



# **Mellanox WinOF VPI User Manual**

Rev 4.70

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# Revision History

**Table 1 - Revision History**

Document Revision	Date	Changes
Rev 4.70	June 29, 2014	Updated the following section: <ul style="list-style-type: none"> <li>Section 8.7.2.2.1, "Using Global Pause Flow Control (GFC)", on page 50</li> </ul>
	May 4, 2014	<p>Updated the following sections:</p> <ul style="list-style-type: none"> <li>Section 1.3, "WinOF Set of Documentation", on page 16</li> <li>Section 5.3, "Firmware Upgrade", on page 27</li> <li>Section 8.10.4.2, "Enabling SR-IOV in Mellanox WinOF Package", on page 66</li> <li>Section 10.3.1, "Verifying Network Adapter Configuration", on page 80</li> <li>Section 15.2, "Ethernet Troubleshooting", on page 162</li> </ul> <p>Added the following sections:</p> <ul style="list-style-type: none"> <li>Section 4, "Installing Mellanox WinOF Driver", on page 20</li> <li>Section 5, "Uninstalling Mellanox WinOF Driver", on page 27</li> <li>Section 8.8.4, "Removing NVGRE configuration", on page 55</li> <li>Section 8.10, "SR-IOV", on page 58</li> <li>Section 8.11, "Virtual Ethernet Adapter", on page 72</li> <li>Section 8.12, "IPoIB SR-IOV over KVM", on page 74</li> <li>Section 8.13, "Lossless TCP", on page 74</li> <li>Section 9, "Bootting Windows from an iSCSI Target", on page 77</li> <li>Section 15.4, "General Troubleshooting", on page 166</li> <li>Section C, "Registry Keys", on page 174</li> </ul> <p>Removed the following sections:</p> <ul style="list-style-type: none"> <li>Documentation</li> </ul>
Rev 4.60	February 13, 2014	<p>Updated the following sections:</p> <ul style="list-style-type: none"> <li>Section 8.1, "Hyper-V with VMQ", on page 36</li> <li>Section 8.8.1, "Enabling/Disabling NVGRE Offloading", on page 53</li> </ul> <p>Added the following sections:</p> <ul style="list-style-type: none"> <li>Section 8.8.3, "Verifying the Encapsulation of the Traffic", on page 55</li> <li>Section 8.11, "Virtual Ethernet Adapter", on page 72</li> </ul>

**Table 1 - Revision History**

Document Revision	Date	Changes
	December 30, 2013	<p>Updated the following sections:</p> <ul style="list-style-type: none"> <li>• Section 8.7.2.2, “Configuring Windows Host”, on page 50 - Updated the example in Step 5</li> <li>• Section 11.1.4.1, “Performance Tuning Tool Application”, on page 85 - Updated the Options table</li> <li>• Section 11.2, “Application Specific Optimization and Tuning”, on page 89 - Removed the “Bus-master DMA Operations”</li> <li>• Section 12, “OpenSM - Subnet Manager”, on page 98 - Added an option of how to register OpemSM via the PowerShell</li> <li>• Section 8.8.2, “Configuring the NVGRE using PowerShell”, on page 54</li> </ul> <p>Added the following sections:</p> <ul style="list-style-type: none"> <li>• Section 7.4, “Configuring Quality of Service (QoS)”, on page 34</li> <li>• Appendix B: “NVGRE Configuration Scrips Examples,” on page 171</li> </ul>
Rev 4.55	December 15, 2013	<p>Updated the following sections:</p> <ul style="list-style-type: none"> <li>• Section 8.8, “Network Virtualization using Generic Routing Encapsulation”, on page 52</li> <li>• Section 8.8.2, “Configuring the NVGRE using PowerShell”, on page 54</li> </ul>
	November 07, 2013	<p>Updated the following sections:</p> <ul style="list-style-type: none"> <li>• Section 8.7.2.2, “Configuring Windows Host”, on page 50</li> <li>• Section 14.4.19.1, “NTtcp Synopsis”, on page 161</li> </ul>
	October 03, 2013	Added support for Windows Server 2012 R2
Rev 4.40	July 17, 2013	<p>Updated the following sections:</p> <ul style="list-style-type: none"> <li>• Section 8.7.1, “RoCE Overview”, on page 48</li> <li>• Section 12, “OpenSM - Subnet Manager”, on page 98</li> <li>• Section 14.4.19, “NTtcp”, on page 160</li> <li>• Section 15, “Troubleshooting”, on page 162</li> </ul> <p>Added the following sections:</p> <p>Appendix A: “Windows MPI (MS-MPI),” on page 168</p>

**Table 1 - Revision History**

Document Revision	Date	Changes
	June 10, 2013	<p>Updated the following sections:</p> <ul style="list-style-type: none"> <li>• Section 6.2, “Downloading Mellanox Firmware Tools”, on page 27</li> <li>• Section 14, “InfiniBand Fabric Utilities”, on page 100</li> <li>• Section 15, “Troubleshooting”, on page 162</li> <li>• Section 1.3, “WinOF Set of Documentation”, on page 16</li> <li>• Section , “Options”, on page 86</li> </ul> <p>Added the following sections:</p> <ul style="list-style-type: none"> <li>• “perf_tuning”Appendix ,“Synopsis,” on page 86</li> <li>• Section 6.3.1, “Upgrading Firmware Manually”, on page 28</li> <li>• Section 8.7.2, “RoCE Configuration”, on page 49</li> <li>• Section 11.4, “Adapter Proprietary Performance Counters”, on page 92</li> </ul>
Rev 4.2	October 20, 2012	<p>Added the following sections:</p> <ul style="list-style-type: none"> <li>• Section 10, “Deploying Windows Server 2012 and Above with SMB Direct”, on page 80, and its subsections</li> <li>• Section 8.2, “Header Data Split”, on page 37</li> <li>• Section 14.2, “part_man - Virtual IPoIB Port Creation Utility”, on page 100</li> </ul> <p>Updated Section 11, “Performance Tuning”, on page 83</p>
Rev 3.2.0	July 23, 2012	<ul style="list-style-type: none"> <li>• No changes</li> </ul>
Rev 3.1.0	May 21, 2012	<ul style="list-style-type: none"> <li>• Added section Tuning the IPoIB Network Adapter</li> <li>• Added section Tuning the Ethernet Network Adapter</li> <li>• Added section Performance tuning tool application</li> <li>• Removed section Tuning the Network Adapter</li> <li>• Removed section part_man</li> <li>• Removed section ibdiagnet</li> </ul>

**Table 1 - Revision History**

Document Revision	Date	Changes
Rev 3.0.0	February 08, 2012	<ul style="list-style-type: none"> <li>• Added section RDMA over Converged Ethernet (RoCE) and its subsections</li> <li>• Added section Hyper-V with VMQ</li> <li>• Added section Network Driver Interface Specification (NDIS)</li> <li>• Added section Header Data Split</li> <li>• Added section Auto Sensing</li> <li>• Added section Adapter Teaming</li> <li>• Added section Port Protocol Configuration</li> <li>• Added section Advanced Configuration for InfiniBand Driver</li> <li>• Added section Advanced Configuration for Ethernet Driver</li> <li>• Added section Updated section Tunable Performance Parameters</li> <li>• Added section Merged Ethernet and InfiniBand features sections</li> <li>• Removed section Sockets Direct Protocol and its subsections</li> <li>• Removed section Winsock Direct and Protocol and its subsections</li> <li>• Removed section Added ConnectX®-3 support</li> <li>• Removed section IPoIB Drivers Overview</li> <li>• Removed section Booting Windows from an iSCSI Target</li> </ul>
Rev 2.1.3	January 28, 2011	Complete restructure
Rev 2.1.2	October 10, 2010	<ul style="list-style-type: none"> <li>• Removed section Debug Options.</li> <li>• Updated Section 3, “Uninstalling Mellanox VPI Driver,” on page 11</li> <li>• Added Section 6, “InfiniBand Fabric,” on page 38 and its subsections</li> <li>• Added Section 6.3, “InfiniBand Fabric Performance Utilities,” on page 71 and its subsections</li> </ul>
Rev 2.1.1.1	July 14, 2010	<ul style="list-style-type: none"> <li>• Removed all references of InfiniHost® adapter since it is not supported starting with WinOF VPI v2.1.1</li> </ul>
Rev 2.1.1	May 2010	First release

# About this Manual

## Scope





The document describes WinOF Rev 4.70 features, performance, InfiniBand diagnostic, tools content and configuration. Additionally, this document provides information on various performance tools supplied with this version.

## Intended Audience

This manual is intended for system administrators responsible for the installation, configuration, management and maintenance of the software and hardware of VPI (InfiniBand, Ethernet) adapter cards. It is also intended for application developers.

## Documentation Conventions

**Table 2 - Documentation Conventions**

Description	Convention	Example
File names	file.extension	
Directory names	directory	
Commands and their parameters	command param1	mts3610-1 > show hosts
Required item	< >	
Optional item	[ ]	
Mutually exclusive parameters	{ p1, p2, p3 } or {p1   p2   p3}	
Optional mutually exclusive parameters	[ p1   p2   p3 ]	
Variables for which users supply specific values	Italic font	<i>enable</i>
Emphasized words	Italic font	<i>These are emphasized words</i>
Note	 <text>	 This is a note..
Warning	 <text>	 May result in system instability.

## Common Abbreviations and Acronyms

**Table 3 - Abbreviations and Acronyms**

Abbreviation / Acronym	Whole Word / Description
B	(Capital) 'B' is used to indicate size in bytes or multiples of bytes (e.g., 1KB = 1024 bytes, and 1MB = 1048576 bytes)
b	(Small) 'b' is used to indicate size in bits or multiples of bits (e.g., 1Kb = 1024 bits)
FW	Firmware
HCA	Host Channel Adapter
HW	Hardware
IB	InfiniBand
LSB	Least significant <i>byte</i>
lsb	Least significant <i>bit</i>
MSB	Most significant <i>byte</i>
msb	Most significant bit
NIC	Network Interface Card
SW	Software
VPI	Virtual Protocol Interconnect
IPoIB	IP over InfiniBand
PFC	Priority Flow Control
PR	Path Record
RDS	Reliable Datagram Sockets
RoCE	RDMA over Converged Ethernet
SL	Service Level
MPI	Message Passing Interface
EoIB	Ethernet over InfiniBand
QoS	Quality of Service
ULP	Upper Level Protocol
VL	Virtual Lane

## Related Documents

**Table 4 - Related Documents**

Document	Description
MFT User Manual	Describes the set of firmware management tools for a single InfiniBand node. MFT can be used for: <ul style="list-style-type: none"><li>• Generating a standard or customized Mellanox firmware image</li><li>• Querying for firmware information</li><li>• Burning a firmware image to a single InfiniBand node</li></ul>
WinOF Release Notes	For possible software issues, please refer to WinOF Release Notes.

# 1 Introduction

This User Manual describes installation, configuration and operation of Mellanox WinOF driver Rev 4.70 package.

Mellanox WinOF is composed of several software modules that contain InfiniBand and Ethernet drivers. The Mellanox WinOF driver supports 10 or 40 Gb/s Ethernet, and 40 or 56 Gb/s InfiniBand network ports. The port type is determined upon boot based on card capabilities and user settings.

For more details please refer to MFT User Manual.

## 1.1 Hardware and Software Requirements

**Table 5 - Hardware and Software Requirements**

Requirements	Description
Required Disk Space for Installation	100MB
Operating Systems	<ul style="list-style-type: none"> <li>• Windows Server 2008 R2 (64 bit only)</li> <li>• Windows Server 2012 (64 bit only)</li> <li>• Windows Server 2012 R2 (64 bit only)</li> </ul> <p><b>Note:</b> The Operating System listed above must run with administrator privileges.</p>

## 1.2 Supplied Packages

Mellanox WinOF driver Rev 4.70 includes the following package:

- MLNX\_VPI\_WinOF-<version>\_All\_<OS>\_<arch>.exe:  
In this package, the port default is auto, RoCE is enabled

## 1.3 WinOF Set of Documentation

Under <installation\_directory>\Documentation:

- License file
- User Manual (this document)
- MLNX\_VPI\_WinOF Release Notes



## 2 Downloading Mellanox WinOF Driver

Follow these steps to download the .exe according to your Operating System.

**Step 1.** Verify the machine architecture.

### For Windows Server 2008 R2

1. Open a CMD console (Click start-->Run and enter CMD).
2. Enter the following command.

```
> echo %PROCESSOR_ARCHITECTURE%
```

On an x64 (64-bit) machine, the output will be “AMD64”.

### For Windows Server 2012 / 2012 R2

1. To go to the Start menu.  
Position your mouse in the bottom-right corner of the Remote Desktop of your screen.
2. Open a CMD console (Click Task Manager-->File --> Run new task --> and enter CMD).
3. Enter the following command.

```
> echo %PROCESSOR_ARCHITECTURE%
```

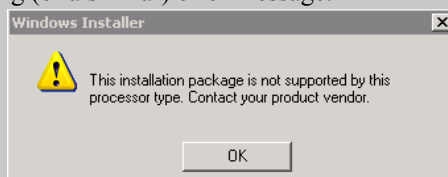
On an x64 (64-bit) machine, the output will be “AMD64”.

**Step 2.** Go to the Mellanox WinOF web page at <http://www.mellanox.com> > Products > InfiniBand/VPI Drivers => Windows SW/Drivers.

**Step 3.** Download the .exe image according to the architecture of your machine (see [Step 1](#)) and the operating system. The name of the .exe is in the following format MLNX\_VPI\_WinOF-<version>\_All\_<OS>\_<arch>.exe.



