



**IBM Flex System IB6132 2-port
FDR InfiniBand Adapter**

User's Guide



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FDR InfiniBand Adapter**

User's Guide

Note: Before using this information and the product it supports, read the general information in Appendix B, “Notices” on page 25, the Safety Information and Environmental Notices and User's Guide documents on the IBM Notices for Network Devices CD, and the Warranty Information document that comes with the product.

First Edition February 2012

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Safety

Before installing this product, read the Safety Information.

قبل تركيب هذا المنتج، يجب قراءة الملاحظات الأمنية

Antes de instalar este produto, leia as Informações de Segurança.

在安装本产品之前，请仔细阅读 **Safety Information**
(安全信息)。

安裝本產品之前，請先閱讀「安全資訊」。

Prije instalacije ovog produkta obavezno pročitajte Sigurnosne Upute.

Před instalací tohoto produktu si přečtěte příručku bezpečnostních instrukcí.

Læs sikkerhedsforskrifterne, før du installerer dette produkt.

Lees voordat u dit product installeert eerst de veiligheidsvoorschriften.

Ennen kuin asennat tämän tuotteen, lue turvaohjeet kohdasta Safety Information.

Avant d'installer ce produit, lisez les consignes de sécurité.

Vor der Installation dieses Produkts die Sicherheitshinweise lesen.

Πριν εγκαταστήσετε το προϊόν αυτό, διαβάστε τις πληροφορίες ασφάλειας
(safety information).

לפני שתתקינו מוצר זה, קראו את הוראות הבטיחות.

A termék telepítése előtt olvassa el a Biztonsági előírásokat!

Prima di installare questo prodotto, leggere le Informazioni sulla Sicurezza.

製品の設置の前に、安全情報をお読みください。

본 제품을 설치하기 전에 안전 정보를 읽으십시오.

Пред да се инсталира овој продукт, прочитајте информацијата за безбедност.

Les sikkerhetsinformasjonen (Safety Information) før du installerer dette produktet.

Przed zainstalowaniem tego produktu, należy zapoznać się z książką "Informacje dotyczące bezpieczeństwa" (Safety Information).

Antes de instalar este produto, leia as Informações sobre Segurança.

Перед установкой продукта прочтите инструкции по технике безопасности.

Pred inštaláciou tohto zariadenia si pečítajte Bezpečnostné predpisy.

Pred namestitvijo tega proizvoda preberite Varnostne informacije.

Antes de instalar este producto, lea la información de seguridad.

Läs säkerhetsinformationen innan du installerar den här produkten.

Important:

Each caution and danger statement in this document is labeled with a number. This number is used to cross reference an English-language caution or danger statement with translated versions of the caution or danger statement in the *Safety Information* document.

For example, if a caution statement is labeled "Statement 1," translations for that caution statement are in the *Safety Information* document under "Statement 1."

Be sure to read all caution and danger statements in this document before you perform the procedures. Read any additional safety information that comes with the server or optional device before you install the device.

This device is intended for use with UL Listed IBM devices.

Statement 1:



DANGER

Electrical current from power, telephone, and communication cables is hazardous.

To avoid a shock hazard:

- **Do not connect or disconnect any cables or perform installation, maintenance, or reconfiguration of this product during an electrical storm.**
- **Connect all power cords to a properly wired and grounded electrical outlet.**
- **Connect to properly wired outlets any equipment that will be attached to this product.**
- **When possible, use one hand only to connect or disconnect signal cables.**
- **Never turn on any equipment when there is evidence of fire, water, or structural damage.**
- **Disconnect the attached power cords, telecommunications systems, networks, and modems before you open the device covers, unless instructed otherwise in the installation and configuration procedures.**
- **Connect and disconnect cables as described in the following table when installing, moving, or opening covers on this product or attached devices.**

To Connect:

1. Turn everything OFF.
2. First, attach all cables to devices.
3. Attach signal cables to connectors.
4. Attach power cords to outlet.
5. Turn device ON.

To Disconnect:

1. Turn everything OFF.
2. First, remove power cords from outlet.
3. Remove signal cables from connectors.
4. Remove all cables from devices.

Chapter 1. IBM Flex System IB6132 2-port FDR InfiniBand adapter

The IBM Flex System IB6132 2-port FDR InfiniBand adapter provides the highest performing and most flexible interconnect solution for servers used in Enterprise Data Centers, High-Performance Computing, and Embedded environments.

This User's Guide contains setup and installation instructions for the IBM Flex System IB6132 2-port FDR InfiniBand adapter and general information about the adapter, including how to install drivers and how to get help.

For information about the types of compatible devices available for IBM products, contact your IBM marketing representative or authorized reseller. For a list of supported optional devices, see

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

The warranty document for this product comes with the network device, and it contains information about the terms of the warranty.

For the most up-to-date product documentation for all of your IBM Flex System products, go to the IBM Flex System Information Center at

<http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp>.

Related documentation

This User's Guide contains setup and installation instructions for the IBM Flex System adapter and general information about the adapter and how to get help. The most recent version of this User's Guide and all other related documents are at <http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp>.

