
Dell PowerEdge Select Network Adapters— The Freedom to Choose

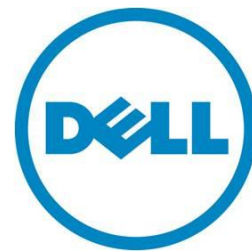
This feature overview describes the Dell PowerEdge Select Network Adapters family, also known as Network Daughter Cards (NDCs).

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Abstract

The twelfth-generation Dell™ PowerEdge™ server portfolio uses a Dell custom daughter card to house the complete LAN on Motherboard (LOM) subsystem. In these systems, the LOM is provided on the Network Daughter Card (NDC) as part of Dell PowerEdge Select Network Adapters family. There are two form factors of Select Network Adapters, one for blade servers and one for rack servers. The Blade Select Network Adapter provides dual port 10GbE from various suppliers. The Rack Select Network Adapter provides a selection of 1GbE and 10GbE port options, such as 1000Base-T, 10GBASE-T and 10Gb SFP+. The Select Network Adapter form factor continues to deliver the value of LOM integration with the system, including BIOS integration and shared ports for manageability while providing flexibility.

Changes in server interconnectivity

Historically, servers have provided a fixed LAN on Motherboard (LOM) subsystem integrated directly on the main system planar as the primary network access. This provided a fixed physical layer interconnect, typically One Gigabit Ethernet, and a fixed number of ports. This has served customers well until the advent of high-speed 10GbE technologies, which now provide significant benefits and physical-layer interface choices. As server designs have become more dense, it has become inevitable that the built in LOM would give way to offer more flexibility. Mainstream servers are now requiring 10Gigabit per second interfaces with added demand for more flexibility from the LOM slot. Dell has listened to our customers and is now offering a flexible approach to the LOM on our rack and blade mainstream Power Edge servers.

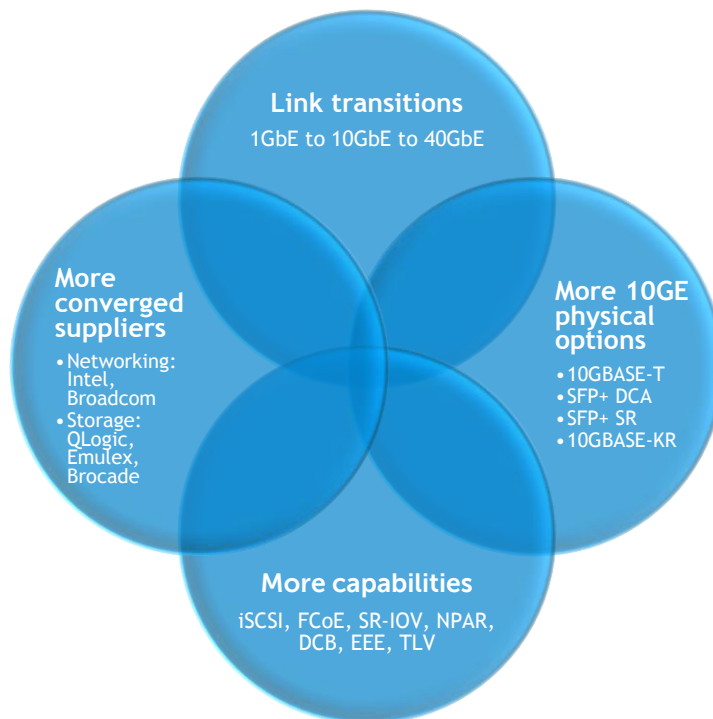
Server virtualization, network convergence, and space efficiency are three primary factors driving the need for flexibility on the choice of LOM subsystem. In addition, each factor drives the need for higher bandwidth interconnects, such as 10GbE and 40GbE.

The server network interconnect landscape has changed significantly. The following points, along with Figure 1, help to explain these changes.