Installing the incorrect .exe file is prohibited. If you do so, an error message will be displayed. For example, if you try to install a 64-bit .exe on a 32-bit machine, the wizard will display the following (or a similar) error message:



### 3 Extracting Files Without Running Installation

To extract the files without running installation, perform the following steps.

**Step 1.** Open a CMD console [**Windows Server 2008 R2**] - Click Start-->Run and enter CMD.

[**Windows Server 2012 / 2012 R2**] - Click Start --> Task Manager-->File --> Run new task --> and enter CMD.

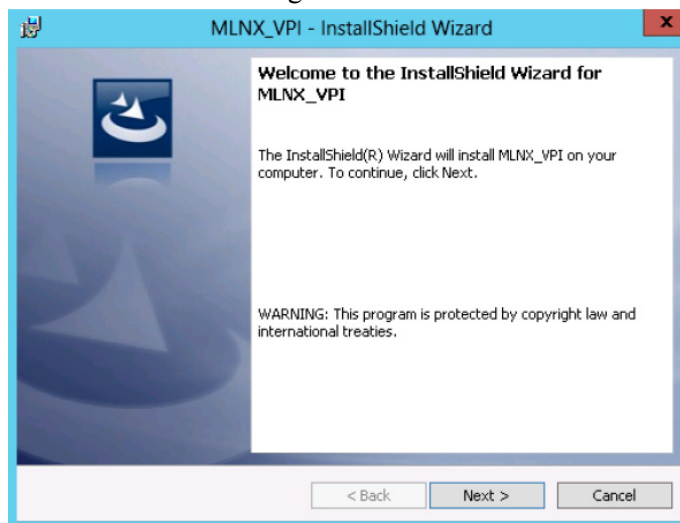
**Step 2.** Extract the driver and the tools:

```
MLNX_VPI_WinOF-<version>_All_<OS>_<arch>.exe /a
```

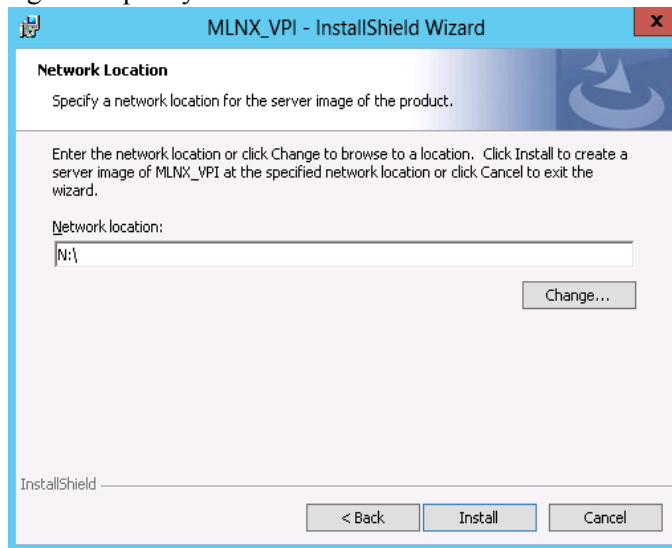
- To extract only the driver files.

```
MLNX_VPI_WinOF-<version>_All_<OS>_<arch>.exe /a /vMT_DRIVERS_ONLY=1
```

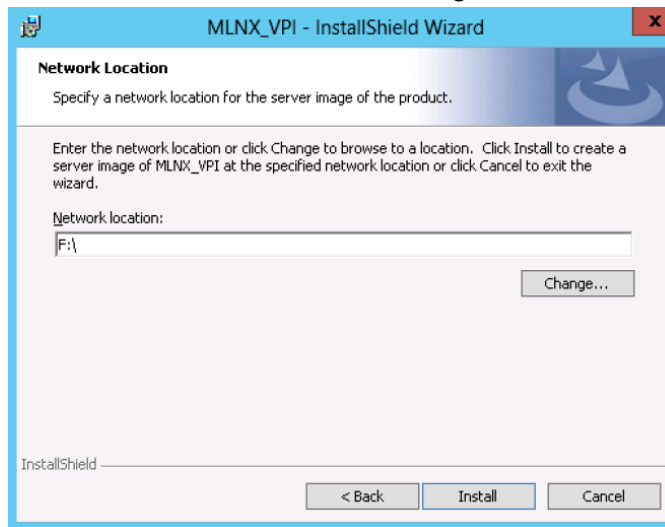
**Step 3.** Click Next to create a server image.



**Step 4.** Click Change and specify the location in which the files are extracted to.



**Step 5.** Click Install to extract this folder, or click Change to install to a different folder.



**Step 6.** To complete the extraction, click Finish.



## 4 Installing Mellanox WinOF Driver

This section provides instructions for two types of installation procedures:

- “Attended Installation”  
An installation procedure that requires frequent user intervention.
- “Unattended Installation”  
An automated installation procedure that requires no user intervention.



Both Attended and Unattended installations require administrator privileges.

### 4.1 Attended Installation

The following is an example of a MLNX\_WinOF\_win2012 x64 installation session.

**Step 1.** Double click the .exe and follow the GUI instructions to install MLNX\_WinOF.



Starting from MLNX WinOF v4.55, the log option is enabled automatically. The default path of the log is: %LOCALAPPDATA%\MLNX\_WinOF.log0

**Step 2.** [Optional] Manually configure your setup to contain the logs option.

```
MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /v"/l*vx [LogFile]"
```

**Step 3.** [Optional] If you do not want to upgrade your firmware version<sup>1</sup>.

```
MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /v" MT_SKIPFWUPGRD=1"
```

**Step 4.** [Optional] If you want to control the installation of the WMI/CIM provider<sup>2</sup>.

```
MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /v" MT_WMI=1"
```

**Step 5.** [Optional] If you want to control whether to restore network configuration or not<sup>3</sup>.

```
MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /v" MT_RESTORECONF=1"
```

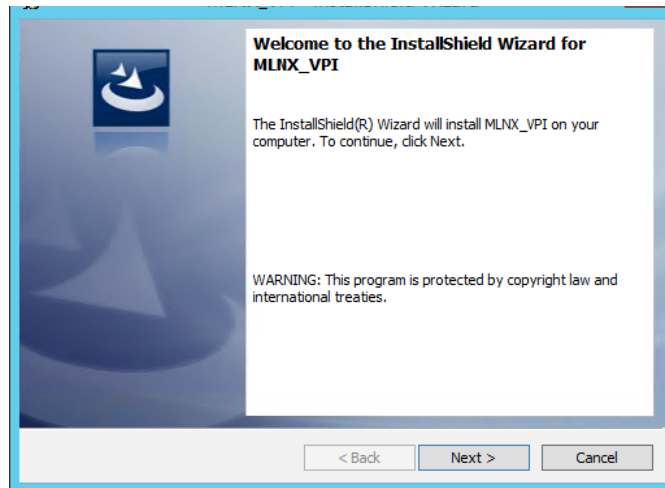
For further help, please run:

```
MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /v" /h"
```

---

1. MT\_SKIPFWUPGRD default value is False  
2. MT\_WMI default value is True  
3. MT\_RESTORECONF default value is True

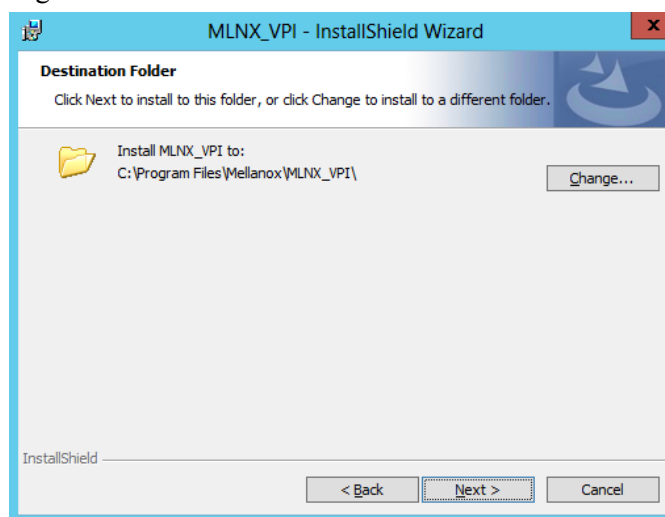
**Step 6.** Click Next in the Welcome screen.



**Step 7.** Read then accept the license agreement and click Next.



**Step 8.** Select the target folder for the installation.



**Step 9.** The firmware upgrade screen will be displayed in the following cases:

- If the user has an OEM card, in this case the firmware will not be updated.
- If the user has a standard Mellanox card with an older firmware version, the firmware will be updated accordingly. However, if the user has both OEM card and Mellanox card, only Mellanox card will be updated.

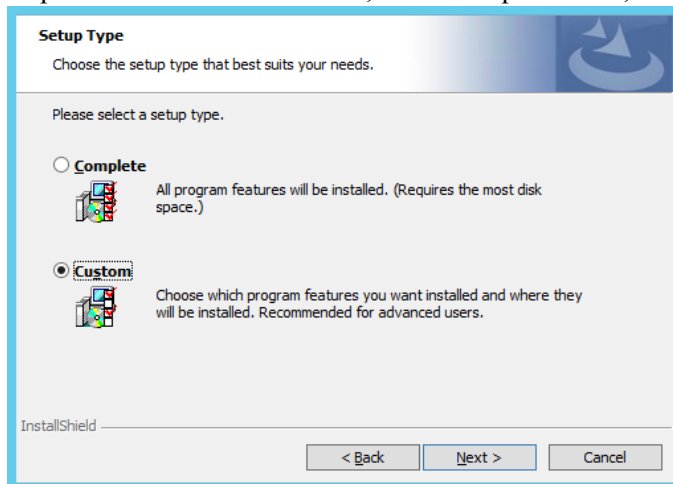


**Step 10.** Configure your system for maximum performance by checking the maximum performance box.



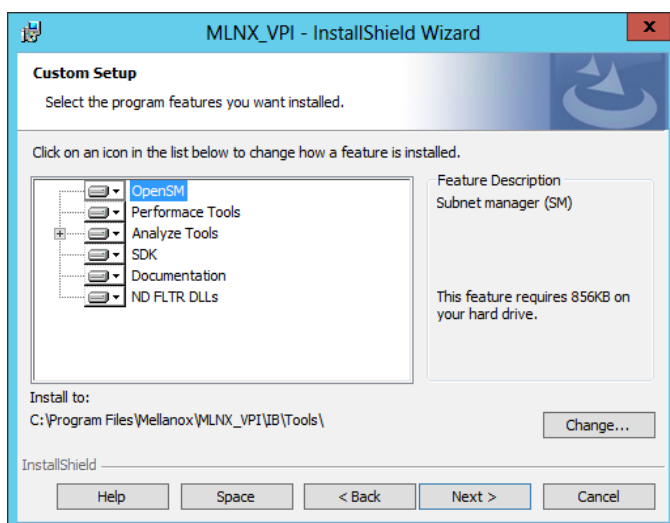
This step requires rebooting your machine at the end of the installation.

**Step 11.** Select a Complete or Custom installation, follow Step a and on, on page 23.

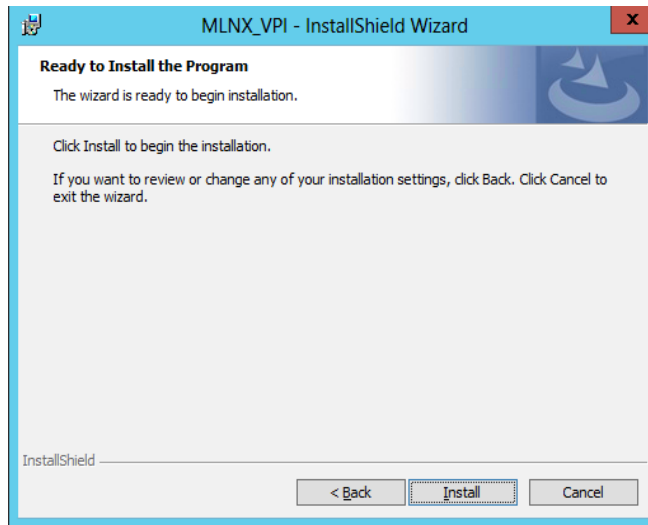


a. Select the desired feature to install:

- OpenSM - installs Windows OpenSM that is required to manage the subnet from a host. OpenSM is part of the driver and installed automatically.
- Performances tools - install the performance tools that are used to measure the InfiniBand performance in user environment.
- Analyze tools - install the tools that can be used either to diagnosed or analyzed the InfiniBand environment.
- SDK - contains the libraries and DLLs for developing InfiniBand application over IBAL.
- Documentation - contains the User Manual and Installation Guide.
- ND FLTR DLLs - contains the files for standalone installation of the mlx4nd provider.



- b. Click Install to start the installation.



- Step 12. Click Finish to complete the installation.



- If the firmware upgrade and the restore of the network configuration failed, the following message will be displayed.





## 4.2 Unattended Installation

The following is an example of a MLNX\_WinOF\_win2012 x64 unattended installation session.