In addition to this User's Guide, the following related documentation is available for your adapter:

- *IBM Flex System Installation and Service Guide*
The Installation and Service Guide that comes with the IBM compute node contains the instructions for installing the adapter in the compute node.
- *Mellanox OFED for Linux User Manual*
- This document is available at www.mellanox.com, and it provides information about the Mellanox OFED software. Mellanox OFED is a single Virtual Protocol Interconnect (VPI) software stack that is based on the OpenFabrics (OFED) Linux stack.
- *MLNX_VPI for Windows User Manual*
This README document is available at www.mellanox.com, and it provides information about the Mellanox WinOF VPI driver Rev 2.1.3 package, which is distributed for Windows Server 2008 (x86 and x64), Windows Server R2 (x64), and Windows 7 (x86 and x64).
- *MLNX_VPI for Windows Installation Guide*
This document is available at www.mellanox.com, and it provides information about installing and testing MLNX_VPI for Windows on a single host machine that has an IBM IB6132 FDR InfiniBand adapter installed.
- Mellanox InfiniBand OFED Driver for VMware vSphere 4.X

This document is available at www.mellanox.com, and it provides information about the Mellanox OFED software. Mellanox OFED is a single Virtual Protocol Interconnect (VPI) software stack that is based on the OpenFabrics (OFED) Linux stack and adapted for use on VMware.

IBM Flex System Notices for Network Devices CD that comes with the adapter contains the following documentation in portable document format (PDF):

- *IBM Flex System Network Devices Basic Troubleshooting Information*
This multilingual document contains basic troubleshooting information and a replacement parts list for the switches, adapters, and pass-thru modules. The product documentation that comes with your IBM chassis, compute node, or network device might contain more detailed troubleshooting information.
- *IBM Safety Information*
This multilingual document contains the translated versions of the safety messages that appear in the IBM documentation.
- *IBM Environmental Notices and User's Guide*
This multilingual document contains the world wide environmental and recycling information for your product.
- *IBM License Agreement for Machine Code*
This multilingual document contains the IBM license information for the machine code for your product.
- *IBM Warranty Information*
This multilingual document is provided on the CD and in printed format. It contains the IBM warranty information for your product.

For the most up-to-date documentation for all of the IBM Flex System products, go to the IBM Flex System Information Center at <http://publib.boulder.ibm.com/infocenter/flexsys/information/index.jsp>.

Notices and statements in this document

The caution and danger statements in this document are also in the multilingual *Safety Information* document, which is provided on the *IBM Notices for Network Device* CD. Each statement is numbered for reference to the corresponding statement in your language in the *Safety Information* document.

The following notices and statements are used in this document:

- **Note:** These notices provide important tips, guidance, or advice.
- **Important:** These notices provide information or advice that might help you avoid inconvenient or problem situations.
- **Attention:** These notices indicate potential damage to programs, devices, or data. An attention notice is placed just before the instruction or situation in which damage could occur.
- **Caution:** These statements indicate situations that can be potentially hazardous to you. A caution statement is placed just before the description of a potentially hazardous procedure step or situation.
- **Danger:** These statements indicate situations that can be potentially lethal or extremely hazardous to you. A danger statement is placed just before the description of a potentially lethal or extremely hazardous procedure step or situation.

Features and specifications

The IBM Flex System IB6132 2-port FDR InfiniBand adapter has the following features and specifications:

- FDR
- Virtual Protocol Interconnect (VPI)
- InfiniBand Architecture Specification v1.2.1 compliant
- IEEE Std. 802.3 compliant
- PCI Express 3.0 (1.1 and 2.0 compatible) through an x8 edge connector up to 8GT/s
- CPU off-load of transport operations
- CORE-Direct® application off-load
- GPUDirect application off-load
- Unified Extensible Firmware Interface (UEFI)
- Wake on LAN (WoL)
- RDMA over Converged Ethernet (RoCE)
- End-to-end QoS and congestion control
- Hardware-based I/O virtualization
- TCP/UDP/IP stateless off-load
- Ethernet encapsulation (EoIB)
- RoHS-6 compliant

Table 1 - IBM Flex System IB6132 2-port FDR InfiniBand adapter specifications table

Physical	Size: 3.3in. x 3.8 in. (84.89mm x 96.7 mm)
Protocol Support	InfiniBand: IBTA v1.2.1 Auto-Negotiation: 1X/2X/4X SDR (2.5Gb/s per lane), DDR (5Gb/s per lane), QDR (10Gb/s per lane), FDR10 (40Gb/s, 10Gb/s per lane), FDR (56Gb/s, 14Gb/s per lane)
	Ethernet: XAUI/10GBASE-KX4 – 4X 10GigE port, XFI/SFI/10GBASE-KR – 1X 10GigE port
	Data Rate: Up to 56 Gb/s FDR– InfiniBand 1/10 Gb/s – Ethernet
	PCI Express Gen3: SERDES @ 8.0GT/s, 8 lanes (2.0 and 1.1 compatible)
Regulatory	EMC: Refer to the following link: www.mellanox.com/related-docs/user_manuals/Regulatory_and_Compliance_Guide.pdf
	Safety: IEC/EN 60950-1:2006 ETSI EN 300 019-2-2 IEC 60068-2- 64, 29, 32
	RoHS: RoHS-R6

Finding the GUID and serial number on the adapter

Each adapter has a label on the print side that shows the adapter serial number and the GUID for the InfiniBand protocol.

Figure 1: Board Label 1



Figure 2: Board Label 2



Chapter 2. Installing the IBM Flex System adapter

This chapter provides information and instructions for installing and managing the adapter. See the documentation that came with the IBM Flex System compute node for the instructions needed to install the adapter in the node; then, return to this User's Guide for the information and instructions needed to complete the installation.

Installation of this adapter should only be done by a properly qualified technician or engineer. Read and follow all safety precautions specified in this document.

Use the documentation supplied with the IBM Flex System chassis to remove and replace the compute node from the chassis.