- The transition to 10GbE has begun with various physical interface choices. Both copper and optical choices are needed, including 10GBASE-T and SFP+ optical and Direct Copper Attached. 10GBASE-T is the physical interconnect of choice for installations requiring long cable runs (for example, >10 m). SFP+ and Direct Copper Attached is the current preference for top-of-rack 10GbE connectivity, but we expect many installations to shift to 10GBASE-T in the future. In addition, XAUI-to-KR transition is driven by blade infrastructure to provide 10GbE on all fabrics.
- Network convergence (iSCSI and FCoE [Fibre Channel over Ethernet]) and virtualization is driving an ever richer feature set that offer choice of capabilities and performance.
- The need for higher space efficiency, or the ability to do more with the same or smaller space, means the network fabric taken by the LOM must be able to do more than just networking via Ethernet.

- Traditional networking and storage server I/O is converging, broadening the supplier choice. The Select Network Adapter provides link speed choice, network interface choice, and vendor choice.

Figure 1. The server interconnect landscape



The need for LOM flexibility

Dell’s unique PowerEdge Select Network Adapters family has a lot of benefits. You can respond to a network infrastructure upgrade in mid-server cycle with full Dell management integration. It is also possible to transition from 1GbE to 10GbE and to converged 10GbE without having to replace servers. The transition from optical to copper network connectivity can be done easily as well. With customers starting to ask for convergence options, it is now possible to deploy full end-to-end convergence without having to rip and replace servers. Networking solutions can be selected depending upon the requirements, and not limited by existing infrastructure, which has not been possible with traditional LOM designs in the current market. This unique feature gives control back to you to choose the best-of-breed technology which best fits your requirements, and it does not require you to pay for something that you will not use.

Dell has chosen the Select Network Adapter to deliver a choice of LOMs. This includes traditional LOM networking capabilities, as well as a new CNA storage functionality. Given the broad spectrum of vendors and capabilities, there is no single solution that addresses all customer needs and priorities. Some solutions are better at core networking functionality at lower power, while others deliver best converged performance. The Select Network Adapter family provides a set of flexible vehicles to transition from 1GbE to 10GbE. By offering 10Gb port devices as well as 1Gb and 10Gb devices on the same NIC, you can maintain legacy 1Gb connectivity while providing 10Gb availability for new

functions and workloads. This allows adaptation to technology changes during server generations, such as 40GbE and multi-port 10GbE.

Dell's rack Select Network Adapter options include quad-port 1GbE and 10GbE options. 10GbE options include two ports of 10GbE and two ports of 1GbE to support a variety of use cases for server interconnect. For example, the 1GbE ports on the rack server NDC could be used for remote management or for Wake on LAN (WoL). Dell's blade Select Network Adapter provides dual-port 10GbE interfaces. Dell chose to offer only 10GbE Network Daughter cards for blades due to faster adoption of 10Gb, convergence, and its cost advantages. The cost advantages are due to no dependence of optics transceivers and aggregation via chassis switches.

Dell provides a choice of LOMs that can increase the operational efficiency and longevity of servers, thereby providing investment protection. Servers do not need to be replaced if IO requirements change, but the servers can be better utilized, allowing you to react faster to a changing networking technology landscape. An IO device can be replaced with a new NDC, which provides more benefits than the traditional LOM. These adapters are fully managed by the Dell Universal Server Configurator (USC) for device configuration, updates, and real-time monitoring. All Select Network Adapters can be monitored in real time, utilizing Dell Embedded Management through iDRAC.

Choosing which NDC to use

Choosing a blade server NDC depends on which features are required:

- Offloads
- Convergence
- Virtualization
- Switch Independent Partitioning
- Bandwidth requirements

Choosing a rack server NDC also depends on a number of factors, such as:

- Link bandwidth requirements: 1 Gbps or 10 Gbps
- If 10GE is required, then SFP+ or 10GBASE-T is needed
- Feature requirements such as:
 - Offloads
 - Convergence
 - Virtualization
 - Switch Independent Partitioning

Dell has also provided information on key strengths and features of these NDCs when a customer is configuring a server for purchase. This will help customer choose the right NDC for them.

Available NDC options

Table 1 and Table 2 detail the NDC options for PowerEdge rack servers and blade servers, respectively. In addition to these, Dell plans to offer more options in the future as well. Keep in mind that an NDC must be present in the system at all times.