**Step 1.** Open a CMD console

**[Windows Server 2008 R2]** - Click Start-->Run and enter CMD.

**[Windows Server 2012 / 2012 R2]** - Click Start --> Task Manager-->File --> Run new task --> and enter CMD.

**Step 2.** Install the driver. Run:

```
> MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /S /v"/qn"
```

**Step 3.** [Optional] Manually configure your setup to contain the logs option:

```
> MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /S /v"/qn" /v"/1*vx [LogFile]"
```



Starting from MLNX WinOF v4.55, the log option is enabled automatically. The default path of the log is: %LOCALAPPDATA%\MLNX\_WinOF.log0

**Step 4.** [Optional] If you do not want to upgrade your firmware version<sup>1</sup>.

```
MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /v" MT_SKIPFWUPGRD=1"
```

**Step 5.** [Optional] If you want to control the installation of the WMI/CIM provider<sup>2</sup>.

```
MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /v" /MT_WMI=1"
```

**Step 6.** [Optional] If you want to control whether to restore network configuration or not<sup>3</sup>.

```
MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /v" MT_RESTORECONF=1"
```

For further help, please run:

```
> MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /v" /h"
```

## 4.3 Installation Results

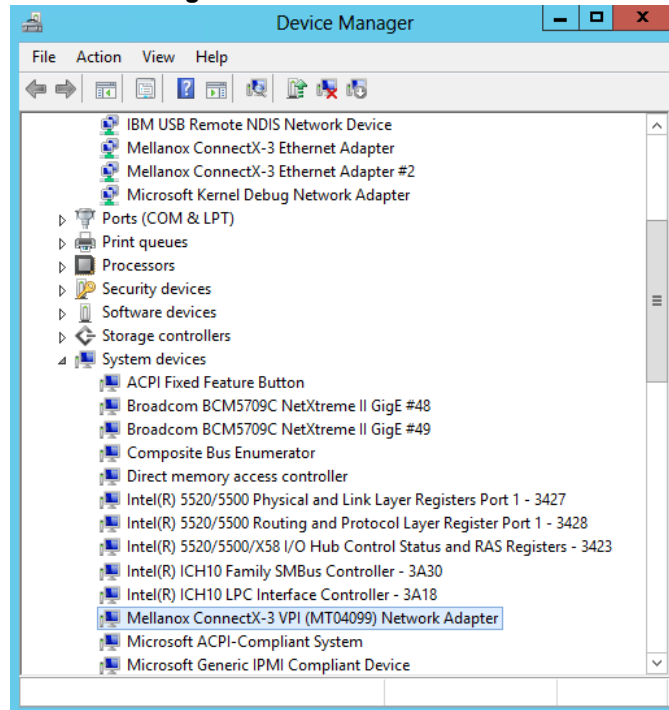
Upon installation completion, you can verify the successful addition of the network card(s) through the Device Manager.

Upon installation completion, the inf files can be located at:

- %ProgramFiles%\Mellanox\MLNX\_VPI\ETH
- %ProgramFiles%\Mellanox\MLNX\_VPI\HW\mlx4\_bus
- %ProgramFiles%\Mellanox\MLNX\_VPI\IB\IPoIB

To see the Mellanox network adapter device, and the Ethernet or IPoIB network device (depending on the used card) for each port, display the Device Manager and expand “System devices” or “Network adapters”.

1. MT\_SKIPFWUPGRD default value is False  
2. MT\_WMI default value is True  
3. MT\_RESTORECONF default value is True

**Figure 1: Installation Results**

## 5 Uninstalling Mellanox WinOF Driver

### 5.1 Attended Uninstall

➤ *To uninstall MLNX\_WinOF on a single node:*

1. Click Start-> Control Panel-> Programs and Features-> MLNX\_VPI-> Uninstall.  
(NOTE: This requires elevated administrator privileges – see [Section 1.1, “Hardware and Software Requirements”](#), on page 16 for details.)
2. Double click the .exe and follow the instructions of the install wizard.
3. Click Start -> All Programs -> Mellanox Technologies -> MLNX\_WinOF -> Uninstall MLNX\_WinOF.

### 5.2 Unattended Uninstall

➤ *To uninstall MLNX\_WinOF in unattended mode:*

**Step 1.** Open a CMD console

[Windows Server 2008 R2] - Click Start-->Run and enter CMD.

[Windows Server 2012 / 2012 R2] - Click Start --> Task Manager-->File --> Run new task --> and enter CMD.

**Step 2.** Uninstall the driver. Run:

```
MLNX_VPI_WinOF-4.70_All_win2012_x64.exe /S /x /v"/qn"
```

### 5.3 Firmware Upgrade

For information on how to upgrade firmware please refer to MFT User Manual:  
[www.mellanox.com](http://www.mellanox.com) ->Products -> Adapter IB/VPI SW ->Firmware Tools

## 6 Upgrading Mellanox WinOF Driver

The upgrade process differs between various Operating Systems.

- Windows Server 2008 R2:

When upgrading from WinOF version 3.2.0 to version 4.40 and above, the MLNX\_WinOF driver upgrades the driver automatically by uninstalling the previous version and installing the new driver. The existing configuration files are not saved upon driver upgrade.

- Windows Server 2012 and above:

- When upgrading from WinOF version 4.2 to version 4.40 and above, the MLNX\_WinOF driver does not completely uninstall the previous version, but rather upgrades only the components that require upgrade. The network configuration is saved upon driver upgrade.
- When upgrading from Inbox or any other version, the network configuration is automatically saved upon driver upgrade.

## 7 Advanced Driver Configuration

Once you have installed Mellanox WinOF VPI package, you can perform various modifications to your driver to make it suitable for your system's needs



Changes made to the Windows registry happen immediately, and no backup is automatically made.

Do **not** edit the Windows registry unless you are confident regarding the changes.

### 7.1 Assigning Port IP After Installation

By default, your machine is configured to obtain an automatic IP address via a DHCP server. In some cases, the DHCP server may require the MAC address of the network adapter installed in your machine.

➤ **To obtain the MAC address:**

**Step 1.** Open a CMD console

**[Windows Server 2008 R2]** - Click Start-->Run and enter CMD.

**[Windows Server 2012 / 2012 R2]** - Click Start --> Task Manager-->File --> Run new task --> and enter CMD.

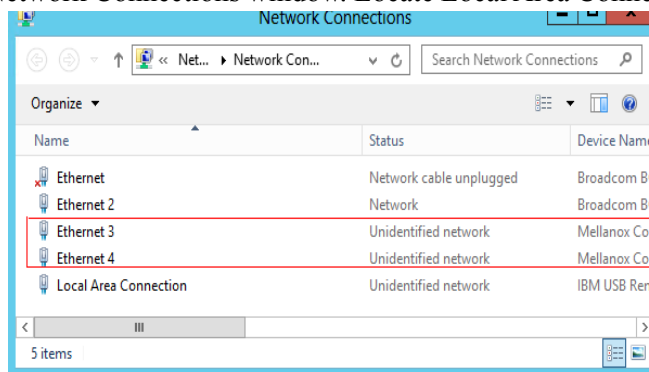
**Step 2.** Display the MAC address as “Physical Address”

```
ipconfig /all
```

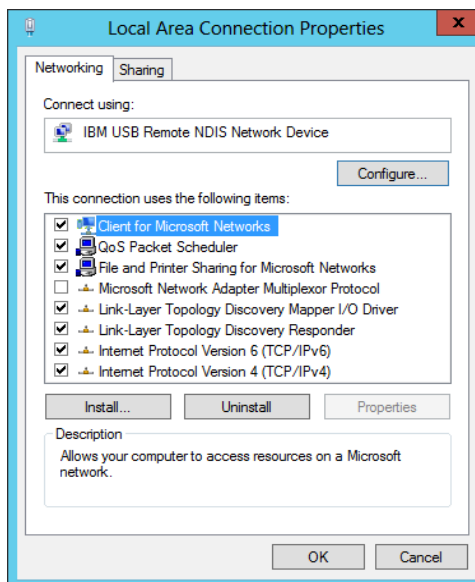
Configuring a static IP is the same for both IPoIB and Ethernet adapters.

➤ **To assign a static IP address to a network port after installation:**

**Step 1.** Open the Network Connections window. Locate Local Area Connections with Mellanox devices.

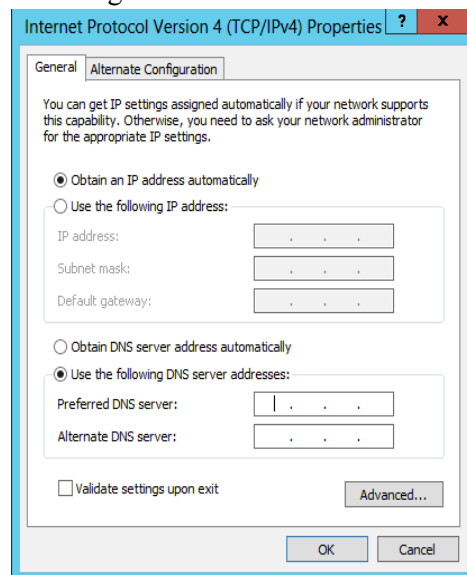


**Step 2.** Right-click a Mellanox Local Area Connection and left-click Properties.



**Step 3.** Select Internet Protocol Version 4 (TCP/IPv4) from the scroll list and click Properties.

**Step 4.** Select the “Use the following IP address:” radio button and enter the desired IP information.



**Step 5.** Click OK.

**Step 6.** Close the Local Area Connection dialog.

**Step 7.** Verify the IP configuration by running 'ipconfig' from a CMD console.

```
> ipconfig
...
Ethernet adapter Local Area Connection 4:

    Connection-specific DNS Suffix  . :
    IP Address. . . . . : 11.4.12.63
    Subnet Mask . . . . . : 255.255.0.0
    Default Gateway . . . . . :
    ...
```

## 7.2 Configuring the InfiniBand Driver

### 7.2.1 Modifying IPoIB Configuration

➤ *To modify the IPoIB configuration after installation, perform the following steps:*

- Step 1.** Open Device Manager and expand Network Adapters in the device display pane.
- Step 2.** Right-click the Mellanox IPoIB Adapter entry and left-click Properties.
- Step 3.** Click the Advanced tab and modify the desired properties.

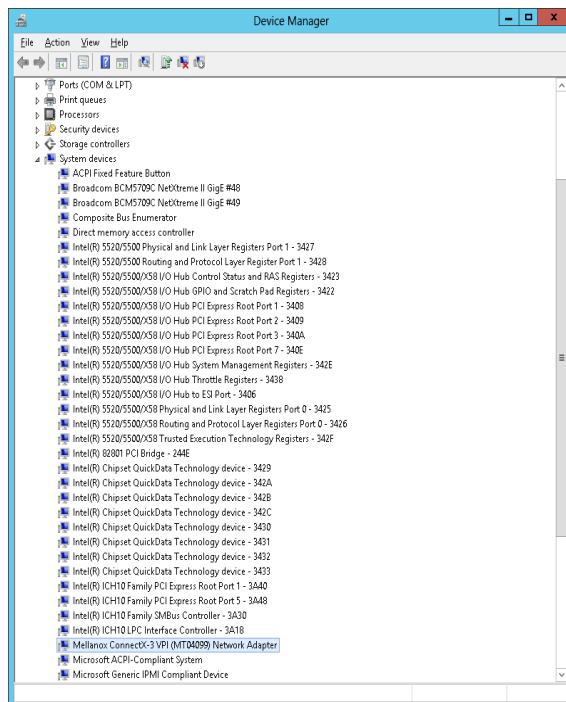


The IPoIB network interface is automatically restarted once you finish modifying IPoIB parameters. Consequently, it might affect any running traffic.

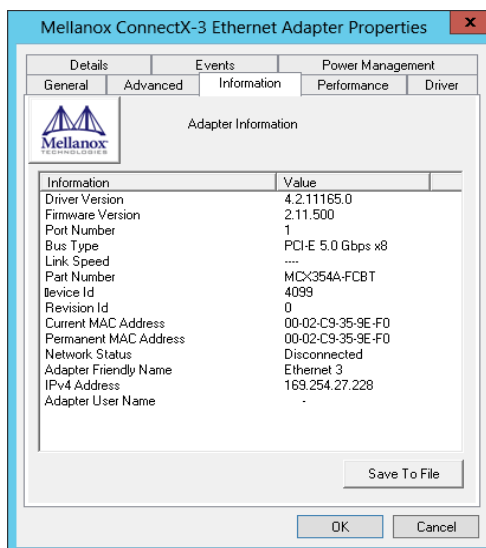
## 7.2.2 Displaying Adapter Related Information

To display a summary of network adapter software, firmware- and hardware-related information such as driver version, firmware version, bus interface, adapter identity, and network port link information, perform the following steps:

**Step 1.** Display the Device Manager.



**Step 2.** Select the Information tab from the Properties sheet.



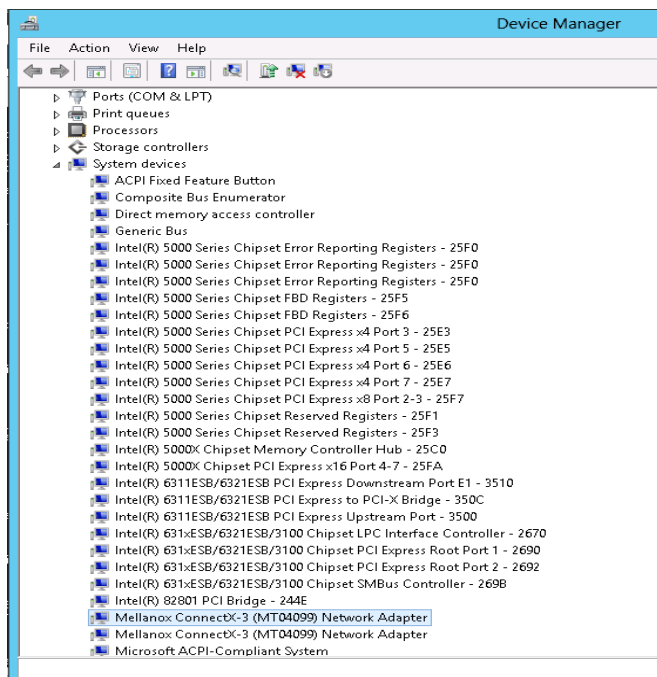
To save this information for debug purposes, click **Save to File** and provide the output file name.