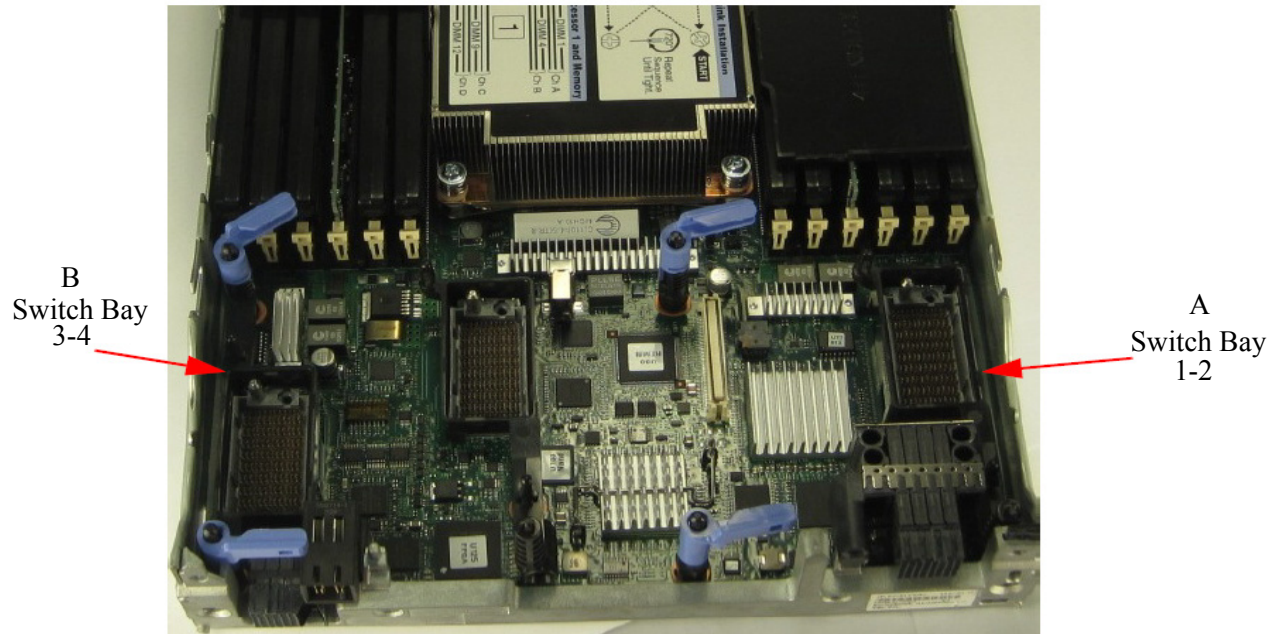
1. Remove the cover from the compute node
 - a. With the compute node sitting on the work table slide the release button, located on the right-side of the compute node, forward while pressing it down as well. This action releases the cover of the compute node.
 - b. Lift the cover from the compute node.

Figure 3: Lift Off Cover



2. The adapter can be placed in either of the two available slots.

Figure 4: Compute Node



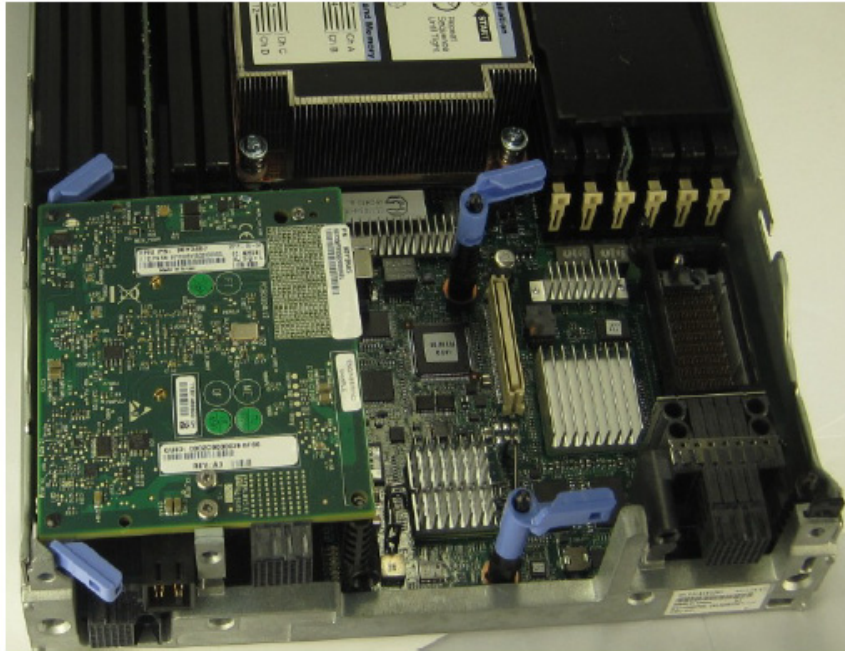
3. Line up the adapter so that the pins of the adapter are over the sockets in the compute node.

Figure 5: IBM Flex System Adapter



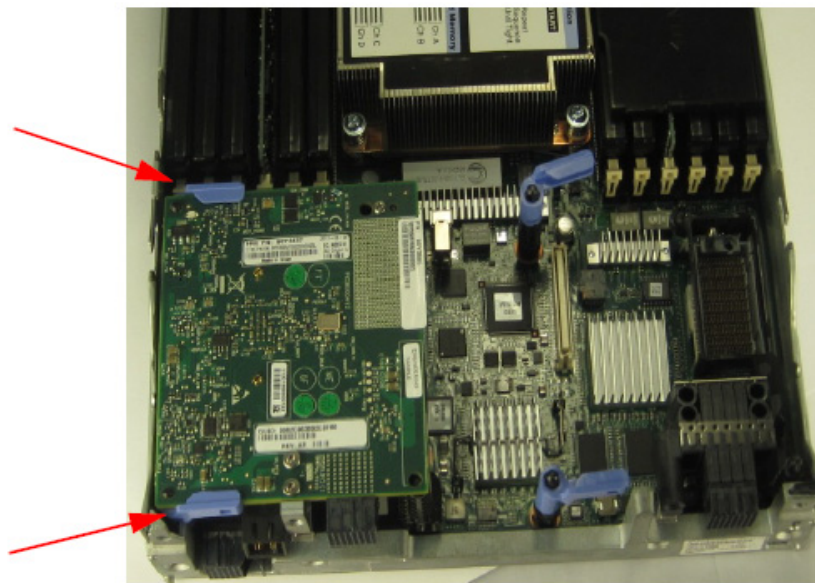
4. Plug the adapter into the socket print-side up.

