
Flexible Port Partitioning: 64 Virtual Functions per port	• Virtual Functions (VFs) appear as Ethernet Controllers in Linux OSes that can be assigned to VMs, Kernel processes or teamed using the Linux* Bonding Drivers
IPv6 Offloading	• Checksum and segmentation capability extended to the new standard packet type
Advanced Packet Filtering	• 24 exact-matched addresses (unicast or multicast) • 4096-bit hash filter for unicast and multicast frames • 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	• Ability to create multiple VLAN segments

Specifications

Order Numbers

Intel® Ethernet NDC X520-DA2/I350-T2		430-4935
Connector	X520: I350:	SFP+ (LC or DAC) RJ-45 Copper
Cabling	X520: I350:	OM3 Cat 5e

Adapter Product Features

Intel® PROSet Utility for easy configuration and management	
Intel® Lead-free technology[2]	
Plug and play specification support	Standard
Includes a full-height bracket	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
RoHS-compliant[2]	
CABLING DISTANCE	
1000BASE-T	100 m
10GBASE-DAC	7 m
10GBASE-SR	300 m

Advanced Software Features

Adapter Fault Tolerance (AFT)
Switch Fault Tolerance (SFT)
Adaptive Load Balancing (ALB)
Teaming support
IEEE 802.3ad5 (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 off-loading

Intel Backing

Limited lifetime warranty
90-day, money-back guarantee (U.S. and Canada)

Physical Dimension Chart

108mm x 93mm nominal

Power (PCIe edge)

SPEED	WATTS (TYPICAL)
10 Gbps	10
1 Gbps	8.2
100 Mbps	5.9

Network Management

Wired for Management (WfM) baseline v2.0 enabled for servers
DMI 2.0 support, Windows Management Instrumentation (WMI) and SNMP
Remote Installation Services (RIS)
PXE 2.0 enabled through boot Read-Only Memory (ROM)

Network Operating Systems (NOS) Software Support

Windows Server 2008 SP2 (IA32 and x64)
Windows Server 2008 SP2 Core (IA32 and x64)
Windows Server 2008 SP2 (w/ Hyper-V role) (x64)
Hyper-V Server 2008 SP2 (stand-alone version) (x64)
Windows Server 2008 R2 SP1 (x64)
Windows Server 2008 R2 SP1 Core (x64)
Windows Server 2008 R2 SP1 (w/ Hyper-V role) (x64)
Hyper-V Server 2008 R2 SP1 (stand-alone version) (x64)
Windows Server 2012 (x64)
Windows Server 2012 Core (x64)
Windows Server 2012 w/Hyper-V Role (x64)
Hyper-V Server 2012 (stand-alone version) (x64)
WinPE 2.1 (2008 PE) (IA32 and x64)
WinPE 3.0 (2008 R2 PE) (IA32 and x64)
WinPE 4.0 (2012PE) (IA32 and x64)
Linux Stable Kernel version 2.6/3.x (IA32 and x64)
Linux RHEL 5.8 (IA32 and x64)
Linux RHEL 6.2 (IA32 and x64)
Linux SLES 10 SP4 (IA32 and x64)
Linux SLES 11 SP2 (IA32 and x64)
FreeBSD 9 (IA32 and x64)
UEFI 2.1 (x64)
UEFI 2.3 (x64)
VMware ESX 4.0 3 (x64)
VMware ESX 4.1 3 (x64)
VMware ESXi 5.0 3 (x64)
VMware ESXi 5.1 3 (x64)
Xen 4 (x64)

Technical Features

Data rate(s) supported per port	1 GbE/10 GbE
Bus type	X520: PCI Express 2.0 (5 GT/s) I350: PCI Express 2.1 (5 GT/s)
Bus width	x8 lane PCI Express, operable in x8 and x16 slots
Bus speed (x8, encoded rate)	20 Gbps uni-directional 40 Gbps bi-directional
Interrupt levels	INTA, MSI, MSI-X
Hardware certifications	FCC B, UL, CE, VCCI, BSMI, CTICK, KCC
Controller-processor	Intel® Ethernet Controller X520 Intel® Ethernet Controller I350

[1] VMDq requires a virtualization operating system that supports VMDq.
[2] Lead and other materials banned in EU RoHS Directive are either (1) below all applicable substance thresholds or (2) an approved exemption applies.
[3] VMware ESX drivers are found on VMware's website.
[4] SR-IOV validation only.

To see the full line of Intel Server Adapters, visit www.intel.com/go/ethernet, www.IntelEthernet-Dell.com or contact your Dell sales representative.

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