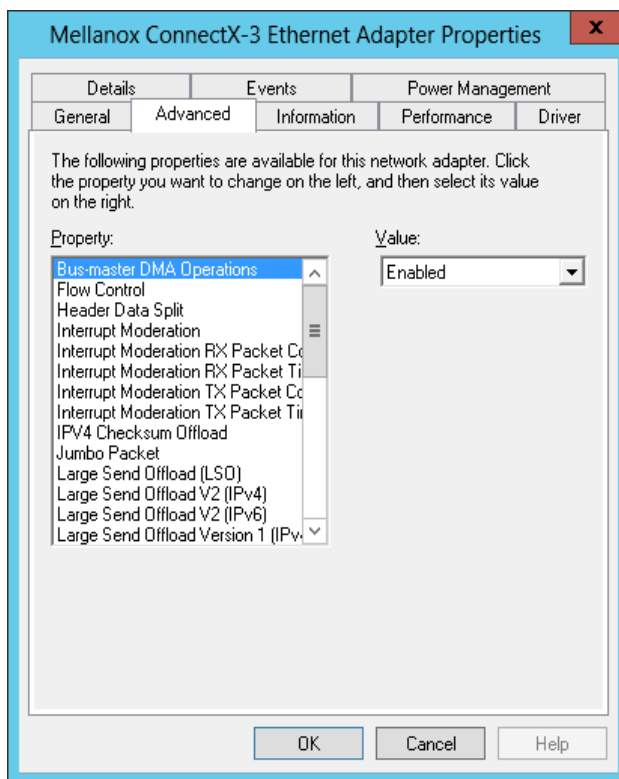
## 7.3 Configuring the Ethernet Driver

The following steps describe how to configure advanced features.

**Step 1.** Display the Device Manager.



**Step 2.** Right-click a Mellanox network adapter (under “Network adapters” list) and left-click Properties. Select the Advanced tab from the Properties sheet.



- Step 3.** Modify configuration parameters to suit your system.
- Please note the following:
- For help on a specific parameter/option, check the help button at the bottom of the dialog.
  - If you select one of the entries Off-load Options, Performance Options, or Flow Control Options, you'll need to click the Properties button to modify parameters via a pop-up dialog.

## 7.4 Configuring Quality of Service (QoS)

Prior to configuring Quality of Service, you must install Data Center Bridging using one of the following methods:

➤ **To install the Data Center Bridging using the Server Manager:**

- Step 1.** Open the 'Server Manager'.
- Step 2.** Select 'Add Roles and Features'.
- Step 3.** Click Next.
- Step 4.** Select 'Features' on the left panel
- Step 5.** Check the 'Data Center Bridging' checkbox.
- Step 6.** Click 'Install'.

➤ **To install the Data Center Bridging using PowerShell:**

- Step 1.** Enable Data Center Bridging (DCB).

```
PS $ Install-WindowsFeature Data-Center-Bridging
```

➤ **To configure QoS on the host:**



The procedure below is not saved after you reboot your system. Hence, we recommend you create a script using the steps below and run it on the local machine. Please see the procedure below on how to add the script to the local machine startup scripts.

- Step 1.** Change the Windows PowerShell execution policy.
- ```
PS $ Set-ExecutionPolicy AllSigned
```
- Step 2.** Remove the entire previous QoS configuration.
- ```
PS $ Remove-NetQosTrafficClass
PS $ Remove-NetQosPolicy -Confirm:$False
```
- Step 3.** Set the DCBX Willing parameter to false as Mellanox drivers do not support this feature.
- ```
PS $ set-NetQosDcbxSetting -Willing 0
```
- Step 4.** Create a Quality of Service (QoS) policy and tag each type of traffic with the relevant priority. In this example we used TCP/UDP priority 1, ND/NDK priority 3.

```
PS $ New-NetQosPolicy "SMB" -store Activestore -NetDirectPortMatchCondition 445 -
PriorityValue8021Action 3
PS $ New-NetQosPolicy "DEFAULT" -store Activestore -Default -PriorityValue8021Action 3
PS $ New-NetQosPolicy "TCP" -store Activestore -IPProtocolMatchCondition TCP -
PriorityValue8021Action 1
PS $ New-NetQosPolicy "UDP" -store Activestore -IPProtocolMatchCondition UDP -
PriorityValue8021Action 1
```

**Step 5.** [Optional] If VLANs are used, mark the egress traffic with the relevant VlanID. The NIC is referred as "Ethernet 4" in the examples below.

```
PS $ Set-NetAdapterAdvancedProperty -Name "Ethernet 4" -RegistryKeyword "VlanID" -RegistryValue "55"
```

**Step 6.** [Optional] Configure the IP address for the NIC.

If DHCP is used, the IP address will be assigned automatically.

```
PS $ Set-NetIPInterface -InterfaceAlias "Ethernet 4" -DHCP Disabled
PS $ Remove-NetIPAddress -InterfaceAlias "Ethernet 4" -AddressFamily IPv4 -Confirm:$false
PS $ New-NetIPAddress -InterfaceAlias "Ethernet 4" -IPAddress 192.168.1.10 -PrefixLength 24 -Type Unicast
```

**Step 7.** [Optional] Set the DNS server (assuming its IP address is 192.168.1.2).

```
PS $ Set-DnsClientServerAddress -InterfaceAlias "Ethernet 4" -ServerAddresses 192.168.1.2
```



After establishing the priorities of ND/NDK traffic, the priorities must have PFC enabled on them.

**Step 8.** Disable Priority Flow Control (PFC) for all other priorities except for 3.

```
PS $ Disable-NetQosFlowControl 0,1,2,4,5,6,7
```

**Step 9.** Enable QoS on the relevant interface.

```
PS $ Enable-NetAdapterQos -InterfaceAlias "Ethernet 4"
```

**Step 10.** Enable PFC on priority 3.

```
PS $ Enable-NetQosFlowControl -Priority 3
```

➤ **To add the script to the local machine startup scripts:**

**Step 1.** From the PowerShell invoke.

```
gpedit.msc
```

**Step 2.** In the pop-up window, under the 'Computer Configuration' section, perform the following:

1. Select Windows Settings
2. Select Scripts (Startup/Shutdown)
3. Double click Startup to open the Startup Properties
4. Click Add
5. Browse for the script's location.
6. Click OK

## 8 Driver Features

The Mellanox VPI WinOF driver release introduces the following capabilities:

- Support for Single and Dual port Adapters
- Up to 16 Rx queues per port
- Rx steering mode (RSS)
- Hardware Tx/Rx checksum calculation
- Large Send off-load (i.e., TCP Segmentation Off-load)
- Hardware multicast filtering
- Adaptive interrupt moderation
- Support for MSI-X interrupts
- Support for Auto-Sensing of Link level protocol

### **Ethernet Only:**

- Hardware VLAN filtering
- Header Data Split
- RDMA over Converged Ethernet (RoCE)
- DSCP over IPv4
- RoCEv2 in ConnectX®-3 Pro
- NVGRE hardware off-load in ConnectX®-3 Pro
- Ports TX arbitration/Bandwidth allocation per port

For the complete list of Ethernet and InfiniBand Known Issues and Limitations, WinOF Release Notes ([www.mellanox.com](http://www.mellanox.com) -> Products -> InfiniBand/VPI Drivers -> Windows SW/Drivers).

### 8.1 Hyper-V with VMQ

Mellanox WinOF Rev 4.70 includes a Virtual Machine Queue (VMQ) interface to support Microsoft Hyper-V network performance improvements and security enhancement.

VMQ interface supports:

- Classification of received packets by using the destination MAC address to route the packets to different receive queues
- NIC ability to use DMA to transfer packets directly to a Hyper-V child-partition's shared memory
- Scaling to multiple processors, by processing packets for different virtual machines on different processors.

#### ➤ *To enable Hyper-V with VMQ using UI:*

**Step 1.** Open Hyper-V Manager.

**Step 2.** Right-click the desired Virtual Machine (VM), and left-click Settings in the pop-up menu.

**Step 3.** In the Settings window, under the relevant network adapter, select “Hardware Acceleration”.

**Step 4.** Check/uncheck the box “Enable virtual machine queue” to enable/disable VMQ on that specific network adapter.

#### ➤ *To enable Hyper-V with VMQ using PowerShell:*

**Step 1.** Enable VMQ on a specific VM: Set-VMNetworkAdapter <VM Name> -VmqWeight 100

**Step 2.** Disable VMQ on a specific VM: Set-VMNetworkAdapter <VM Name> -VmqWeight 0

## 8.2 Header Data Split

The header-data split feature improves network performance by splitting the headers and data in received Ethernet frames into separate buffers. The feature is disabled by default and can be enabled in the Advanced tab (Performance Options) from the Properties window.

For further information, please refer to the MSDN library:

[http://msdn.microsoft.com/en-us/library/windows/hardware/ff553723\(v=VS.85\).aspx](http://msdn.microsoft.com/en-us/library/windows/hardware/ff553723(v=VS.85).aspx)

## 8.3 Receive Side Scaling (RSS)

Mellanox WinOF Rev 4.70 IPoIB and Ethernet drivers use NDIS 6.30 new RSS capabilities. The main changes are:

- Removed the previous limitation of 64 CPU cores
- Individual network adapter RSS configuration usage
- **RSS capabilities can be set per individual adapters as well as globally.**  
*To do so, set the registry keys listed below:*

For instructions on how to find interface index in registry <nn>, Please refer to C.2 “Finding the Index Value of the Network Interface,” on page 175.

**Table 6 - Registry Keys Setting**

| Sub-key                                                                                                   | Description                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HKLM\SYSTEM\CurrentControlSet\Control\Class\{4d36e972-e325-11ce-bfc1-08002be10318}\<nn>*MaxRSSProcessors  | <b>Maximum number of CPUs allotted.</b> Sets the desired maximum number of processors for each interface. The number can be different for each interface.<br>Note: Restart the network adapter after you change this registry key.                             |
| HKLM\SYSTEM\CurrentControlSet\Control\Class\{4d36e972-e325-11ce-bfc1-08002be10318}\<nn>*RssBaseProcNumber | <b>Base CPU number.</b> Sets the desired base CPU number for each interface. The number can be different for each interface. This allows partitioning of CPUs across network adapters.<br>Note: Restart the network adapter when you change this registry key. |
| HKLM\SYSTEM\CurrentControlSet\Control\Class\{4d36e972-e325-11ce-bfc1-08002be10318}\<nn>*NumaNodeID        | <b>NUMA node affinitization</b>                                                                                                                                                                                                                                |
| HKLM\SYSTEM\CurrentControlSet\Control\Class\{4d36e972-e325-11ce-bfc1-08002be10318}\<nn>*RssBaseProcGroup  | Sets the RSS base processor group for systems with more than 64 processors.                                                                                                                                                                                    |

## 8.4 Port Configuration

### 8.4.1 Auto Sensing

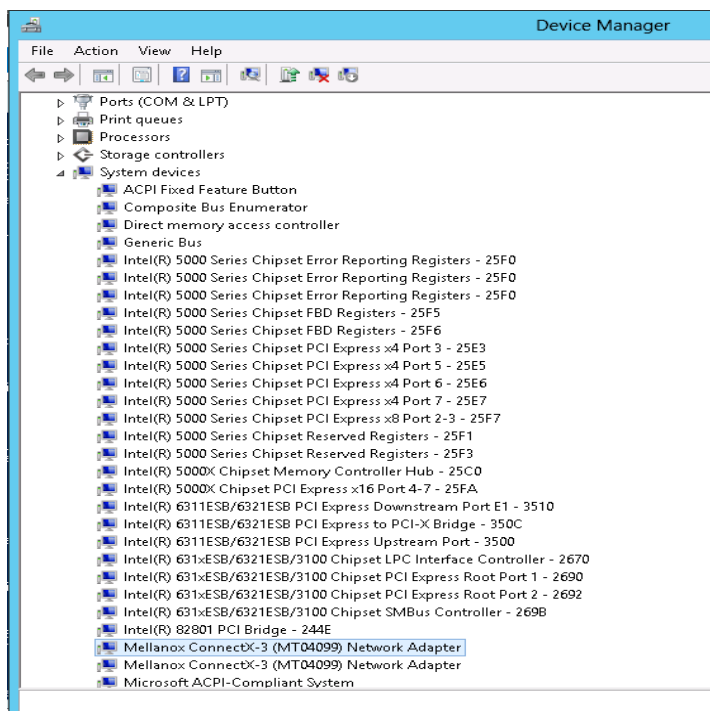
Auto Sensing enables the NIC to automatically sense the link type (InfiniBand or Ethernet) based on the cable connected to the port and load the appropriate driver stack (InfiniBand or Ethernet).

Auto Sensing is performed only when rebooting the machine or after disabling/enabling the `mlx4_bus` interface from the Device Manager. Hence, if you replace cables during the runtime, the NIC will not perform Auto Sensing.

For further information on how to configure it, please refer to [Section 8.4.2, “Port Protocol Configuration”, on page 38](#).

### 8.4.2 Port Protocol Configuration

**Step 1.** Display the Device Manager and expand “System devices”.

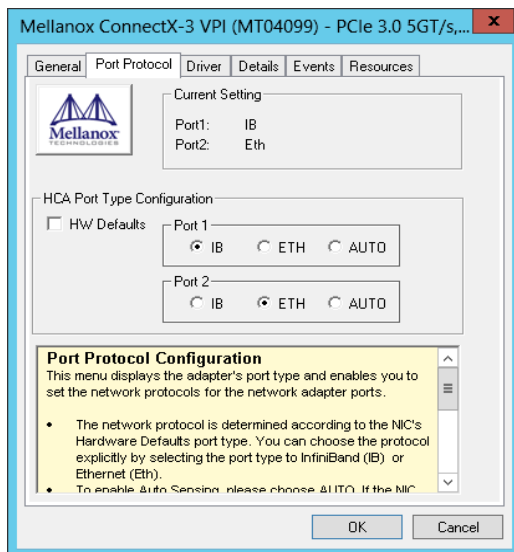


**Step 2.** Right-click on the Mellanox ConnectX Ethernet network adapter and left-click Properties. Select the Port Protocol tab from the Properties window.