Figure 6: Plug the Adapter



5. Close the retaining clips.

Figure 7: Retaining Clips



6. Replace the compute node cover.

Installing device drivers and verification

The following provides brief device driver installation instructions. For more on device driver installation instructions, refer to the following operating system-specific documentation:

www.mellanox.com => Products => Software/Drivers => InfiniBand and VPI SW/Drivers => Linux SW/Drivers => MLNX_OFED

AIX Version 7.1 with the 7100-01 Technology Level Service Pack 3

- AIX device driver software - this adapter device driver is included in the following AIX releases or later levels. Refer to the installation instructions for the specific AIX release to install or update driver software.

www.mellanox.com => Products => Software/Drivers => InfiniBand and VPI SW/Drivers => Windows SW/Drivers => MLNX_WinOF VPI

www.mellanox.com => Products => Software/Drivers => InfiniBand and VPI SW/Drivers => VMware Drivers

Linux drivers

For Linux, download and install the latest OpenFabrics Enterprise Distribution (OFED) software package available via the Mellanox web site at: <http://www.mellanox.com> => Products => Software/Drivers => InfiniBand & VPI Software/Drivers => Mellanox OFED => Download. Follow the installation instructions included in the download package (also available from the download page). To ensure that communication has been established follow the instructions below.

Get the device location

Get the device location on the PCI bus by running `lspci` and locating lines with the string "Mellanox Technologies":

```
> lspci |grep -i Mellanox  
  
07:00.0 Network controller: Mellanox Technologies MT27500 Family [ConnectX-3]
```

Check the OFED version

To get the version of the running Mellanox OFED/BXOFED, run the following command:

```
> # ofed_info |head -1  
  
MLNX_OFED_LINUX-1.5.3-2.1.0 (OFED-1.5.3-2.1.0)
```

Load the Ethernet Driver

By default, the Mellanox OFED stack loads `mlx4_en`. Run `lsmod` to verify that the module is listed.

```
> Host# lsmod |grep mlx4_en

mlx4_en                96382  0
mlx4_core              1184104  2 mlx4_ib,mlx4_en
```

If you don't see the `mlx4_en` driver, run: `' modprobe mlx4_en'`

Another option is to use the command below to see which modules are active.

Example:

```
Edit "/etc/infiniband/openib.conf" which modules needs to load
from a service.

Load MLX4_EN module

MLX4_EN_LOAD=yes
```

The "Usage: `openibd {start|stop|restart|status}`" command to modify this file and thereby control the drivers.

Verify IPoIB Functionality

To verify your configuration and your IPoIB functionality use the `ifconfig` command.

Example:

```
> host2# ifconfig ib0 11.4.3.176 netmask 255.255.0.0
```

Check the IB link status

For IB adapters, run "ibstat" and focus on the physical state attributes.

Example:

```
> Host# ibstat

LCA 'mlx4_0'

CA type: MT4099

Number of ports: 2

Firmware version: 2.10.2000

Hardware version: 0

Node GUID: 0x0002c903002fefe0

System image GUID: 0x0002c903002fefe3

Port 1:

    State: Active

    Physical state: LinkUp

    Rate: 56

    Base lid: 4

    LMC: 0
```

```

SM lid: 12
Capability mask: 0x02514868
Port GUID: 0x0002c903002fefef1
Link layer: InfiniBand

Port 2:

State: Active
Physical state: LinkUp
Rate: 56
Base lid: 8
LMC: 0
SM lid: 12
Capability mask: 0x02514868
Port GUID: 0x0002c903002fefef2
Link layer: InfiniBand

```

Check the network interface name:

run: `ifconfig -a`

```

> ifconfig -a
eth0      Link encap:Ethernet  HWaddr 5C:F3:FC:5F:40:EA
inet addr:10.7.5.170  Bcast:10.7.7.255  Mask:255.255.252.0
inet6 addr: fe80::5ef3:fcff:fe5f:40ea/64 Scope:Link
UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
RX packets:20009  errors:0  dropped:0  overruns:0  frame:0
TX packets:4492  errors:0  dropped:0  overruns:0  carrier:0
collisions:0 txqueuelen:1000
RX bytes:7005902 (6.6 MiB)  TX bytes:399581 (390.2 KiB)

```

run: `ethtool <interface>`

```

> Host# ethtool eth0
Settings for eth0:
Supported ports: [ TP ]
Supported link modes:   1000baseT/Full
                       10000baseT/Full
Supports auto-negotiation: Yes
Advertised link modes:  1000baseT/Full
                       10000baseT/Full

```

```
Advertised auto-negotiation: N
Speed: 1000Mb/s
Duplex: Full
Port: Twisted Pair
PHYAD: 0
Transceiver: internal
Auto-negotiation: on
Supports Wake-on: g
Wake-on: d
Link detected: yes
```