Table 1. Supported Select Network Adapters for PowerEdge rack servers

Features	Broadcom 5720 Base-T	Intel® I350 Base-T	Broadcom 57800 Base-T and SFP+	Intel x540 Base-T
Ports x link speed	4x1Gb	4x1Gb	2x1Gb + 2x10Gb	2x1Gb + 2x10Gb
Supported speed	1Gb	1Gb	1Gb and 10Gb	1Gb and 10Gb
SR-IOV	Not supported	Not supported	Not supported	Supported (10GE only)
ISCSI HBA	Not supported	Not supported	Supported ¹	Not supported
EEE	Supported	Supported	Not supported*	Not supported
FCoE	Not supported	Not supported	Not supported	Supported ²
Switch Independent Partitioning	Not supported	Not supported	Supported ³	Not supported

Features	Broadcom 5720 Base-T	Intel® I350 Base-T	Broadcom 57800 Base-T and SFP+	Intel x540 Base-T
DCB	Not supported	Not supported	Not supported	Supported ⁴
iSCSI TLV	Not supported	Not supported	Not supported	Supported ⁵
Supported PowerEdge servers	R620, R720, R720XD	R620, R720, R720XD	R620, R720, R720XD	R620, R720, R720XD

¹Only 10GbE ports have iSCSI HBA support.

²Only 10GbE ports have FCoE support.

³Only 10GbE ports have Switch Independent Partitioning support. The maximum number of partitions supported is 4 (2 partitions per 10Gb port). 1Gb ports do not support switch independent partitioning.

⁴Only 10GbE ports have DCB support.

⁵Only 10GbE ports have iSCSI TLV support.

Note: Dell will provide a software update for above listed unsupported features in a future release.

Table 2. Supported Select Network Adapters for PowerEdge blade servers

Features	Broadcom 57810S KR	Intel x520 KR	QLogic QMD8262 KR
Ports x link speed	2x10Gb	2x10Gb	2x10Gb
Supported speed	1Gb and 10Gb	1Gb and 10Gb	10Gb only
SR-IOV	Not supported	Supported	Not supported
iSCSI HBA	Supported ¹	Not supported	Supported ¹
FCoE	Not supported	Supported ²	Supported ²
Switch Independent Partitioning	Supported ³	Not supported	Supported ³
DCB	Not supported	Supported ⁴	Supported ⁴
DCB with iSCSI TLV	Not supported	Supported ⁵	Supported ⁵

Features	Broadcom 57810S KR	Intel x520 KR	QLogic QMD8262 KR
Supported PowerEdge servers	M620	M620	M620

¹Only 10GbE ports have iSCSI HBA support.

²Only 10GbE ports have FCoE support.

³Only 10GbE ports have Switch Independent Partitioning support. The maximum number of partitions supported is 8 (4 partitions per 10GE port).

⁴Only 10GbE ports have DCB support.

⁵Only 10GbE ports have iSCSI TLV support.

Typically, the system board will have one blade NDC connector for two-socket, half-height blades. An NDC is always required for the system to POST without error.

1GbE port features

Dell's 1GbE rack server NDCs support triple link speeds—10M/100M/1G—over unshielded twisted pair. Features such as iSCSI boot and EEE are supported as well.

iSCSI boot

The 1GbE NDC ports support the ability to boot the server from a remote iSCSI target over the network. This is fully managed by Dell USC for device configuration, updates, and real-time monitoring.

Energy Efficient Ethernet (EEE)

Dell Broadcom and Intel NDC GE ports support Energy Efficient Ethernet (EEE). EEE is based on the IEEE 802.3az specification. EEE defines a mechanism to reduce power consumption on the port during periods of low-link utilization. EEE reduces power consumption on an operational link by transitioning the link to Low Power Idle state when the transmitter is idle.

The EEE implementation ensures the following behavior:

- The link status does not change as a result of the transition to Low Power Idle
- No frames in transit are dropped or corrupted during the transition
- The transition is transparent to upper layer protocols and applications

10GE port features

The 10GBASE-T rack server NDC supports triple link speeds—100M/1G/10G—over unshielded twisted pair. This allows an easy way to provision for 10GE on the server side while allowing connectivity to the legacy GE infrastructure.