The “Port Protocol” tab is displayed only if the NIC is a VPI (IB and ETH).

The figure below is an example of the displayed Port Protocol window for a dual port VPI adapter card.



**Step 3.** In this step, you can perform the following functions:

- If you choose the HW Defaults option, the port protocols will be determined according to the NIC's hardware default values.
- Choose the desired port protocol for the available port(s). If you choose IB or ETH, both ends of the connection must be of the same type (IB or ETH).
- Enable Auto Sensing by checking the AUTO checkbox. If the NIC does not support Auto Sensing, the AUTO option will be grayed out.



If you choose AUTO, the current setting will indicate the actual port settings: IB or ETH.

## 8.5 Load Balancing, Fail-Over (LBFO) and VLAN

Windows Server 2012 and above supports load balancing as part of the operating system. Please refer to Microsoft guide “NIC Teaming in Windows Server 2012” following the link below:

<http://social.technet.microsoft.com/wiki/contents/articles/14951.nic-teaming-in-windows-server-2012.aspx>

For other earlier operating systems, please refer to the sections below.

### 8.5.1 Adapter Teaming

Adapter teaming can group a group of ports inside a network adapter or a number of physical network adapters into virtual adapters that provide the fault-tolerance and load-balancing functions. Depending on the teaming mode, one or more interfaces can be active. The non-active interfaces in a team are in a standby mode and will take over the network traffic in the event of a link failure in the active interfaces. All of the active interfaces in a team participate in load-balancing operations by sending and receiving a portion of the total network traffic.

### 8.5.1.1 Teaming (Bundle) Modes

- 1. Fault Tolerance**  
Provides automatic redundancy for the server's network connection. If the primary adapter fails, the secondary adapter (currently in a standby mode) takes over. Fault Tolerance is the basis for each of the following teaming types and is inherent in all teaming modes.
- 2. Switch Fault Tolerance**  
Provides a failover relationship between two adapters when each adapter is connected to a separate switch.
- 3. Send Load Balancing**  
Provides load balancing of transmit traffic and fault tolerance. The load balancing performs only on the send port.
- 4. Load Balancing (Send & Receive)**  
Provides load balancing of transmit and receive traffic and fault tolerance. The load balancing splits the transmit and receive traffic statically among the team adapters (without changing the base of the traffic loading) based on the source/destination MAC and IP addresses.
- 5. Adaptive Load Balancing**  
The same functionality as Load Balancing (Send & Receive). In case of traffic load in one of the adapters, the load balancing channels the traffic between the other team adapter.
- 6. Dynamic Link Aggregation (802.3ad)**  
Provides dynamic link aggregation allowing creation of one or more channel groups using same speed or mixed-speed server adapters.
- 7. Static Link Aggregation (802.3ad)**  
Provides increased transmission and reception throughput in a team comprised of two to eight adapter ports through static configuration.  
  
If the switch connected to the HCA supports 802.3ad the recommended setting is teaming mode 6.

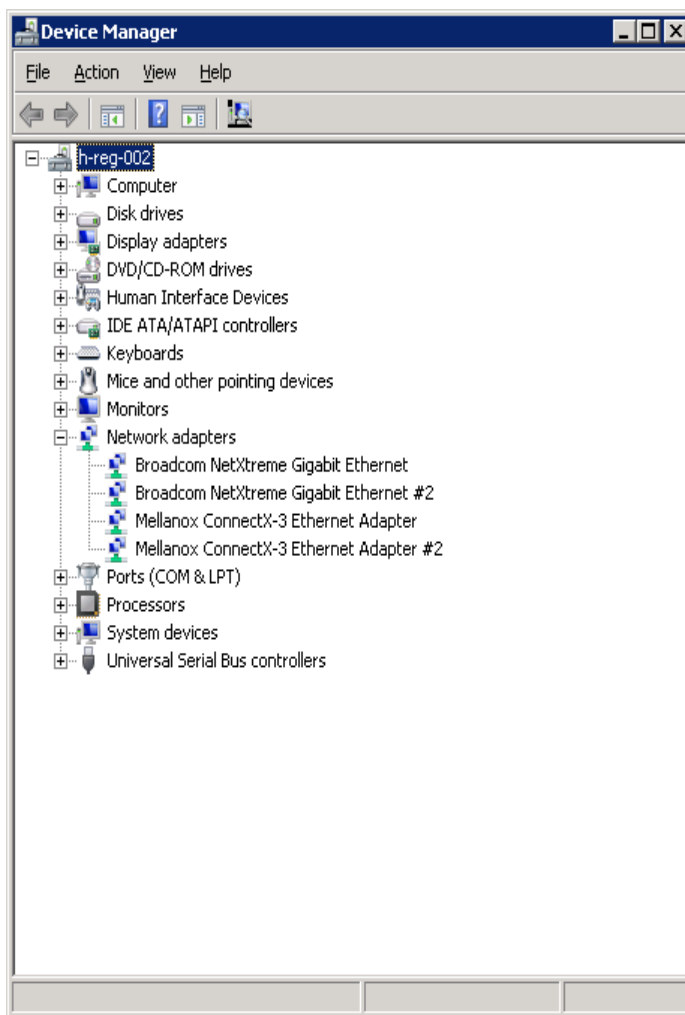
### 8.5.2 Creating a Load Balancing and Fail-Over (LBFO) Bundle

LBFO is used to balance the workload of packet transfers by distributing the workload over a bundle of network instances and to set a secondary network instance to take over packet indications and information requests if the primary network instance fails.

The following steps describe the process of creating an LBFO bundle.



**Step 1.** Display the Device Manager.



**Step 2.** Right-click a Mellanox ConnectX 10Gb Ethernet adapter (under “Network adapters” list) and left click Properties. Select the LBFO tab from the Properties window.



It is not recommended to open the Properties window of more than one adapter simultaneously.

The LBFO dialog enables creating, modifying or removing a bundle.

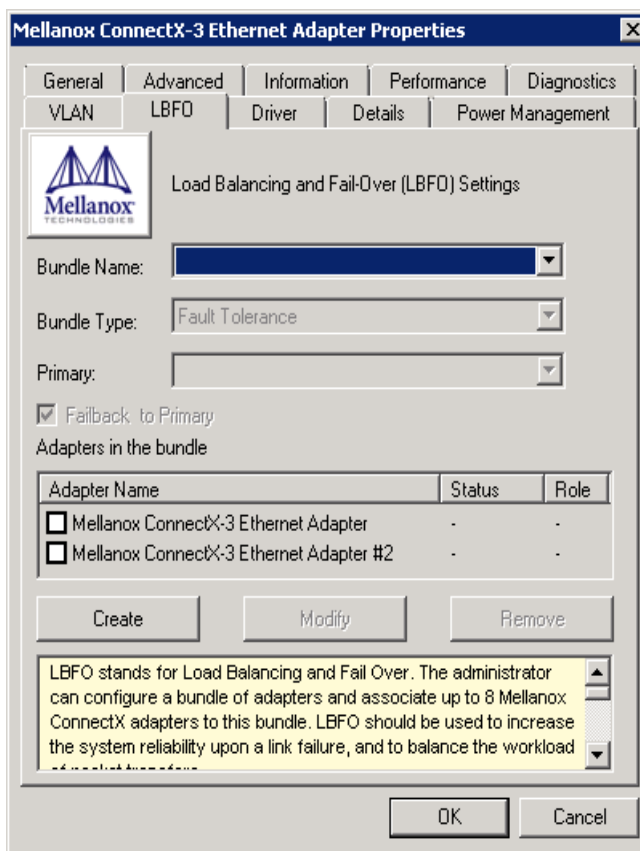


Only Mellanox Technologies adapters can be part of the LBFO.

➤ **To create a new bundle, perform the following**

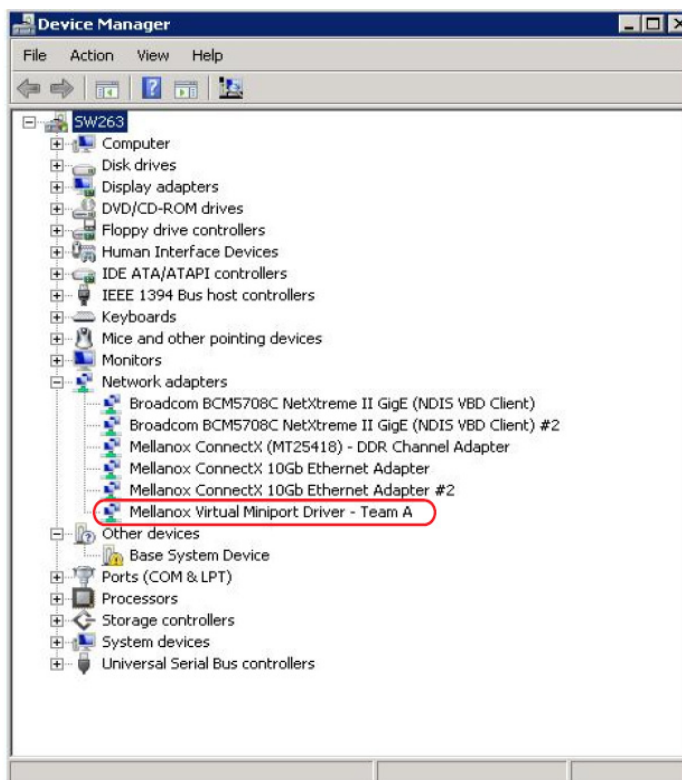
- Step 1.** Click Create.
- Step 2.** Enter a (unique) bundle name.
- Step 3.** Select a bundle type.

- Step 4.** Select the adapters to be included in the bundle (that have not been associated with a VLAN).
- Step 5.** [Optional] Select Primary Adapter.  
An active-passive scenario used for data transfer of link disconnecting. In such scenario, the system uses one of the other interfaces. When the primary link comes up, the LBFO interface returns to transfer data using the primary interface. If the primary adapter is not selected, the primary interface is selected randomly.
- Step 6.** [Optional] Failback to Primary
- Step 7.** Check the checkbox.



The newly created virtual Mellanox adapter representing the bundle will be displayed by the Device Manager under “Network adapters” in the following format (see the figure below):

```
Mellanox Virtual Miniport Driver - Team <bundle_name>
```



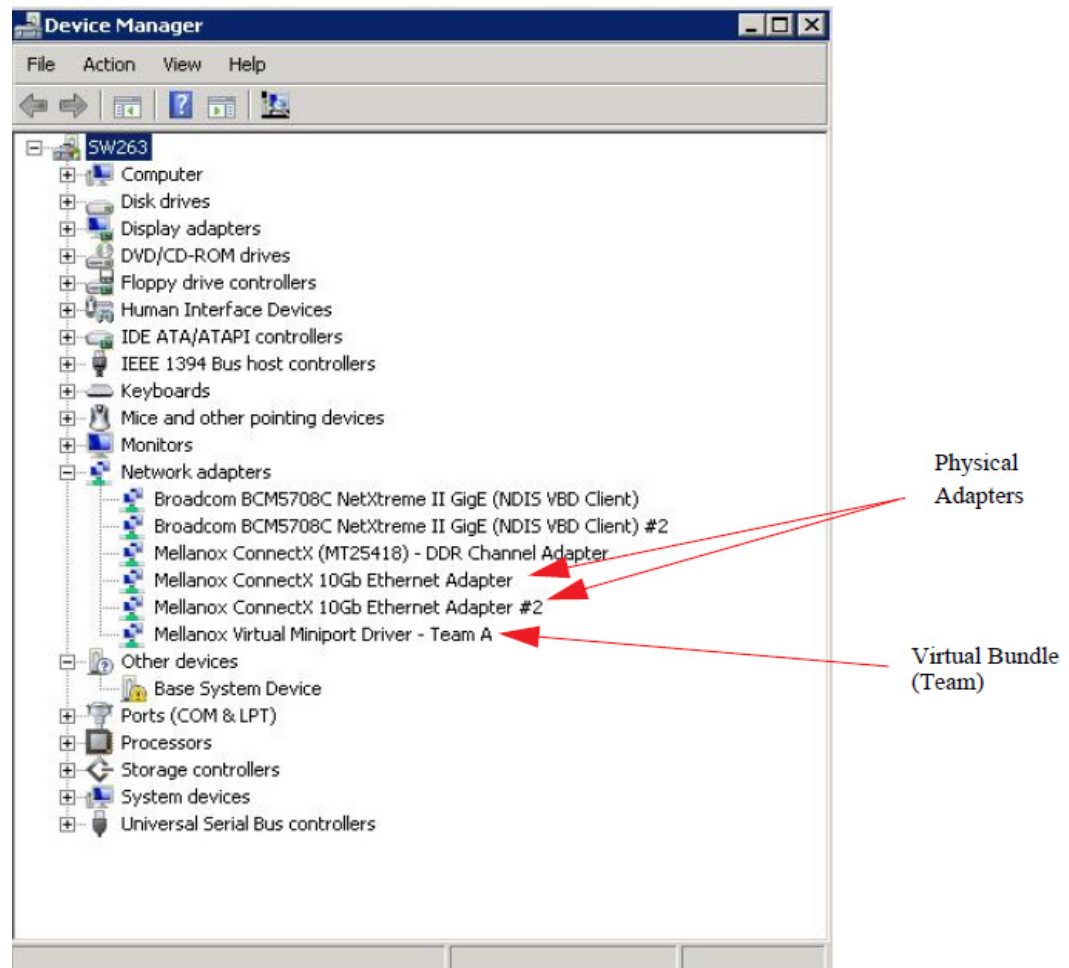
- **To modify an existing bundle, perform the following:**
  - a. Select the desired bundle and click Modify
  - b. Modify the bundle name, its type, and/or the participating adapters in the bundle
  - c. Click the Commit button
- **To remove an existing bundle, select the desired bundle and click Remove. You will be prompted to approve this action.**

