

# Intel X520 and X540-T2 Dual Port 10 GbE Adapters for IBM System x

## IBM Redbooks Product Guide

The Intel X520 and X540-T2 Dual Port 10 GbE adapters for IBM® System x® are powered by reliable and proven 10 Gb Ethernet technology from Intel. These cards offer full line-rate 10 Gbps performance for high-I/O intensive applications, and showcase the next generation in 10 GbE networking features for the enterprise network and data center. The Intel X520 adapter provides SFP+ based connectivity options (fiber or DAC cabling). The Intel X540-T2 adapter offers 10GBASE-T connectivity with RJ-45 ports, with compatibility with the existing 1000BASE-T network, simplifying the transition to the 10 Gb Ethernet technology. The following figure shows the Intel X540-T2 Dual Port 10GBaseT Adapter for IBM System x.



Figure 1. Intel X540-T2 Dual Port 10GBaseT Adapter for IBM System x

### Did you know

In a multicore platform, the Intel X520 and X540-T2 adapters support Intel I/O Virtualization Technology (I/OVT), which helps accelerate data across the platform, therefore improving application response times. For virtualized environments, Intel Ethernet adapters offer advanced features with VMDq that lower processor utilization and increase I/O performance.

The X520 adapter is also available in a special mezzanine form factor for supported servers. This form factor allows you to use the server's standard PCIe slots for other technologies.

## Part number information

The following table provides the ordering part numbers and feature codes for the Intel X520 and X540-T2 adapters.

Table 1. Ordering part numbers and feature codes

Part number	Feature code	Description
49Y7960	A2EC	Intel X520 Dual Port 10GbE SFP+ Adapter for IBM System x
49Y7980	A3JS	Intel X520 Dual Port 10GbE SFP+ Embedded Adapter for IBM System x
49Y7970	A2ED	Intel X540-T2 Dual Port 10GBaseT Adapter for IBM System x

The adapter option part numbers includes the following items:

- One Intel 10 Gb Ethernet adapter
- 3U bracket attached with 2U bracket included in the box (except for the Embedded Adapter)
- Quick Install Guide
- Warranty Flyer
- Documentation CD
- Important Notices Flyer

**Note:** The X520 adapters ship without any SFP+ transceivers or direct attach cables. These items need to be ordered separately (see Table 2 and Table 3 for details).

The following figure shows the Intel X520 Dual Port 10GbE SFP+ Adapter for IBM System x.



Figure 2. Intel X520 Dual Port 10GbE SFP+ Adapter for IBM System x

## Supported transceivers and direct-attach cables

The Intel X520 Dual Port 10GbE SFP+ Adapter and X520 Dual Port 10GbE SFP+ Embedded Adapter have two empty SFP+ cages that support SFP+ SR transceivers and Twinax direct attached copper cables, as listed in Table 2 and Table 3.

Table 2. Supported SFP+ transceivers

Part number	Feature code	Description
Optical Transceivers		
44W4408	4942	10GbE 850 nm Fiber SFP+ Transceiver (SR)
49Y4216	0069	Brocade 10Gb SFP+ SR Optical Transceiver
46C3447	5053	IBM SFP+ SR Transceiver (10Gb)
49Y4218	0064	QLogic 10Gb SFP+ SR Optical Transceiver

Table 3. Supported direct attach cables

Part number	Feature code	Description
Active DAC/Twinax cables		
95Y0323	A25A	1m IBM Active DAC SFP+ Cable
95Y0326	A25B	3m IBM Active DAC SFP+ Cable
95Y0329	A25C	5m IBM Active DAC SFP+ Cable
Passive DAC/Twinax cables		
00D6288	A3RG	.5m IBM Passive DAC SFP+ Cable
90Y9427	A1PH	1m IBM Passive DAC SFP+ Cable
90Y9430	A1PJ	3m IBM Passive DAC SFP+ Cable
90Y9433	A1PK	5m IBM Passive DAC SFP+ Cable
00D6151	A3RH	7m IBM Passive DAC SFP+ Cable

## Features

The Intel X520 and X540-T2 adapters have the following features:

- Load balancing on multiple processors, which increases performance on multiprocessor systems by efficiently balancing network loads across processor cores when used with Receive Side Scaling from Microsoft or Scalable I/O on Linux.
- Header Splits and Replication in Receive helps the driver focus on the relevant part of the packet without needing to parse it.
- Multiple queues allow packet handling without the waiting/buffer overflow, which provides efficient packet prioritization.