The 10GE NDCs offer a broad set of capabilities, including the following:

- iSCSI HBA
- FCoE
- Data center bridging
- Multiple Receive Queues
- Switch Independent Partitioning
- SR-IOV

iSCSI boot

The 10GbE NDC ports support the ability to boot the server from a remote iSCSI target over the network. This is fully managed by Dell USC for device configuration, updates, and real-time monitoring.

iSCSI HBA

The iSCSI offload adapter supports full offload of the data path for iSCSI IO, including offload for iSCSI header and data digests. Session initiator and teardown is managed by host driver components, but once an iSCSI session is established, all iSCSI protocol involved in initiating and completing SCSI IOs are offloaded to the network controller hardware.

Fiber Channel over Ethernet (FCoE)

The FCoE offload adapter supports FCoE and FIP per the T11 American National Standard for Information Technology- Fibre Channel—Fibre Channel Backbone - 5 (FC-BB-5). Full offload of the data path for SCSI IO including offload for FC and FCoE is supported. Session initiation and teardown is managed by host driver components, but once an FC session is established, all FC protocol involved in initiating and completing SCSI IOs are offloaded in hardware.

Data Center Bridging (DCB)

Data Center Bridging (DCB) includes support for the following IEEE standards:

- **P802.1Qaz:** IEEE Standard for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks - Amendment: Enhanced Transmission Selection.
- **P802.1Qbb:** IEEE Standard for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks - Amendment: Priority-based Flow Control.
- **DCBx iSCSI Application Type-Length-Value (TLV):** Dell has recently added this application TLV, which provides the primary mechanism for communicating capabilities from switch-to-switch or switch-to-edge device node within the DCBx protocol. This is an extension to the 802.1AB LLDP protocol. Of particular need is the support for an application TLV that supports the TCP well-known port 3260 (iSCSI).

Enhanced Transmission Selection

Enhanced Transmission Selection (ETS) enables transmission bandwidth management and rate limiting per traffic class. ETS allows traffic classes to use spare bandwidth above the guaranteed minimum. ETS provides common management of bandwidth allocation on a per priority group basis. Switches that claim support for DCB, should allow configuration of priority groups, assignment of individual classes of service to each group and the allotment of per-port bandwidth to each group.

Priority-based Flow Control

Priority-based Flow Control (PFC) enables multiple traffic types to share a common Ethernet physical link without interfering with each other. PFC allows link flow control to be performed on a per-priority basis. Priority-based Flow Control (PFC) provides a link level flow control mechanism that can be controlled independently for each priority queue. PFC provides a link level flow control mechanism that can be controlled independently for each frame priority class of service. Switches that claim support for DCB should provide mechanisms for assigning a class of service to different "streams" of traffic.

Data Center Bridging Capability Exchange Protocol

Data Center Bridging Capability Exchange Protocol (DCBCXP) is an LLDP-based protocol used to exchange link configuration parameters for PFC, and ETS. It is a discovery- and capability-exchange protocol that is used to convey link capabilities and configuration. Link partners can choose the following supported features and parameters for PFC and ETS using LLDP, as defined by IEEE 802.1AB:

- Protocol to exchange DCB parameters
- Set local operational parameters based on exchange
- Resolve conflicting parameters

Multiple Receive Queues

Multiple Receive Queues is a hypervisor-enabled technology that offloads the software vswitch from sorting and forwarding the received packets to specific VMs. The NDC controller does the sorting and forwarding of received traffic into queues that are mapped to a given VM using destination MAC Address and VLAN ID, if applicable. This eliminates bottlenecks in the vswitch implementation, increasing the total throughput. VMware calls this technology NetQueue, and Microsoft calls it VMQ.

Switch Independent Partitioning

Switch Independent Partitioning is also referred to as NIC Partitioning (NPAR). Switch Independent Partitioning provides the capability to divide a 10GE NIC port into multiple PCI functions with flexible bandwidth capacity allocation that looks to the OS and network infrastructure as separate NIC interfaces. On the host OS side, Switch Independent Partitioning presents up to eight PCI functions per device using standard PCI configuration space. Dell's implementation maps four PCI functions to a physical port on a dual-port 10GE device. Each function or partition is assigned a unique MAC Address.

Switch Independent Partitioning enables allows you to replace multiple 1GE NICs with partitioning-enabled 10GE NICs. This allows consolidation of multiple GE ports into fewer 10GE ports, reducing switch port and cabling complexity while maintaining the network segmentation and isolation. In addition, flexible-bandwidth allocation per partition allows for efficient use of the 10GE link.