Notes on this step:

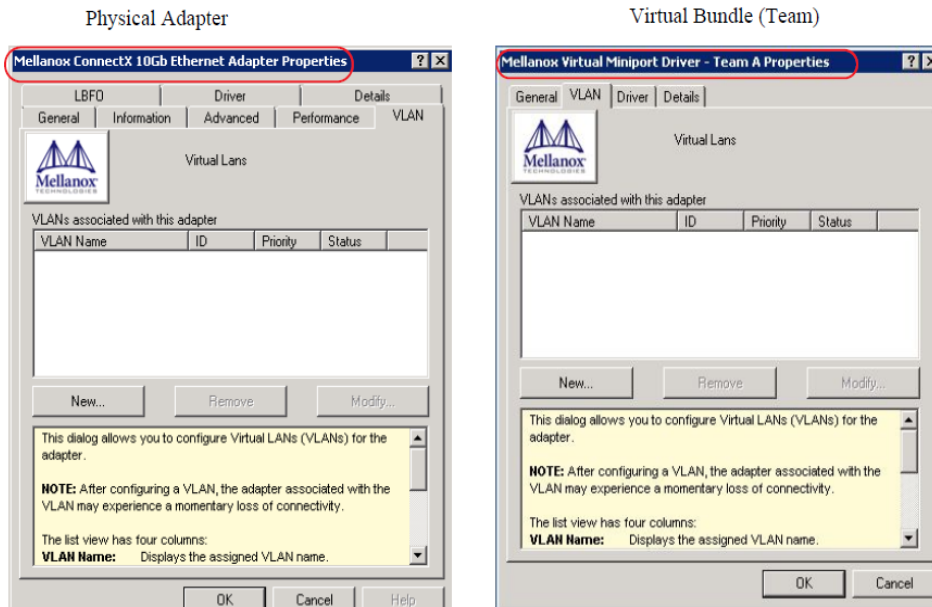
- a. Each adapter that participates in a bundle has two properties:
  - Status: Connected/Disconnected/Disabled
  - Role: Active or Backup
- b. Each network adapter that is added or removed from a bundle gets refreshed (i.e. disabled then enabled). This may cause a temporary loss of connection to the adapter.
- c. In case a bundle loses one or more network adapters by a “create” or “modify” operation, the remaining adapters in the bundle are automatically notified of the change.

### 8.5.3 Creating a Port VLAN in Windows 2008 R2

You can create a Port VLAN either on a physical Mellanox ConnectX® EN adapter or a virtual bundle (team). The following steps describe how to create a port VLAN.

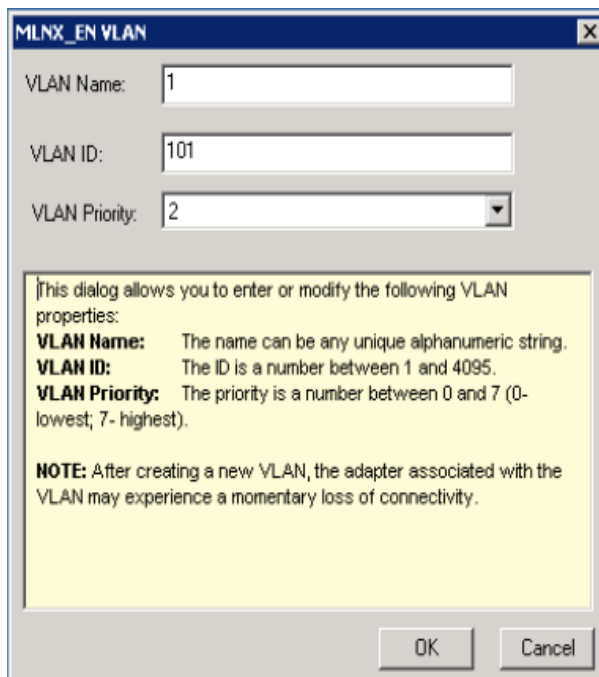
**Step 1.** Display the Device Manager.

**Step 2.** Right-click a Mellanox network adapter (under “Network adapters” list) and left-click Properties. Select the VLAN tab from the Properties sheet.



If a physical adapter has been added to a bundle (team), the VLAN tab will not be displayed.

**Step 3.** Click New to open a VLAN dialog window. Enter the desired VLAN Name and VLAN ID, and select the VLAN Priority.





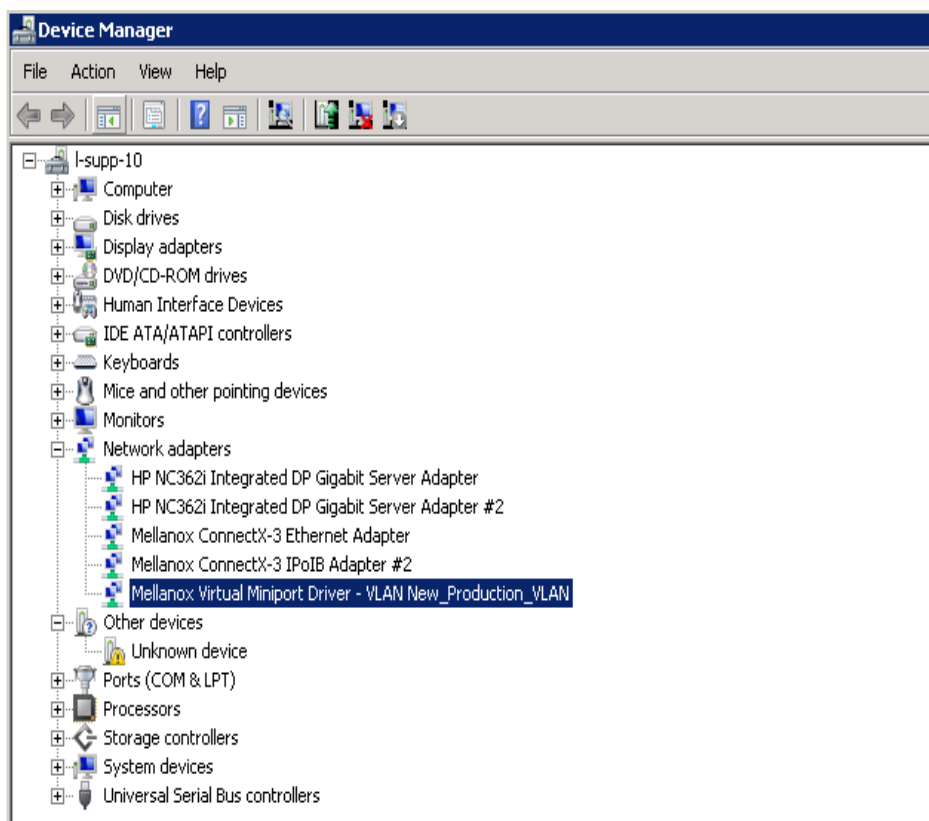
After installing the first virtual adapter (VLAN) on a specific port, the port becomes disabled. This means that it is not possible to bind to this port until all the virtual adapters associated with it are removed.



When using a VLAN, the network address is configured using the VLAN ID. Therefore, the VLAN ID on both ends of the connection must be the same.

- Step 4.** Verify the new VLAN(s) by opening the Device Manager window or the Network Connections window. The newly created VLAN will be displayed in the following format.

```
Mellanox Virtual Miniport Driver - VLAN <name>
```



### 8.5.4 Removing a Port VLAN in Windows 2008 R2

➤ *To remove a port VLAN, perform the following steps:*

- Step 1.** In the Device Manager window, right-click the network adapter from which the port VLAN was created.
- Step 2.** Left-click Properties.
- Step 3.** Select the VLAN tab from the Properties sheet.

- Step 4.** Select the VLAN to be removed.
- Step 5.** Click Remove and confirm the operation.

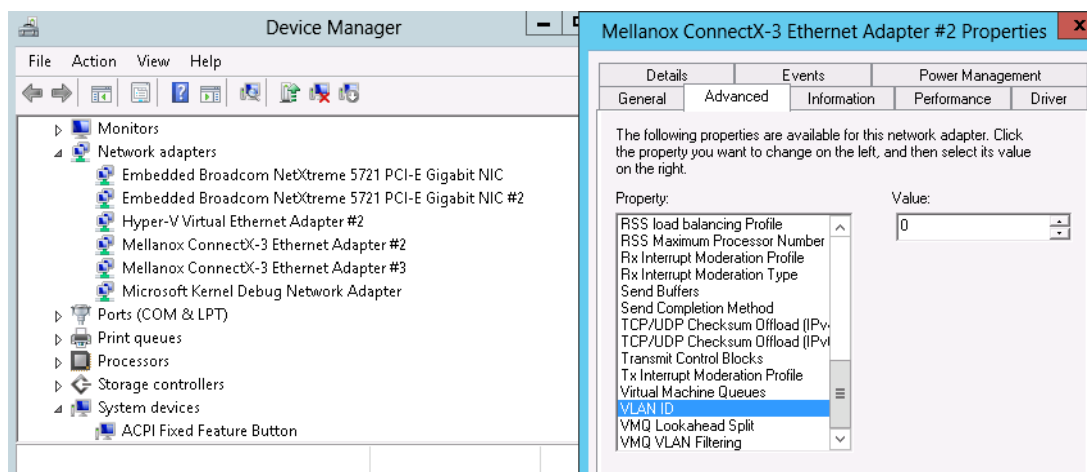
## 8.5.5 Configuring a Port to Work with VLAN in Windows 2012 and Above



In this procedure you DO NOT create a VLAN, rather use an existing VLAN ID.

### ➤ *To configure a port to work with VLAN using the Device Manager.*

- Step 1.** Open the Device Manager.
- Step 2.** Go to the Network adapters.
- Step 3.** Right click ' Properties on Mellanox ConnectX®-3 Ethernet Adapter card.
- Step 4.** Go to Advanced tab.
- Step 5.** Choose the VLAN ID in the Property window.
- Step 6.** Set its value in the Value window.



## 8.6 Ports TX Arbitration

On a setup with a dual-port NIC with both ports at link speed of 40GbE, each individual port can achieve maximum line rate. When both ports are running simultaneously in a high throughput scenario, the total throughput is bottlenecked by the PCIe bus, and in this case each port may not achieve its maximum of 40GbE.

Ports TX Arbitration ensures bandwidth precedence is given to one of the ports on a dual-port NIC, enabling the preferred port to achieve the maximum throughput and the other port taking up the rest of the remaining bandwidth.

### ➤ *To configure Ports TX Arbitration:*

- Step 1.** Open the Device Manager.
- Step 2.** Go to the Network adapters.
- Step 3.** Right click ' Properties on Mellanox ConnectX®-3 Ethernet Adapter card.
- Step 4.** Go to Advanced tab.

**Step 5.** Choose the 'Tx Throughput Port Arbiter' option.

**Step 6.** Set one of the following values:

- Best Effort (Default) - Default behavior. No precedence is given to this port over the other.
- Guaranteed - Give higher precedence to this port.
- Not Present - No configuration exists, defaults are used.

## 8.7 RDMA over Converged Ethernet (RoCE)

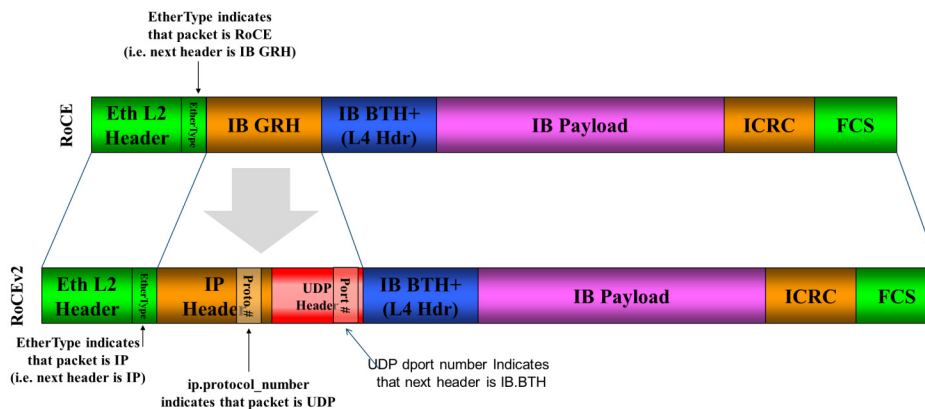
### 8.7.1 RoCE Overview

Remote Direct Memory Access (RDMA) is the remote memory management capability that allows server to server data movement directly between application memory without any CPU involvement. RDMA over Converged Ethernet (RoCE) is a mechanism to provide this efficient data transfer with very low latencies on loss-less Ethernet networks. With advances in data center convergence over reliable Ethernet, ConnectX® EN with RoCE uses the proven and efficient RDMA transport to provide the platform for deploying RDMA technology in mainstream data center application at 10GigE and 40GigE link-speed. ConnectX® EN with its hardware offload support takes advantage of this efficient RDMA transport (InfiniBand) services over Ethernet to deliver ultra-low latency for performance-critical and transaction intensive applications such as financial, database, storage, and content delivery networks. RoCE encapsulates IB transport and GRH headers in Ethernet packets bearing a dedicated ether type. While the use of GRH is optional within InfiniBand subnets, it is mandatory when using RoCE. Applications written over IB verbs should work seamlessly, but they require provisioning of GRH information when creating address vectors. The library and driver are modified to provide mapping from GID to MAC addresses required by the hardware.