- Offload features:
  - IP, TCP, and UDP checksum offload (IPv4 and IPv6)
  - TCP segmentation/large send offload (IPv4 and IPv6)
  - IPsec offload
  - MACsec offload
  - Receive Side Scaling for Windows and Scalable I/O for Linux (IPv4, IPv6, and TCP/ UDP)
- Support for Intel Virtualization Technology (VT) with I/OAT and VMDq.
- IEEE 802.1Q VLAN support with VLAN tag insertion, with stripping and packet filtering for up to 4096 VLAN tags.
- IEEE 802.3x flow control support.
- IEEE 802.1p Class of Service/Quality of Service.
- Support for Advanced Packet Filtering.
- Jumbo frames support (up to 9,500 bytes).
- Support for both UEFI and PXE boot.
- iSCSI and iSCSI boot as a software iSCSI initiator.
- Teaming support:
  - Adapter Fault Tolerance (AFT)
  - Switch Fault Tolerance (SFT)
  - Adaptive Load Balancing (ALB)
  - Virtual Machine Load Balancing (VMLB)
  - IEEE 802.3ad (link aggregation control protocol)
- Intel PROSet Utility for easy configuration and management.

Intel I/O Acceleration Technology (Intel I/OAT) is a suite of features that improves data acceleration across the platform, from networking devices to the chipset and processors, which helps improve system performance and application response times. The suite of features includes:

- Direct Cache Access (DCA): Enables the adapter to prefetch data from the memory cache, thereby avoiding cache misses and improving application response times.
- MSI-X interrupts: Minimizes the impact of I/O interrupts by load balancing interrupts across multiple processor cores.
- Low-Latency Interrupts: Allows the adapter to bypass the automatic moderation of time intervals between the interrupts (based on the sensitivity of the incoming data).
- Receive Side Scaling (RSS) and Scalable I/O: Directs the interrupts to a specific processor core based on the application's address.

Virtual Machine Device Queues (VMDq) reduces I/O impact on the hypervisor in a virtualized server by performing data sorting and coalescing in the network silicon. VMDq technology makes use of multiple queues in the network controller. As data packets enter the network adapter, they are sorted, and packets traveling to the same destination (or virtual machine) are grouped together in a single queue. The packets are then sent to the hypervisor, which directs them to their respective virtual machines. Relieving the hypervisor of packet filtering and sorting improves overall processor usage and throughput levels.

The adapters have complete iSCSI support for proven native OS and VM iSCSI initiators and for iSCSI boot. The Intel adapters support IPsec and MACsec offloads that provides full 10 Gbps line-rate performance in secured environments.

## Technical specifications

The Intel X520 Dual Port 10GbE Adapter and X520 Dual Port 10GbE SFP+ Embedded Adapter have the following specifications:

- Intel 82599 dual-port 10 Gb Ethernet controller
- Two empty SFP+ cages for SFP+ transceivers or DAC cables
- Supports 10 Gbps speeds with the optional SFP+ transceivers or DAC cables
- Standard PCIe low-profile card form factor (X520 Dual Port 10GbE Adapter)
- Mezzanine form factor (X520 Dual Port 10GbE SFP+ Embedded Adapter)
- PCIe 2.0 x8 host interface

The Intel X540-T2 Dual Port 10GBaseT Adapter for IBM System x has the following specifications:

- Intel X540 dual-port 10 Gb Ethernet controller
- Two 10GBASE-T RJ-45 ports
- Supports 100 Mbps, 1 Gbps, and 10 Gbps speeds
- Standard PCIe low-profile card form factor
- PCIe 2.0 x8 host interface

## Standards supported

Both the Intel X520 and Intel X540-T2 adapters support the following IEEE standards:

- IEEE 802.1p Class of Service (CoS) traffic prioritization
- IEEE 802.1Q VLAN tagging
- IEEE 802.3ad Link Aggregation Control Protocol
- IEEE 802.3x Full-duplex flow control