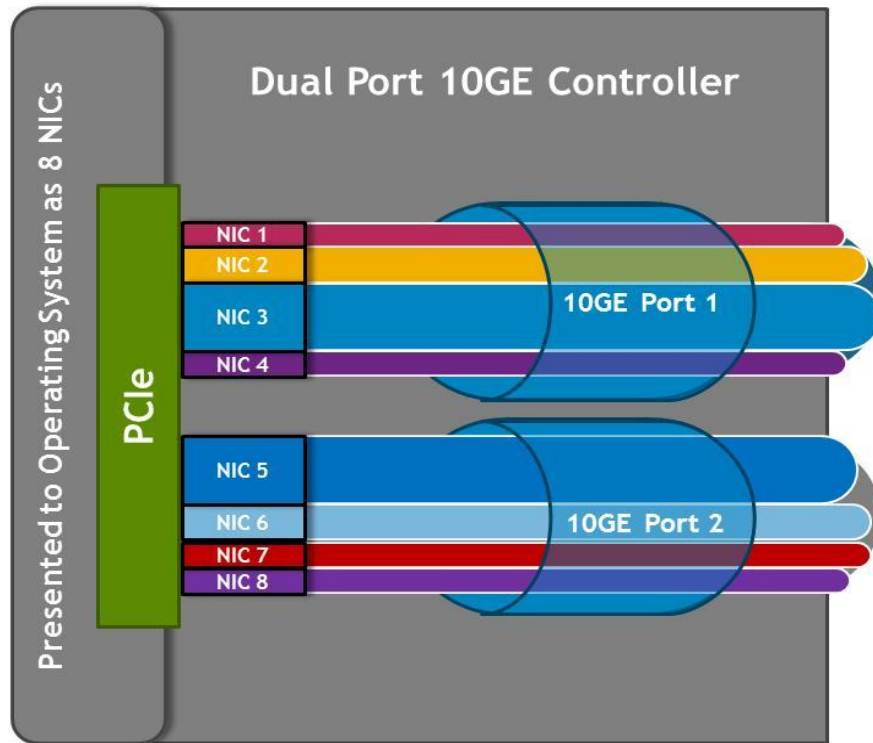
A Switch Independent Partitioning enabled 10GE link supports the following server use cases:

- **Server segmentation:** The partitions can be on separate subnets or VLANs.
- **Server high availability:** The partitions support NIC teaming, including switch dependent link failover and load balancing.
- **Physical and virtual server:** NIC Partitioning is supported in both native OS and hypervisor-based OS. In a virtual server, emulated and direct assignment I/O of partitions to VMs are supported.

Partitions are available for VM assignment (direct or emulated) and for application segmentation via VLAN or IP subnets.

Note: The maximum number of supported partitions by the Broadcom 2x1Gb+2x10Gb rack NDC is 4 (2 partitions per 10Gb port). The 1Gb ports do not support Switch Independent Partitioning.

Figure 2. 10Gb Switch Independent Partitioning



SR-IOV ready

Single Root I/O Virtualization (SR-IOV) enables a natively shareable device that can bypass the hypervisor on a virtualized server for the main data movement. It enables a VM to have direct access to a PCI I/O device while sharing the device among multiple VMs or GOSes. The PCI-SIG Single Root I/O Virtualization and Sharing specification defines a standard to implement a natively shareable device in a virtualized host. Virtual functions provide independent DMA streams that can be assigned to a VM. A Physical Function includes the resource capabilities to create the VFs.

A single Ethernet port appears as multiple devices showing in PCI Configuration space as multiple functions. SRIOV enabled hypervisors initialize and assign VFs to virtual machines.