#### 8.7.1.1 IP Routable (RoCEv2)

A straightforward extension of the RoCE protocol enables traffic to operate in layer 3 environments. This capability is obtained via a simple modification of the RoCE packet format. Instead of the GRH used in RoCE, routable RoCE packets carry an IP header which allows traversal of IP L3 Routers and a UDP header that serves as a stateless encapsulation layer for the RDMA Transport Protocol Packets over IP.

**Figure 2: RoCEv2 and RoCE Frame Format Differences**

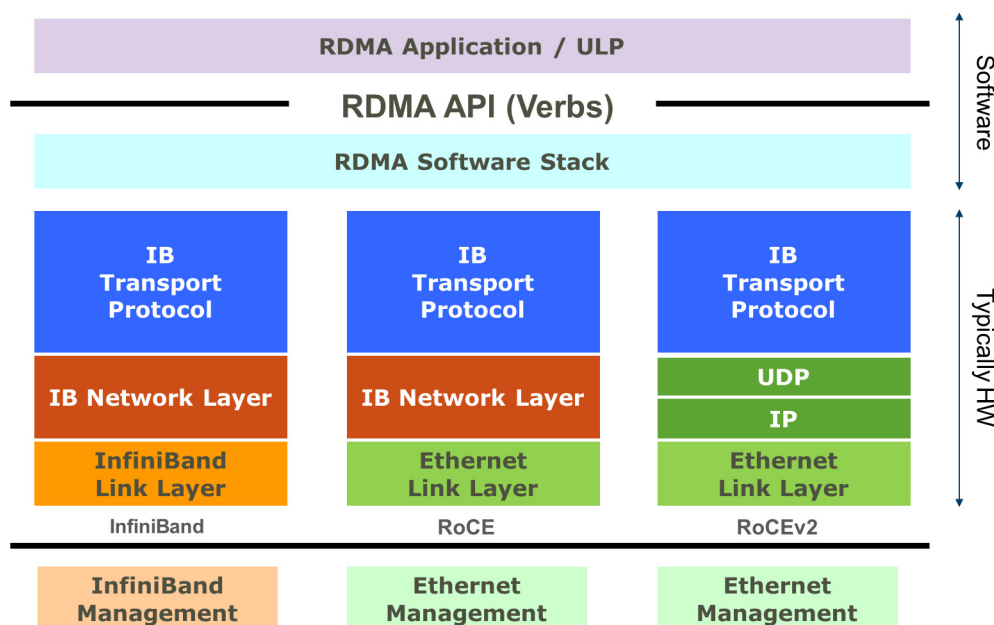




The proposed RoCEv2 packets use a well-known UDP destination port value that unequivocally distinguishes the datagram. Similar to other protocols that use UDP encapsulation, the UDP source port field is used to carry an opaque flow-identifier that allows network devices to implement packet forwarding optimizations (e.g. ECMP) while staying agnostic to the specifics of the protocol header format.

Furthermore, since this change exclusively affects the packet format on the wire, and due to the fact that with RDMA semantics packets are generated and consumed below the AP applications can seamlessly operate over any form of RDMA service (including the routable version of RoCE as shown in Figure 2), in a completely transparent way<sup>1</sup>.

**Figure 3: RoCEv2 Protocol Stack**



### 8.7.2 RoCE Configuration

In order to function reliably, RoCE requires a form of flow control. While it is possible to use global flow control, this is normally undesirable, for performance reasons.

The normal and optimal way to use RoCE is to use Priority Flow Control (PFC). To use PFC, it must be enabled on all endpoints and switches in the flow path.

In the following section we present instructions to configure PFC on Mellanox ConnectX™ cards. There are multiple configuration steps required, all of which may be performed via PowerShell. Therefore, although we present each step individually, you may ultimately choose to write a PowerShell script to do them all in one step. Note that administrator privileges are required for these steps.

For further information, please refer to:

<http://blogs.technet.com/b/josebda/archive/2012/07/31/deploying-windows-server-2012-with-smb-direct-smb-over-rdma-and-the-mellanox-connectx-3-using-10gbe-40gbe-roce-step-by-step.aspx>

1. Standard RDMA APIs are IP based already for all existing RDMA technologies

### 8.7.2.1 Prerequisites

The following are the driver's prerequisites in order to set or configure RoCE:

- ConnectX®-3 and ConnectX®-3 Pro firmware version 2.30.3000 or higher
- All InfiniBand verbs applications which run over InfiniBand verbs should work on RoCE links if they use GRH headers.
- Set HCA to use Ethernet protocol:  
Display the Device Manager and expand "System Devices". Please refer to [Section 8.4.2, "Port Protocol Configuration", on page 38.](#)

### 8.7.2.2 Configuring Windows Host



Since PFC is responsible for flow controlling at the granularity of traffic priority, it is necessary to assign different priorities to different types of network traffic.

As per RoCE configuration, all ND/NDK traffic is assigned to one or more chosen priorities, where PFC is enabled on those priorities.

Configuring Windows host requires configuring QoS. To configure QoS, please follow the procedure described in [Section 7.4, "Configuring Quality of Service \(QoS\)", on page 34](#)

#### 8.7.2.2.1 Using Global Pause Flow Control (GFC)

- *To use Global Pause Flow Control (GFC) mode, disable QoS and Priority:*

```
PS $ Disable-NetQosFlowControl
PS $ Disable-NetAdapterQos <interface name>
```

### 8.7.3 Configuring SwitchX® Based Switch System

- *To enable RoCE, the SwitchX should be configured as follows:*

- Ports facing the host should be configured as access ports, and either use global pause or Port Control Protocol (PCP) for priority flow control
- Ports facing the network should be configured as trunk ports, and use Port Control Protocol (PCP) for priority flow control

For further information on how to configure SwitchX, please refer to SwitchX User Manual.

### 8.7.4 Configuring Arista Switch

- Step 1.** Set the ports that face the hosts as trunk.

```
(config)# interface et10
(config-if-Et10)# switchport mode trunk
```

- Step 2.** Set VID allowed on trunk port to match the host VID.

```
(config-if-Et10)# switchport trunk allowed vlan 100
```

- Step 3.** Set the ports that face the network as trunk.

```
(config)# interface et20
(config-if-Et20)# switchport mode trunk
```

- Step 4.** Assign the relevant ports to LAG.

```
(config)# interface et10
(config-if-Et10)# dcbx mode ieee
```

```
(config-if-Et10)# speed forced 40gfull
(config-if-Et10)# channel-group 11 mode active
```

**Step 5. Enable PFC on ports that face the network.**

```
(config)# interface et20
(config-if-Et20)# load-interval 5
(config-if-Et20)# speed forced 40gfull
(config-if-Et20)# switchport trunk native vlan tag
(config-if-Et20)# switchport trunk allowed vlan 11
(config-if-Et20)# switchport mode trunk
(config-if-Et20)# dcbx mode ieee
(config-if-Et20)# priority-flow-control mode on
(config-if-Et20)# priority-flow-control priority 3 no-drop
```

### 8.7.4.1 Using Global Pause Flow Control (GFC)

- *To enable GFC on ports that face the hosts, perform the following:*

```
(config)# interface et10
(config-if-Et10)# flowcontrol receive on
(config-if-Et10)# flowcontrol send on
```

### 8.7.4.2 Using Priority Flow Control (PFC)

- *To enable PFC on ports that face the hosts, perform the following:*

```
(config)# interface et10
(config-if-Et10)# dcbx mode ieee
(config-if-Et10)# priority-flow-control mode on
(config-if-Et10)# priority-flow-control priority 3 no-drop
```

### 8.7.5 Configuring Router (PFC only)

The router uses L3's DSCP value to mark the egress traffic of L2 PCP. The required mapping, maps the three most significant bits of the DSCP into the PCP. This is the default behavior, and no additional configuration is required.

#### 8.7.5.1 Copying Port Control Protocol (PCP) between Subnets

The captured PCP option from the Ethernet header of the incoming packet can be used to set the PCP bits on the outgoing Ethernet header.

### 8.7.6 Configuring the RoCE Mode

Configuring the RoCE mode requires the following:

- RoCE mode is configured per-driver and is enforced on all the devices in the system



The supported RoCE modes depend on the firmware installed. If the firmware does not support the needed mode, the fallback mode would be the maximum supported RoCE mode of the installed NIC.

RoCE mode can be enabled and disabled via PowerShell.

•

➤ **To enable RoCE using the PowerShell:**

- Open the PowerShell and run:

```
Set-MlnxDriverCoreSetting -RoceMode 1
```

➤ **To enable RoCEv2 using the PowerShell:**

- Open the PowerShell and run:

```
Set-MlnxDriverCoreSetting -RoceMode 2
```

➤ **To disable any version of RoCE using the PowerShell:**

- Open the PowerShell and run:

```
Set-MlnxDriverCoreSetting -RoceMode 0
```

➤ **To check current version of RoCE using the PowerShell:**

- Open the PowerShell and run:

```
Get-MlnxDriverCoreSetting
```

- Example output:

```
Caption           : DriverCoreSettingData 'mlx4_bus'
Description       : Mellanox Driver Option Settings
.
.
.
RoceMode         : 0
```

## 8.8 Network Virtualization using Generic Routing Encapsulation



Network Virtualization using Generic Routing Encapsulation (NVGRE) off-load is currently supported in Windows Server 2012 R2 only.

Network Virtualization using Generic Routing Encapsulation (NVGRE) is a network virtualization technology that attempts to alleviate the scalability problems associated with large cloud computing deployments. It uses Generic Routing Encapsulation (GRE) to tunnel layer 2 packets across an IP fabric, and uses 24 bits of the GRE key as a logical network discriminator (which is called a tenant network ID).

Configuring the Hyper-V Network Virtualization, requires two types of IP addresses:

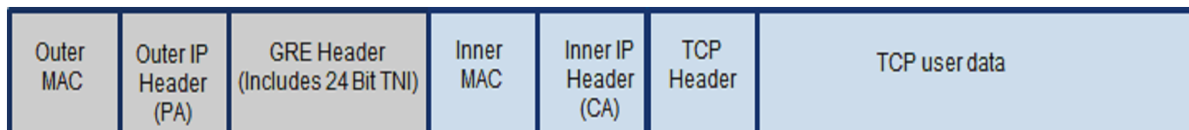
- **Provider Addresses (PA)** - unique IP addresses assigned to each Hyper-V host that are routable across the physical network infrastructure. Each Hyper-V host requires at least one PA to be assigned.
- **Customer Addresses (CA)** - unique IP addresses assigned to each Virtual Machine that participate on a virtualized network. Using NVGRE, multiple CAs for VMs running on a Hyper-V host can be tunneled using a single PA on that Hyper-V host. CAs must be unique across all VMs on the same virtual network, but they do not need to be unique across virtual networks with different Virtual Subnet ID.

The VM generates a packet with the addresses of the sender and the recipient within the CA space. Then Hyper-V host encapsulates the packet with the addresses of the sender and the recipient in PA space.

PA addresses are determined by using virtualization table. Hyper-V host retrieves the received packet, identifies recipient and forwards the original packet with the CA addresses to the desired VM.

NVGRE can be implemented across an existing physical IP network without requiring changes to physical network switch architecture. Since NVGRE tunnels terminate at each Hyper-V host, the hosts handle all encapsulation and de-encapsulation of the network traffic. Firewalls that block GRE tunnels between sites have to be configured to support forwarding GRE (IP Protocol 47) tunnel traffic.

**Figure 4: NVGRE Packet Structure**



### 8.8.1 Enabling/Disabling NVGRE Offloading

To leverage NVGRE to virtualize heavy network IO workloads, the Mellanox ConnectX®-3 Pro network NIC provides hardware support for GRE off-load within the network NICs by default.

➤ **To enable/disable NVGRE off-loading:**

- Step 1.** Open the Device Manager.
- Step 2.** Go to the Network adapters.
- Step 3.** Right click 'Properties on Mellanox ConnectX®-3 Pro Ethernet Adapter card.
- Step 4.** Go to Advanced tab.
- Step 5.** Choose the 'Encapsulate Task Offload' option.
- Step 6.** Set one of the following values:
  - Enable - GRE off-loading is Enabled by default
  - Disabled - When disabled the Hyper-V host will still be able to transfer NVGRE traffic, but TCP and inner IP checksums will be calculated by software that significant reduces performance.

## 8.8.2 Configuring the NVGRE using PowerShell

Hyper-V Network Virtualization policies can be centrally configured using PowerShell 3.0 and PowerShell Remoting.