The Intel X540-T2 adapter supports the following standards:

- IEEE 802.3u 100BASE-TX Fast Ethernet
- IEEE 802.3ab 1000BASE-T copper twisted pair Gigabit Ethernet
- IEEE 802.3an 10GBASE-T copper twisted pair 10 Gb Ethernet

The Intel X520 adapter supports the following standards:

- IEEE 802.3ae 10GBASE-SR short range fiber optics 10 Gb Ethernet
- 10GSFP+Cu SFP+ Direct Attach copper

## Supported servers

The Intel X520 and X540-T2 10 Gb Ethernet adapters are supported on the IBM System x servers that are listed in the following table.

Table 4. Supported System x servers (Part 1)

Product description	Part number	x3100 M4 (2582)	x3250 M4 (2583)	x3300 M4 (7382)	x3500 M4 (7383)	x3530 M4 (7160)	x3550 M4 (7914)	x3630 M4 (7158)	x3650 M4 (7915)	x3690 X5 (7147)	x3750 M4 (8722)	x3850 X5 (7143)	dx360 M4 (7912)
Intel X520 Dual Port 10GbE SFP+ Adapter	49Y7960	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Intel X520 Dual Port 10GbE SFP+ Embedded Adapter	49Y7980	N	N	N	N	N	Y	N	Y	N	N	N	Y
Intel X540-T2 Dual Port 10GBaseT Adapter	49Y7970	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

† The Embedded VFA, 90Y6454, requires both processors be installed in the server to ensure sufficient air flow. The second processor includes additional system fans.

Table 4. Supported System x servers (Part 2)

Product description	Part number	x3200 M3 (7327, 7328)	x3250 M3 (4251, 4252)	x3400 M3 (7378, 7379)	x3500 M3 (7380)	x3550 M3 (7944)	x3620 M3 (7376)	x3630 M3 (7377)	x3650 M3 (7945)	x3755 M3 (7164)	dx360 M3 (6391)
Intel X520 Dual Port 10GbE SFP+ Adapter	49Y7960	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Intel X520 Dual Port 10GbE SFP+ Embedded Adapter	49Y7980	N	N	N	N	N	N	N	N	N	N
Intel X540-T2 Dual Port 10GBaseT Adapter	49Y7970	Y	Y	Y	Y	Y	Y	Y	Y	N	Y

For the latest information about the System x servers that support each adapter, see the IBM ServerProven website at:

<http://ibm.com/servers/eserver/serverproven/compat/us/>

## Network cabling requirements

The network cables that can be used with the adapters are described in the following sections.

### Intel X520 Dual Port 10GbE SFP+ Adapter

#### Intel X520 Dual Port 10GbE SFP+ Embedded Adapter

- 10GBASE-SR (supported with the optional 10 GbE SFP+ transceivers listed in Table 2)
  - 850 nm communication using multimode fiber cable (50  $\mu$  or 62.5  $\mu$ ), up to 300 m, using an LC duplex connector
- 10GSFP+Cu (supported with the optional SFP+ DAC cables listed in Table 3)
  - Up to 5 m SFP+ copper direct attach cables, as listed in Table 3

### Intel X540-T2 Dual Port 10GBaseT Adapter

- 10GBASE-T
  - UTP Category 7 (100 m maximum)
  - UTP Category 6a (100 m maximum)
  - UTP Category 6 (55 m maximum)
- 1000BASE-T and 100BASE-TX
  - UTP Category 7 (100 m maximum)
  - UTP Category 6a (100 m maximum)
  - UTP Category 6 (100 m maximum)
  - UTP Category 5e (100 m maximum)

Figure 3 shows the Intel X520 Dual Port 10GbE SFP+ Embedded Adapter. This form factor is designed to fit into a special slot in selected servers (see Table 4), allowing you to use the regular PCIe slots for other technologies.