Table 3. Dell PowerEdge Select Network Adapters software features

Vendors	Chipset	Supported speed	FCoE (offload, boot)	iSCSI (boot, offload, software)	Switch Independent Partitioning	SR-IOV	DCB with iSCSI	System management with real-time monitoring
Broadcom®	5720	1GbE	Not supported	Software iSCSI, iSCSI boot	Not supported	Not supported	Not supported	Supported
	57800 57810	1Gb and 10GbE	Not supported	All	Supported (only 10GE)	Not supported	Not supported	Supported
Intel®	I350	1GbE	Not supported	Software iSCSI, iSCSI boot	Not supported	Not supported	Not supported	Supported
	X520/X540	1Gb and 10GbE	All (only 10GE)	Software iSCSI, iSCSI boot	Not supported	Supported	Supported	Supported
QLogic®	P3+	10GbE only	All	All	Supported	Not supported	Supported	Supported

Supported system interfaces

PCIe interface

Two PCIe links are available on the rack NDC. A Gen3-capable x8 link that can be bifurcated is the primary link and is sourced from CPU1, and a secondary link that is Gen2 x2 is also available for additional device support and is sourced from the PCH.

The blade NDC supports one PCIe x8 Gen 2 or Gen 3 interface.

NC-SI interface

An RMI interface is available to the NDC for NC-SI (Network Controller Sideband Interface) implementation. The NDC supports NC-SI implementation that conforms to NC-SI Specification Version 1.0.0 as defined by DMTF. Any port on the NDC can be used for iDRAC remote access. This allows for dual use of a single switch port and server port that carries data to/from the OS platform and iDRAC.

I2C interface

I2C clock and data signals are connected to the TFRU. The Field Replaceable Unit (FRU) part is specific to Dell programs and comes preprogrammed with the base FRU code, greatly simplifying manufacturing of the device. It also includes a temperature sensor.

PowerEdge platforms that support Select Network Adapters

The Blade Select Network Adapter is offered on the PowerEdge M620 blade server.

The Rack Select Network Adapter is offered on the following PowerEdge platforms:

- R620
- R720
- R720xd

System integration

Features for Select Network Adapter system integration include Device Disable, WoL, and iDRAC integration.

Device Disable

The Select Network Adapter supports disabling the LAN controller(s) by putting the device(s) into the lowest power state. The Select Network Adapter supports an enable/disable mechanism exposed through the BIOS F2 setup or Dell USC tool. This allows a card level disable where all ports are on or off.

Wake on LAN

The NDC connects to the system chipset PCI Power Management Event pin to generate power management events in Wake on LAN (WOL) implementations.

When the system is operating in Vaux with WoL enabled, the device driver uses link auto-negotiation to advertise the lowest-supported speed in attempt to negotiate the lowest speed possible to conserve power. The 10GBASE-T device will not link up at 10Gbps when operating in Vaux due to the large Vaux power requirement.

Wake on LAN is supported on only one port in a server at any given time.

iDRAC integration

The NDC supports a Shared LOM Port for iDRAC communication via any port over the NC-SI sideband interface.

Form factors

Blade Select Network Adapters

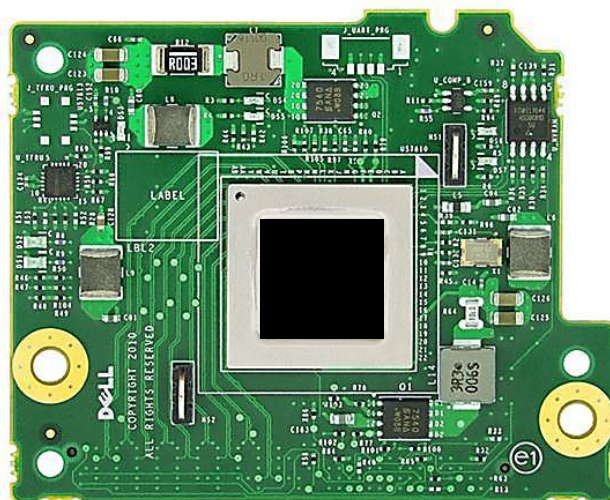
This is a single type of Select Network Adapter that supports 10GBASE-KR. KR is a 10Gbps serial interface routed over the blade server mid-plane connecting to an IOM switch or Pass-thru. Three blade Select Network Adapters are offered by Dell as follows:

- Intel x520 Dual Port 10Gb KR NDC: A dual-port 10GbE blade NDC based on the Intel x520 chipset
- Broadcom 57810S Dual Port 10Gb KR NDC: A dual-port 10GbE blade NDC based on the Broadcom 57810S chipset
- QLogic QMD8262-k Dual Port 10Gb KR NDC: A dual-port 10GbE blade NDC based on the QLogic P3+ chipset

Note: Both the Broadcom and Intel blade NDCs will support both 1Gb and 10Gb speeds, while the QLogic blade NDC will run only at 10Gb speeds.