Ethernet Driver Usage and Configuration

To check driver and device information run:

```
> ethtool -i eth<x>
```

Example:

```
> ethtool -i eth0
driver:mlx4_en (MT_1020110019_CX-3)
version: 1.5.6.33 (Oct 2011)
firmware-version:2.10.0000
bus-info: 0000:07:00.0
```

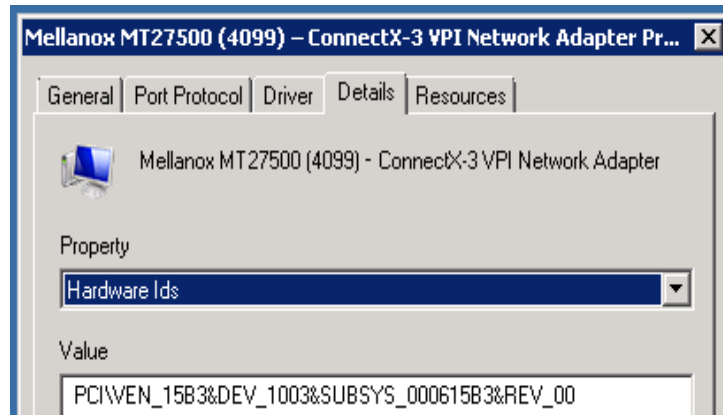
Windows drivers

For Windows, download and install the latest Mellanox WinOF VPI for Windows software package available via the Mellanox web site at: <http://www.mellanox.com> => Products => Software/Drivers => InfiniBand & VPI Software/Drivers => Mellanox WinOF VPI => Download. Follow the installation instructions included in the download package (also available from the download page). To ensure that communication has been established follow the instructions below.

Get the device location on the PCI bus by performing the following steps:

1. Open Device Manager on the server. Click start=> Run, and then enter "devmgmt.msc"
2. Expand System Devices and locate the adapter
3. Right click and select Properties to display the adapter properties window
4. Click the Details tab and select Device Instance Id (Windows 2003) or Hardware Ids (Windows 2008/R2) from the Property pull-down menu

Figure 8: PCI Device

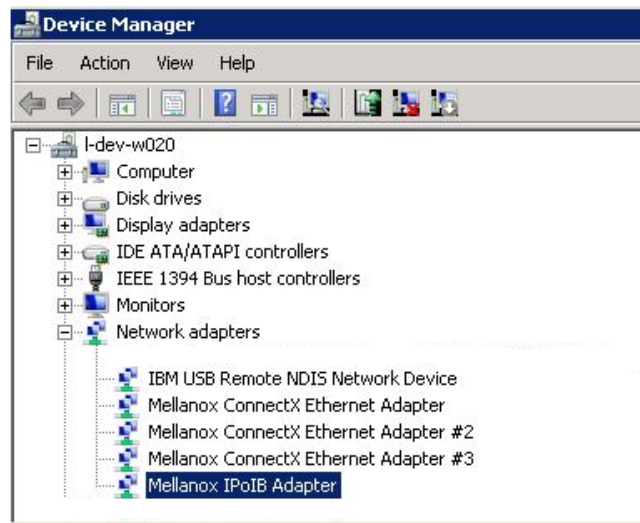


5. In the Value display box, check the fields VEN and DEV (fields are separated by '&'). In the display example above, notice the sub-string "PCI\VEN_15B3&DEV_1003": VEN is equal to 0x15B3 – this is the Vendor ID of Mellanox Technologies; and DEV is equal to 1003 – this is a valid Mellanox Technologies PCI Device ID.

Verify IPoIB driver

To verify the IPoIB driver run the following steps:

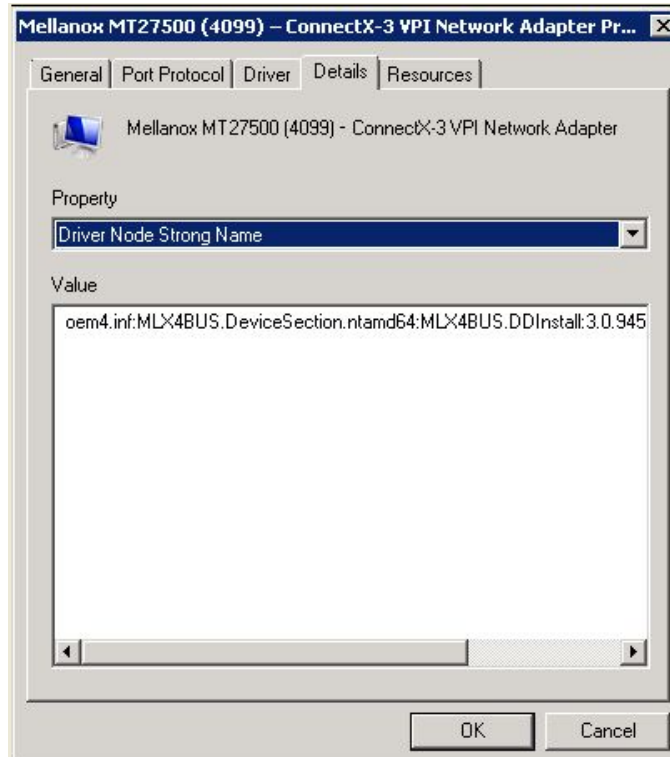
1. Start the "Device Manager" (open a command line window and enter: devmgmt.msc)
2. Open "Network Adapters"
3. Right click the relevant IPoIB adapter and select Properties



Verify MLX driver

1. Start the "Device Manager" (open a command line window and enter: devmgmt.msc)
2. Open "System Devices"
3. Right click the relevant adapter and select Properties

4. Click the Details tab



5. Choose Driver Node Strong Name from the Property pull-down menu

Check the IB link status

For IB adapters, run “ibstat”