Figure 3. Intel X520 Dual Port 10GbE SFP+ Embedded Adapter

## Supported operating systems

The Intel X520 and X540-T2 10 Gb Ethernet adapters for IBM System x support the following operating systems:

- Microsoft Windows Server 2008 R2
- Microsoft Windows Server 2008, Datacenter x64 Edition
- Microsoft Windows Server 2008, Datacenter x86 Edition
- Microsoft Windows Server 2008, Enterprise x64 Edition
- Microsoft Windows Server 2008, Enterprise x86 Edition
- Microsoft Windows Server 2008, Standard x64 Edition
- Microsoft Windows Server 2008, Standard x86 Edition
- Microsoft Windows Server 2008, Web x64 Edition
- Microsoft Windows Server 2008, Web x86 Edition
- Microsoft Windows Server 2012
- Red Hat Enterprise Linux 5 Server Edition
- Red Hat Enterprise Linux 5 Server with Xen x64 Edition
- Red Hat Enterprise Linux 5 Server x64 Edition
- Red Hat Enterprise Linux 6 Server Edition
- Red Hat Enterprise Linux 6 Server x64 Edition
- SUSE LINUX Enterprise Server 10 for AMD64/EM64T
- SUSE LINUX Enterprise Server 10 for x86
- SUSE LINUX Enterprise Server 10 with Xen for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 for AMD64/EM64T
- SUSE LINUX Enterprise Server 11 for x86
- SUSE LINUX Enterprise Server 11 with Xen for AMD64/EM64T
- VMware ESX 4.1
- VMware ESXi 4.1
- VMware vSphere 5.0 (ESXi)
- VMware vSphere 5.1 (ESXi)

For the latest information about the specific versions and service packs supported, see the IBM ServerProven website at:

<http://ibm.com/servers/eserver/serverproven/compat/us/>

Click **System x servers**, and then click **LAN** to see the support matrix. Select the check mark associated with the System x server in question to see the operating system support details.

## Physical specifications

The adapters have the following physical specifications:

The adapter dimensions has the following specifications (approximate, without bracket):

- Length: 168 mm (6.6 in.)
- Width: 69 mm (2.7 in.)
- Height: 15 mm (0.6 in.)

The mezzanine adapter has the following physical specifications:

- Height: 60 mm (2.4 in)
- Width: 160 mm (6.3 in)
- Depth: 17 mm (0.7 in)

Shipping box dimensions (approximate):

- Length: 238 mm (9.4 in.)
- Width: 143 mm (5.6 in.)
- Height: 51 mm (2.0 in.)

## Operating environment

These adapters are supported in the following environment:

- Operating temperature: 0 - 55 °C (32 - 131 °F)
- Storage temperature: -20 - 65 °C (-4 - 149 °F)
- Shipping conditions: -20 - 70 °C (-4 - 158 °F)
- Air flow requirement (LFPM): 45 minimum
- Wet bulb (max): 27 °C (81 °F)
- Relative humidity (operating/nonoperating): 10% - 90%
- Relative humidity (shipping): 5% - 95%, no condensation
- Relative humidity (storage): 5% - 80%
- Maximum dew point (operating): 21 °C (70 °F)
- Maximum operating altitude: 7,000 feet (2,134 m)
- Vibration and shock: IEC 68, FCC Part 68.302, NSTA, 1A
- Electrostatic/electromagnetic susceptibility: IEC 801-2, -3, -4, and -5

## Warranty

One-year limited warranty. When installed in a System x server, these cards assume your system's base warranty and any IBM ServicePac® upgrade.

## Agency approvals

The adapters conform to the following standards:

- EN55022
- EN55024
- EN60950 / CE
- EN 61000-3-2
- EN 61000-3-3
- ICES-003, Issue-004
- IEC 950 CB Scheme
- FCC 47 CFR Part 15 Class A
- UL 1950
- CSA C22.2 950-95
- VCCI
- AS/NZS CISPR 22 / C-tick
- RRL for KC
- BSMI
- UL 94-IV

## Top-of-rack Ethernet switches

The Intel X520 and X540-T2 adapters support end-to-end 10 GbE connections to the top-of-rack Ethernet switches from IBM System Networking that are listed in the following table.