A 10Gb blade NDC is shown in Figure 3.

Figure 3. 10GbE blade NDC



Rack Select Network Adapters

This is a single type of Select Network Adapter that supports four rack NDCs as follows:

- Intel:
 - Intel Ethernet x540 Dual Port 10Gb BT + i350 DP 1Gb BT NDC: A quad-port rack NDC with 2 ports x 1GbE + 2 ports x 10GBASE-T based on the Intel I350 and x540 chipsets
 - Intel Ethernet i350 Quad Port 1GbE NDC: A quad-port rack NDC with 4 ports x 1GbE based on the Intel I350 chipset
- Broadcom
 - Broadcom 57800S 2x1Gb+2x10Gb SFP+ NDC: A quad-port rack NDC with 2 ports x 1GbE + 2 ports x 10G SFP+ based on the Broadcom 57800S chipset
 - Broadcom 5720 4x1Gb Base-T NDC: A quad-port rack NDC with 4 ports of 1GbE based on the Broadcom 5720 chipset

An Intel 2x1Gb + 2x10Gb Base-T rack NDC, as shown in Figure 4, offers two types of interconnects to meet various connectivity needs.

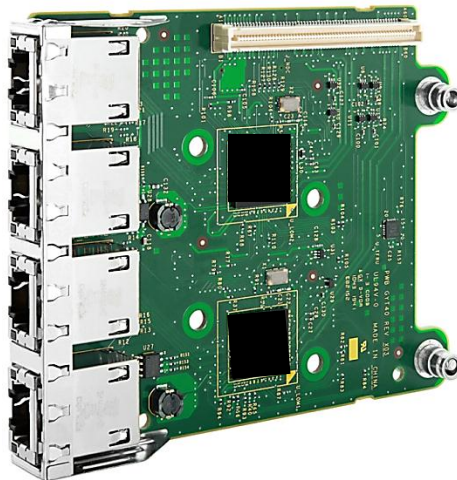
Figure 4. Rack 2x1Gb+ 2x10Gb BT NDC



4 x 1G NDC

A Broadcom 4 x 1G NDC provides four 1000BASE-T ports, as shown in **Error! Reference source not found..**

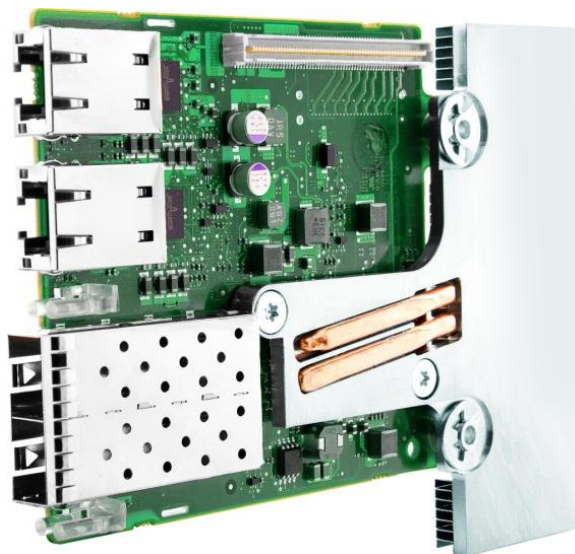
Figure 5. 4 x 1G BT NDC



2 x 1G + 2 x 10G SFP+ NDC

A Broadcom 2 x 1G + 2 x 10G SFP+ NDC provides two 1000BASE-T ports and two 10G SFP+ ports as shown in Figure 6.

Figure 6. Rack 2x1Gb+ 2x10Gb SFP+ NDC



Conclusion

The Dell PowerEdge Select Network Adapters family is designed to provide a choice of integrated network interconnects for PowerEdge rack and blade servers. The portfolio includes choice of vendor, link speeds, and physical interconnect to meet our customer requirements. In addition, Dell PowerEdge Select Network Adapters offer a full-featured portfolio, including convergence and virtualization. Customers now have more I/O bandwidth choices through the Select Network Adapters on our new twelfth-generation Dell PowerEdge servers, including 1GbE and 10GbE, when compared to current servers. Convergence features such as iSCSI and FCoE are offered built-in, supporting LAN/SAN traffic right off the motherboard without a license fee. Virtualization enhancements such as Switch Independent Partitioning and SRIOV are now offered on both blade and rack mount servers through the Select Network Adapters. We are excited to offer this compelling capability to our customers that provides investment protection as demands for I/O capacity (1GbE vs. 10GbE) driven by convergence and virtualization increase.