Output includes LID, SMLID, port state, link width active, and port physical state.

```
> ibstat [-d(ebug)] [-l(ist_of_cas)] [-s(hort)] [-p(ort_list)] [-V(ersion)] [-h] <ca_name> [portnum]
```

Example:

```
> ibstat          # display status of all ports on all IB
                   devices

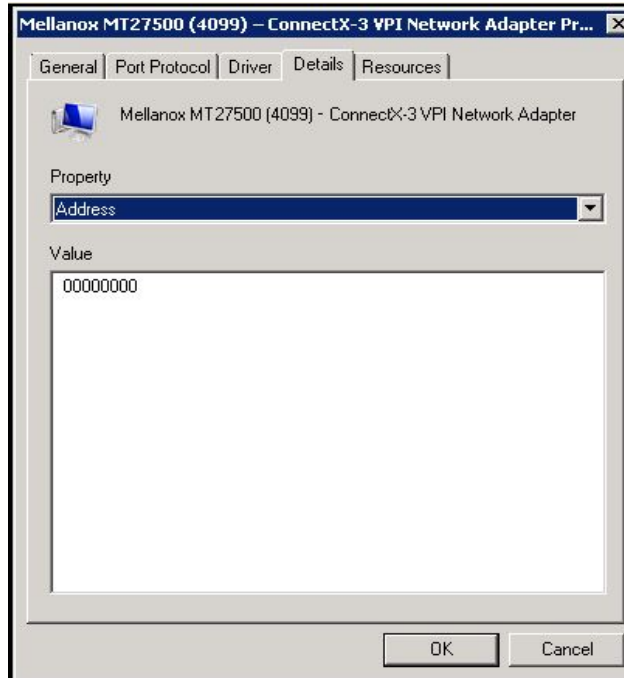
> ibstat -l       # list all IB devices

> ibstat -p       # show port guides

> ibstat mthca0 2 # show status of port 2 of 'mthca0'
```

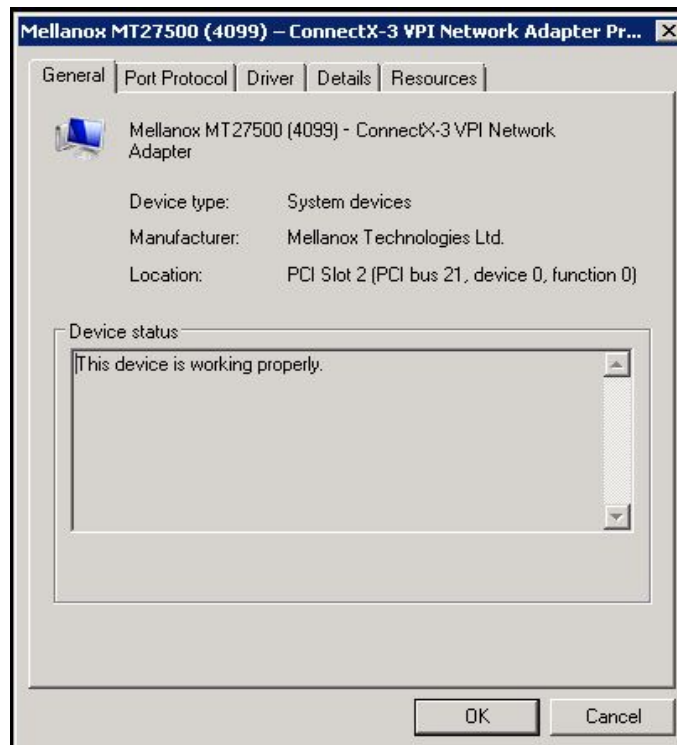
Obtain the Ethernet address

1. Display the “Device Manager”
2. Right-click the relevant adapter and left-click Properties
3. Select the Details tab from the Properties sheet
4. Select Address from the Property pull-down menu



Driver and device information

To check driver and device information click on the General tab (example)



VMware driver

For VMware download and install the latest Mellanox WinOF VPI for Windows software package available via the Mellanox web site at: <http://www.mellanox.com> => Products => Software/Drivers => InfiniBand & VPI Software/Drivers => InfiniBand OFED Driver for VMware® ESX Server => Download. Follow the installation instructions included in the download package (also available from the download page).

RDMA over Converged Ethernet

ConnectX®-3 connected to an Ethernet fabric provides all of the basic NIC functionality plus RDMA over Converged Ethernet (RoCE). RoCE utilizes advances in Data Center Bridging (DCB) to enable efficient and low cost implementations of RDMA over Ethernet, supporting the entire breadth of RDMA and low latency features. This includes reliable connected service, datagram service, RDMA and send/receive semantics, atomic operations, user level multicast, user level I/O access, kernel bypass, and zero copy. This capability is enabled when using the Mellanox OFED or WinOF VPI drivers.

ConnectX®-3 EN with RoCE based network management is the same as that for any Ethernet and DCB-based network management, eliminating the need for IT managers to learn new technologies.

Hardware and Software Requirements

Software:

- Mellanox OFED or WinOF VPI

Hardware:

- IBM Flex System adapter

Managing the adapter: port type management via driver software

Linux

If you wish to change the port type, use the `connectx_port_config` script after the driver is loaded.

The script is installed as part of the Mellanox OFED for Linux package (under `/sbin`). See the Mellanox OFED for the Linux User Manual available at <http://www.mellanox.com> => Support => InfiniBand Products => Mellanox OFED. Running `"/sbin/connectx_port_config -s"` will show the current port configuration for all ConnectX®-3 devices.