Table 5. IBM System Networking - Top-of-rack switches

Part number	Description
SFP+ or DAC connections (Intel X520)	
7309DRX	IBM System Networking RackSwitch G8264CS (Rear to Front)
7309DFX	IBM System Networking RackSwitch G8264CS (Front to Rear)
7309BD5	IBM System Networking RackSwitch G8124DC
7309BR6	IBM System Networking RackSwitch G8124ER
7309BF7	IBM System Networking RackSwitch G8124EF
7309G64	IBM System Networking RackSwitch G8264R
730964F	IBM System Networking RackSwitch G8264F
0719410	Juniper Networks EX4500 - Front to Back Airflow
0719420	Juniper Networks EX4500 - Back to Front Airflow
10GBASE-T connections (Intel X540-T2)	
7309CR9	IBM System Networking RackSwitch G8264TR
7309CF9	IBM System Networking RackSwitch G8264TF

For more information, see the IBM Redbooks® Product Guides in the top-of-rack switch category:  
<http://www.redbooks.ibm.com/Redbooks.nsf/portals/systemx?Open&page=pg&cat=tor>

## Popular configurations

The following figure shows Intel 10 Gb Ethernet adapters installed in a supported rack server. The servers are connected to a 10 Gb Ethernet network using a pair of 10 Gb Ethernet switches.

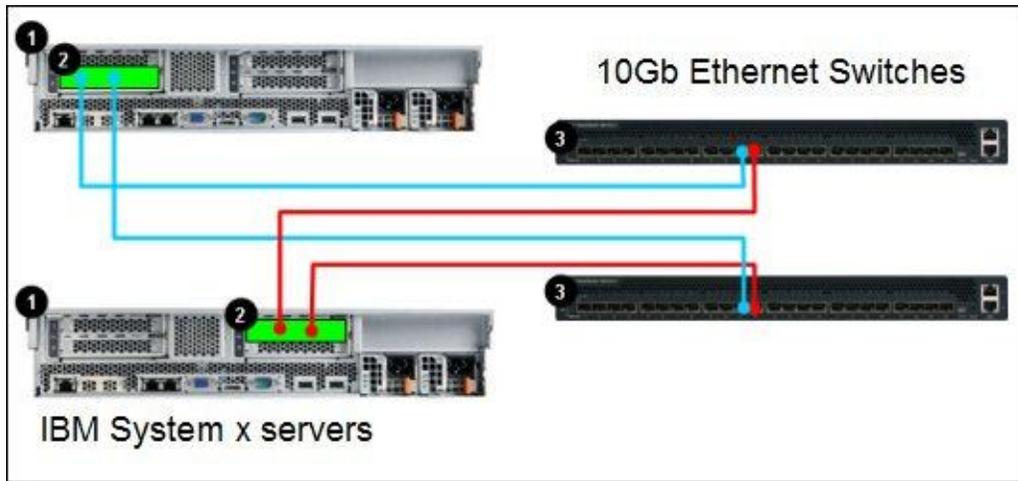


Figure 4. Popular configuration

The parts used are listed in the following table.

Table 6. Components used with the Intel 10 GbE adapters (Figure 4)

Diagram reference	Part number / machine type	Description	Quantity
1	Varies	Supported server (See Table 5)	2
2	Varies	Intel 10 Gb Ethernet Adapter (See Table 1)	2
2	Varies	Supported 10 Gb SFP+ Transceivers or direct-attach cables (See Tables 2 and 3)*	4
3	Varies	10 Gb Ethernet Switch (See Table 6)	2

\* SFP+ transceivers are not used with the Intel X540-T2 10GBaseT adapter because it has built-in RJ-45 ports. If SFP+ transceivers are used, this configuration also requires fiber optic cabling between the servers and the switches.

## Related publications

For more information, see the following documents:

- IBM US Announcement Letter - X520 Embedded:  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS111-209>
- IBM US Announcement Letter - X520:  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS111-222>
- IBM US Announcement Letter - X540-T2:  
<http://ibm.com/common/ssi/cgi-bin/ssialias?infotype=dd&subtype=ca&&htmlfid=897/ENUS112-088>
- Intel-based Gigabit and 10 Gigabit Ethernet adapters and cards *Installation and User's Guide*  
(download and unpack the ISO image and open index.htm in a browser):  
<http://ibm.com/support/entry/portal/docdisplay?Indocid=MIGR-5087548>
- *IBM System x Configuration and Options Guide*:  
<http://ibm.com/systems/xbc/cog/>
- Intel site for IBM Ethernet adapters:  
<http://www.intelethernet-ibm.com/>

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