Satisfying these needs is what the Select Network Adapter family is designed for. Flexibility, converged functions, virtualized I/O, and effective system management all replace a single-function, fixed I/O LOM on rack and blade servers. This powerful new approach to server I/O, combined with a family of advanced server platforms from which to choose from, is a compelling reason to choose Dell.

Dell will continue to investigate and expand the portfolio of Select Network Adapters, based on customer requirements and the progression of technology.

Appendix A: Industry specifications

- IEEE Data Center Bridging (DCB) standards: <http://www.ieee802.org/1/pages/dcbridges.html>
- SR-IOV Specification: http://www.pcisig.com/specifications/iov/single_root/
- NC-SI Specification Version 1.0.0: http://www.dmtf.org/sites/default/files/standards/documents/DSP0222_1.0.0.pdf
- IEEE 802.1AB <http://standards.ieee.org/findstds/standard/802.1AB-2009.html>

Appendix B: Acronyms

Acronym	Meaning	Acronym	Meaning
10GE	10 Gigabit Ethernet	HII	Human Infrastructure Interface
ACL	Access Control List	I/O	Input/Output
BIOS	Basic Input/Output System	iDRAC	Integrated Dell Remote Access Controller
BPE	Bridge Port Extension	IHV	Independent Hardware Vendor
CLP	Command Line Protocol	IP	Internet Protocol
CN	Congestion Notification	iSCSI	Internet Small Computer System Interface
CPU	Central Processing Unit	LAA	Locally Administered Address
CSO	Checksum Offload	LACP	Link Aggregation Control Protocol
DCB	Data Center Bridging	LAN	Local Area Network
DCBX	Data Center Bridging Exchange Protocol	LCC	Lifecycle controller
DMA	Direct Memory Access	LOM	LAN On Motherboard
DPN	Dell Part Number	LRO	Large Receive Offload
DRS	Distributed Resource Scheduler	LSO	Large Send Offload
ETS	Enhanced Transmission Selection	MAC	Media Access Controller
EVB	Edge Virtual Bridge	MIB	Management Information Base
FCoE	FibreChannel over Ethernet	MSI	Message Signaled Interrupt
FLR	Function Level Reset	MTU	Maximum Transmission Unit
FQDD	Fully Qualified Device Descriptor	NC-SI	Network Controller Sideband Interface
GE	Gigabit Ethernet	NIC	Network Interface Card
GOS	Guest Operating System	NPar	NIC Partitioning
NRM	Network Resource Manager	SDCL	Supplier Deliverable Control List

Acronym	Meaning	Acronym	Meaning
NVRAM	Non-Volatile Random Access Memory	SIG	Special Interest Group
OptROM	Option ROM	SLES	Novell® SUSE® Linux Enterprise Server
OS	Operating System	SRIOV	Single Root I/O Virtualization
PCI	Peripheral Component Interconnect	TCP	Transmission Control Protocol
PCI-E	PCI Express	TOE	TCP Offload Engine
PFC	Priority-based Flow Control	UEFI	Unified Extensible Firmware Interface
PXE	Preboot Execution Environment	VEB	Virtual Ethernet Bridge
QoS	Quality of Service	VLAN	Virtual Local Area Network
RHEL	Red Hat® Enterprise Linux®	VM	Virtual Machine
ROM	Read Only Memory	VMM	Virtual Machine Monitor
RSS	Receive Side Scaling	vNIC	Virtual Network Interface Card
SAN	Storage Area Network	VPD	Vital Product Data
		WOL	Wake On LAN

Appendix C: 10GE connectivity options

Below are the sample pictures of direct attach cables, a fibre optics cable, and 10Gb SR optics.

Direct attach cable



Direct attach cable connectors



Multi mode 10Gb fibre optic cable



10Gb Base SR connector