Port configuration is saved in the file: `/etc/infiniband/connectx.conf`. This saved configuration is restored at driver restart only if done via

```
> /etc/init.d/openibd restart
```

Possible port types are:

- "eth" - Always Ethernet
- "ib" - Always InfiniBand

- "auto" - Link sensing mode - detect the port type based on the attached network type. If no link is detected, the driver retries link sensing every few seconds.

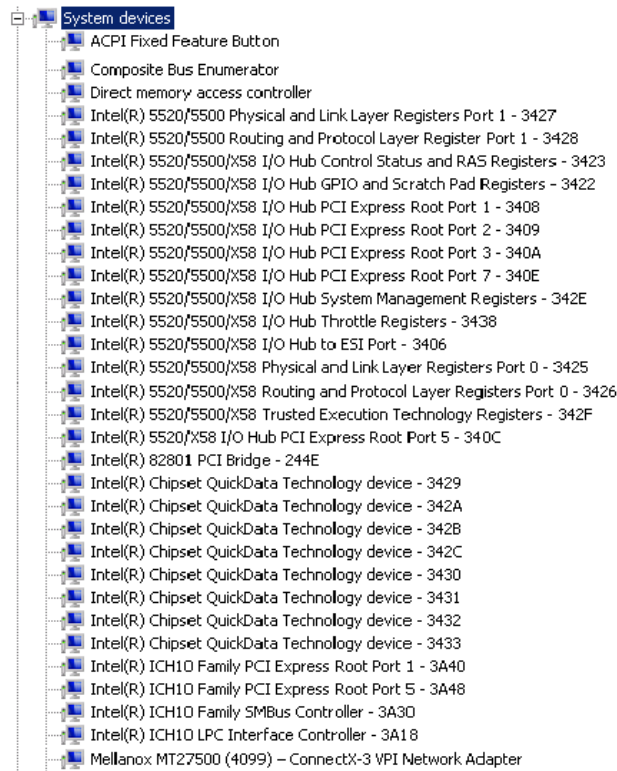
The port link type can be configured for each device in the system at run time using the "/sbin/connectx_port_config" script. This utility will prompt for the PCI device to be modified (if there is only one it will be selected automatically). At the next stage the user will be prompted for the desired mode for each port. The desired port configuration will then be set for the selected device. Note: This utility also has a non-interactive mode:

```
/sbin/connectx_port_config [[-d|--device <PCI device ID>] -
c|--conf <port1,port2>]
```

Windows

After installing Mellanox WinOF VPI for Windows on your machine, you can change a port's protocol configuration. The following steps describe how to configure the port type.

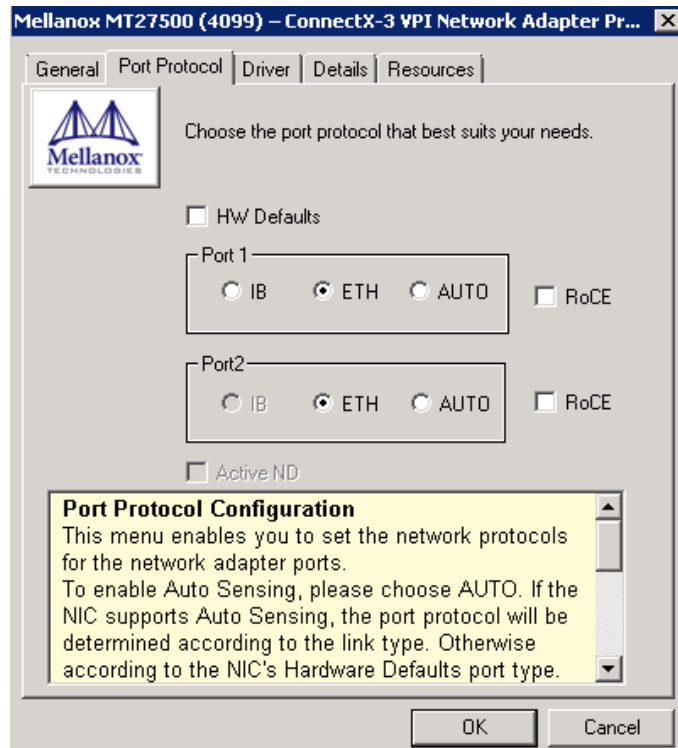
Step 1: Display the Device Manager and expand "System Devices".



Step 2: Right-click on the relevant adapter and left-click Properties. Select the Port Protocol tab from the Properties sheet.

Note: The "Port Protocol" tab is displayed only if the NIC is a VPI (IB and ETH). If the NIC is either only IB or ETH, the tab will not be shown.

The figure below is an example of the displayed Port Protocol sheet for a dual-port adapter.



Step 3: In this step, you can perform two different functions: (a) Choose the desired port protocol for the available port(s), and (b) activate or deactivate the WSD, ND, and/or SDP ULPs.

IB *must* be always the first port in Port 1. If you choose ETH as your first port in Port 1, then the second port in Port 2 can be only ETH.

Note: WSD is not supported in Windows 7. Consequently, on this OS the WSD checkbox is grayed out and cannot be selected.

Chapter 3. Solving problems

If you cannot locate and correct a problem by using the information in this section, see Appendix A, “Getting help and technical assistance,” on page 21.

Parts listing

Replaceable components are of three types:

- **Tier 1 customer replaceable unit (CRU):** Replacement of Tier 1 CRUs is your responsibility. If IBM installs a Tier 1 CRU at your request, you will be charged for the installation.
- **Tier 2 customer replaceable unit (CRU):** You may install a Tier 2 CRU yourself or request IBM to install it, at no additional charge, under the type of warranty service that is designated for your server.
- **Field replaceable unit (FRU):** FRUs must be installed only by trained service technicians.

For information about the terms of the warranty, see the *Warranty Information* document.

The replaceable components in the following table are Tier 1 CRUs. If other components require replacement, see the documentation that came with those devices for instructions.

Table 2 - Part CRU Number

Part	CRU number (Tier 1)
IBM Flex System IB6132 2-port FDR InfiniBand Adapter	90Y3457

Appendix A. Getting help and technical assistance

If you need help, service, or technical assistance or just want more information about IBM products, you will find a wide variety of sources available from IBM to assist you. This section contains information about where to go for additional information about IBM and IBM products, what to do if you experience a problem with your system, and whom to call for service, if it is necessary.

Before you call

Before you call, make sure that you have taken these steps to try to solve the problem yourself:

- Check all cables to make sure that they are connected.
- Check the power switches to make sure that the system and any optional devices are turned on.
- Use the troubleshooting information in your system documentation, and use the diagnostic tools that come with your system.
- Go to the IBM support website at <http://www.ibm.com/supportportal/> to check for technical information, hints, tips, and new device drivers or to submit a request for information.

You can solve many problems without outside assistance by following the troubleshooting procedures that IBM provides in the online help or in the documentation that is provided with your IBM product. The documentation that comes with IBM systems also describes the diagnostic tests that you can perform. Most systems, operating systems, and programs come with documentation that contains troubleshooting procedures and explanations of error messages and error codes. If you suspect a software problem, see the documentation for the operating system or program.

Using the documentation

Information about your IBM system and preinstalled software, if any, or optional device is available in the documentation that comes with the product. That documentation can include printed documents, online documents, readme files, and help files. See the troubleshooting information in your system documentation for instructions for using the diagnostic programs. The troubleshooting information or the diagnostic programs might tell you that you need additional or updated device drivers or other software. IBM maintains pages on the World Wide Web where you can get the latest technical information and download device drivers and updates. To access these pages, go to <http://www.ibm.com/supportportal/> and follow the instructions.

Getting help and information from the World Wide Web

On the World Wide Web, the IBM website has up-to-date information about IBM systems, optional devices, services, and support. You can find service information for IBM systems and optional devices at <http://www.ibm.com/supportportal/>.

Software service and support

Through IBM Support Line, you can get telephone assistance, for a fee, with usage, configuration, and software problems. For information about which products are supported by Support Line in your country or region, see <http://www.ibm.com/services/supline/products/>.

For more information about Support Line and other IBM services, see <http://www.ibm.com/services/>, or see <http://www.ibm.com/planetwide/> for support telephone numbers. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

Hardware service and support

You can receive hardware service through your IBM reseller or IBM Services. To locate a reseller authorized by IBM to provide warranty service, go to <http://www.ibm.com/partnerworld/> and click **Find Business Partners** on the right side of the page. For IBM support telephone numbers, see <http://www.ibm.com/planetwide/>. In the U.S. and Canada, call 1-800-IBM-SERV (1-800-426-7378).

In the U.S. and Canada, hardware service and support is available 24 hours a day, 7 days a week. In the U.K., these services are available Monday through Friday, from 9 a.m. to 6 p.m.

IBM Taiwan product service

台灣 IBM 產品服務聯絡方式：
台灣國際商業機器股份有限公司
台北市松仁路 7 號 3 樓
電話：0800-016-888

IBM Taiwan product service contact information:
IBM Taiwan Corporation
3F, No 7, Song Ren Rd.
Taipei, Taiwan
Telephone: 0800-016-888

Appendix B. Notices

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The publications for this product are in Adobe Portable Document Format (PDF) and should be compliant with accessibility standards. If you experience difficulties when you use the PDF files and want to request a web-based format or accessible PDF document for a publication, direct your mail to the following address:

*Information Development
IBM Corporation
205/A015
3039 E. Cornwallis Road
P.O. Box 12195
Research Triangle Park, North Carolina 27709-2195
U.S.A.*

In the request, be sure to include the publication part number and title.

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Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

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This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Industry Canada Class A emission compliance statement

This Class A digital apparatus complies with Canadian ICES-003.

Avis de conformité à la réglementation d'Industrie Canada

Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

Australia and New Zealand Class A statement

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Responsible manufacturer:
International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
914-499-1900

European Community contact:
IBM Technical Regulations, Department M456
IBM-Allee 1, 71137 Ehningen, Germany
Telephone: +49 7032 15-2937
E-mail: tjahn@de.ibm.com

Germany Class A statement

Deutschsprachiger EU Hinweis:

Hinweis für Geräte der Klasse A EU-Richtlinie zur Elektromagnetischen Verträglichkeit

Dieses Produkt entspricht den Schutzanforderungen der EU-Richtlinie 2004/108/EG zur Angleichung der Rechtsvorschriften über die elektromagnetische Verträglichkeit in den EU-Mitgliedsstaaten und hält die Grenzwerte der EN 55022 Klasse A ein.

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Deutschland: Einhaltung des Gesetzes über die elektromagnetische Verträglichkeit von Geräten

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Verantwortlich für die Einhaltung der EMV Vorschriften ist der Hersteller:

International Business Machines Corp.
New Orchard Road
Armonk, New York 10504
914-499-1900

Der verantwortliche Ansprechpartner des Herstellers in der EU ist:

IBM Deutschland
Technical Regulations, Department M456
IBM-Allee 1, 71137 Ehningen, Germany
Telephone: +49 7032 15-2937
E-mail: tjahn@de.ibm.com

Generelle Informationen:

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中华人民共和国“A类”警告声明

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Printed in USA

(1P) P/N: 88Y7932