- Step 1. [Windows Server 2012 Only]** Enable the Windows Network Virtualization binding on the physical NIC of each Hyper-V Host (Host 1 and Host 2)

```
Enable-NetAdapterBinding <EthInterfaceName>(a) -ComponentID ms_netwnv
```

<EthInterfaceName> - Physical NIC name

- Step 2.** Create a vSwitch.

```
New-VMSwitch <vSwitchName> -NetAdapterName <EthInterfaceName> -AllowManagementOS $true
```

- Step 3.** Shut down the VMs.

```
Stop-VM -Name <VM Name> -Force -Confirm
```

- Step 4.** Configure the Virtual Subnet ID on the Hyper-V Network Switch Ports for each Virtual Machine on each Hyper-V Host (Host 1 and Host 2).

```
Add-VMNetworkAdapter -VMName <VMName> -SwitchName <vSwitchName> -StaticMacAddress <StaticMAC Address>
```

- Step 5.** Configure a Subnet Locator and Route records on all Hyper-V Hosts (same command on all Hyper-V hosts)

```
New-NetVirtualizationLookupRecord -CustomerAddress <VMInterfaceIPAddress 1/n> -ProviderAddress <HypervisorInterfaceIPAddress1> -VirtualSubnetID <virtualsubnetID> -MACAddress <VMmacaddress1>a -Rule "TranslationMethodEncap"
```

```
New-NetVirtualizationLookupRecord -CustomerAddress <VMInterfaceIPAddress 2/n> -ProviderAddress <HypervisorInterfaceIPAddress2> -VirtualSubnetID <virtualsubnetID> -MACAddress <VMmacaddress2>a -Rule "TranslationMethodEncap"
```

- a. This is the VM's MAC address associated with the vSwitch connected to the Mellanox device.

- Step 6.** Add customer route on all Hyper-V hosts (same command on all Hyper-V hosts).

```
New-NetVirtualizationCustomerRoute -RoutingDomainID "{11111111-2222-3333-4444-000000005001}" -VirtualSubnetID <virtualsubnetID> -DestinationPrefix <VMInterfaceIPAddress/Mask> -NextHop "0.0.0.0" -Metric 255
```

- Step 7.** Configure the Provider Address and Route records on each Hyper-V Host using an appropriate interface name and IP address.

```
$NIC = Get-NetAdapter <EthInterfaceName>
New-NetVirtualizationProviderAddress -InterfaceIndex $NIC.InterfaceIndex -ProviderAddress <HypervisorInterfaceIPAddress> -PrefixLength 24
```

```
New-NetVirtualizationProviderRoute -InterfaceIndex $NIC.InterfaceIndex -DestinationPrefix "0.0.0.0/0" -NextHop <HypervisorInterfaceIPAddress>
```

- Step 8.** Configure the Virtual Subnet ID on the Hyper-V Network Switch Ports for each Virtual Machine on each Hyper-V Host (Host 1 and Host 2).

```
Get-VMNetworkAdapter -VMName <VMName> | where {$_.MacAddress -eq <VMmacaddress1>} | Set-VMNetworkAdapter -VirtualSubnetID <virtualsubnetID>
```



Please repeat steps 5 to 8 on each Hyper-V after rebooting the Hypervisor.

### 8.8.3 Verifying the Encapsulation of the Traffic

Once the configuration using PowerShell is completed, verifying that packets are indeed encapsulated as configured is possible through any packet capturing utility. If configured correctly, an encapsulated packet should appear as a packet consisting of the following headers:

Outer ETH Header, Outer IP, GRE Header, Inner ETH Header, Original Ethernet Payload.

### 8.8.4 Removing NVGRE configuration

**Step 1.** Set VSID back to 0 (on each Hyper-V for each Virtual Machine where VSID was set)

```
#Get-VMNetworkAdapter <VMName>(a) | where {$_.MacAddress -eq <VMMacAddress>(b)} | Set-VMNetwork-Adapter -VirtualSubnetID 0
```

- VMName - the name of Virtual machine
- VMMacAddress - the MAC address of VM's network interface associated with vSwitch that was connected to Mellanox device.

**Step 2.** Remove all lookup records (same command on all Hyper-V hosts)

```
Remove-NetVirtualizationLookupRecord
```

**Step 3.** Remove customer route (same command on all Hyper-V hosts)

```
Remove-NetVirtualizationCustomerRoute
```

**Step 4.** Remove Provider address (same command on all Hyper-V hosts)

```
Remove-NetVirtualizationProviderAddress
```

**Step 5.** For HyperV running Windows 2012 only disable network adapter binding to ms\_netwnv service

```
Disable-NetAdapterBinding <EthInterfaceName>(a) -ComponentID ms_netwnv
```

<EthInterfaceName> - Physical NIC name

## 8.9 Differentiated Services Code Point (DSCP)

DSCP is a mechanism used for classifying network traffic on IP networks. It uses the 6-bit Differentiated Services Field (DS or DSCP field) in the IP header for packet classification purposes. Using Layer 3 classification enables you to maintain the same classification semantics beyond local network, across routers.

Every transmitted packet holds the information allowing network devices to map the packet to the appropriate 802.1Qbb CoS. For DSCP based PFC the packet is marked with a DSCP value in the Differentiated Services (DS) field of the IP header.

### 8.9.1 Setting the DSCP in the IP Header

Marking DSCP value in the IP header is done differently for IP packets constructed by the NIC (e.g. RDMA traffic) and for packets constructed by the IP stack (e.g. TCP traffic).

- For IP packets generated by the IP stack, the DSCP value is provided by the IP stack. The NIC does not validate the match between DSCP and Class of Service (CoS) values. CoS and DSCP values are expected to be set through standard tools, such as PowerShell command `New-NetQosPolicy` using `PriorityValue8021Action` and `DSCPAction` flags respectively.
- For IP packets generated by the NIC (RDMA), the DSCP value is generated according to the CoS value programmed for the interface. CoS value is set through standard tools, such as PowerShell command `New-NetQosPolicy` using `PriorityValue8021Action` flag. The NIC uses a mapping table between the CoS value and the DSCP value configured through the `RroceDscpMarkPriorityFlow- Control[0-7]` Registry keys

### 8.9.2 Configuring Quality of Service for TCP and RDMA Traffic

**Step 1.** Verify that DCB is installed and enabled (is not installed by default).

```
$ Install-WindowsFeature Data-Center-Bridging
```

**Step 2.** Import the PowerShell modules that are required to configure DCB.

```
$ import-module NetQos
$ import-module DcbQos
$ import-module NetAdapter
```

**Step 3.** Configure DCB.

```
$ Set-NetQosDcbxSetting -Willing 0
```

**Step 4.** Enable Network Adapter QoS.

```
$ Set-NetAdapterQos -Name "Cx3Pro_ETH_P1" -Enabled 1
```

**Step 5.** Enable Priority Flow Control (PFC) on the specific priority 3,5.

```
$ Enable-NetQosFlowControl 3,5
```

### 8.9.3 Configuring DSCP for TCP Traffic

- Create a QoS policy to tag All TCP/UDP traffic with CoS value 1 and DSCP value 9.

```
$ New-NetQosPolicy "DEFAULT" -PriorityValue8021Action 3 -DSCPAction 9
```

DSCP can also be configured per protocol.

```
$ New-NetQosPolicy "TCP" -IPProtocolMatchCondition TCP -PriorityValue8021Action 3 -DSCPAction 16
$ New-NetQosPolicy "UDP" -IPProtocolMatchCondition UDP -PriorityValue8021Action 3 -DSCPAction 32
```

### 8.9.4 Configuring DSCP for RDMA Traffic

- Create a QoS policy to tag the ND traffic for port 10000 with CoS value 3.

```
$ New-NetQosPolicy "ND10000" -NetDirectPortMatchCondition 10000 - PriorityValue8021Action 3
```

Related Commands:

- `Get-NetAdapterQos` - Gets the QoS properties of the network adapter
- `Get-NetQosPolicy` - Retrieves network QoS policies
- `Get-NetQosFlowControl` - Gets QoS status per priority



## 8.9.5 Registry Settings

The following attributes must be set manually and will be added to the miniport registry.

**Table 7 - DSCP Registry Keys Settings**

| Registry Key                          | Description                                                                                                                                                                                                                                          |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| TxUntagPriorityTag                    | If 0x1, do not add 802.1Q tag to transmitted packets which are assigned 802.1p priority, but are not assigned a non-zero VLAN ID (i.e. priority-tagged).<br>Default 0x0, for DSCP based PFC set to 0x1.                                              |
| RxUntaggedMapToLossless               | If 0x1, all untagged traffic is mapped to the lossless receive queue.<br>Default 0x0, for DSCP based PFC set to 0x1.                                                                                                                                 |
| RroceDscpMarkPriorityFlowControl_<ID> | A value to mark DSCP for RoCE v2 packets assigned to CoS=ID, when priority flow control is enabled. The valid values range is from 0 to 63,<br>Default is ID value, e.g.<br>RroceDscpMarkPriorityFlowControl_3 is 3.<br>ID values range from 0 to 7. |



For changes to take affect, please restart the network adapter after changing this registry key.

### 8.9.5.1 Default Settings

When DSCP configuration registry keys are missing in the miniport registry, the following defaults are assigned.

**Table 8 - DSCP Default Registry Keys Settings**

| Registry Key                       | Default Value |
|------------------------------------|---------------|
| TxUntagPriorityTag                 | 0             |
| RxUntaggedMapToLossles             | 0             |
| RroceDscpMarkPriorityFlowControl_0 | 0             |
| RroceDscpMarkPriorityFlowControl_1 | 1             |
| RroceDscpMarkPriorityFlowControl_2 | 2             |
| RroceDscpMarkPriorityFlowControl_3 | 3             |
| RroceDscpMarkPriorityFlowControl_4 | 4             |
| RroceDscpMarkPriorityFlowControl_5 | 5             |
| RroceDscpMarkPriorityFlowControl_6 | 6             |

**Table 8 - DSCP Default Registry Keys Settings**

| Registry Key                       | Default Value |
|------------------------------------|---------------|
| RroceDscpMarkPriorityFlowControl_7 | 7             |

### 8.9.6 DSCP Sanity Testing

To verify that all QoS and DSCP settings were correct, you can capture incoming and outgoing traffic by using the ibdump tool and see the DSCP value in the captured packets as displayed in the figure below.

```

ibdump.pcap [Wireshark 1.8.6 (SVN Rev 48)
File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help
Filter: Expression... Clear Apply Save
No. Time Source Destination Protocol Length Info
8 0.042502 11.7.33.148 11.7.33.149 UDP 1086 Source port: 49153 Destination port: expl
9 0.042502 11.7.33.148 11.7.33.149 UDP 1086 Source port: 49153 Destination port: expl
10 0.043752 11.7.33.148 11.7.33.149 UDP 1086 Source port: 49153 Destination port: expl
11 0.043752 11.7.33.148 11.7.33.149 UDP 1086 Source port: 49153 Destination port: expl
12 0.043752 11.7.33.148 11.7.33.149 UDP 1086 Source port: 49153 Destination port: expl
+ Frame 9: 1086 bytes on wire (8688 bits), 1086 bytes captured (8688 bits)
  Ethernet II, Src: Mellanox_e9:57:11 (00:02:c9:e9:57:11), Dst: Mellanox_e9:56:41 (00:02:c9:e9:56:41)
  Internet Protocol Version 4, Src: 11.7.33.148 (11.7.33.148), Dst: 11.7.33.149 (11.7.33.149)
  Version: 4
  Header length: 20 bytes
  Differentiated Services Field: 0x0e (DSCP 0x03: Unknown DSCP; ECN: 0x02: ECT(0) (ECN-Capable Transport))
  0000 11.. = Differentiated Services Codepoint: Unknown (0x03)
  .... 110 = Explicit Congestion Notification: ECT(0) (ECN-Capable Transport) (0x02)
  Total Length: 1068
  Identification: 0x0001 (1)
  Flags: 0x02 (Don't Fragment)
  Fragment offset: 0
  Time to live: 16
  Protocol: UDP (17)
  Header checksum: 0x0d7c [correct]
  Source: 11.7.33.148 (11.7.33.148)
  Destination: 11.7.33.149 (11.7.33.149)
  [Source GeoIP: unknown]
  [Destination GeoIP: unknown]
  User Datagram Protocol, Src Port: 49153 (49153), Dst Port: expl (1021)
  Data (1040 bytes)

```

## 8.10 SR-IOV

Single Root I/O Virtualization (SR-IOV) is a technology that allows a physical PCIe device to present itself multiple times through the PCIe bus. This technology enables multiple virtual instances of the device with separate resources. Mellanox adapters are capable of exposing in ConnectX®-3/ConnectX®-3 Pro adapter cards, up to 126 virtual instances called Virtual Functions (VFs). These virtual functions can then be provisioned separately. Each VF can be seen as an addition device connected to the Physical Function. It also shares resources with the Physical Function.

SR-IOV is commonly used in conjunction with an SR-IOV enabled hypervisor to provide virtual machines direct hardware access to network resources hence increasing its performance.

This guide demonstrates the setup and configuration of SR-IOV, using Mellanox ConnectX® VPI adapter cards family, in Windows Server 2012 R2 and above. SR-IOV VF is a single port device.

### 8.10.1 System Requirements

- A server/blade with an SR-IOV-capable motherboard and BIOS. BIOS settings might need to be updated to enable virtualization support and SR-IOV support.
- Hypervisor OS: Windows Server 2012 R2 and above
- Virtual Machine (VM) OS:
  - The VM OS can be either Windows Server 2012 or Windows Server 2012 R2
- Mellanox ConnectX®-3/ ConnectX®-3 Pro VPI Adapter Card family with SR-IOV capability
- Mellanox WinOF 4.61 or higher

### 8.10.2 SR-IOV Feature Limitations

- SR-IOV is supported only in Ethernet ports and can be enable if all ports are set as Ethernet.
- RDMA capability is not available in SR-IOV mode on either port

### 8.10.3 Configuring SR-IOV Host Machine

The following are the necessary steps for configuring host machine:

#### 8.10.3.1 Enabling SR-IOV in BIOS

Depending on your system, perform the steps below to set up your BIOS. The figures used in this section are for illustration purposes only.

For further information, please refer to the appropriate BIOS User Manual.

➤ **To enable SR-IOV in BIOS:**

**Step 1.** Make sure the machine's BIOS supports SR-IOV.

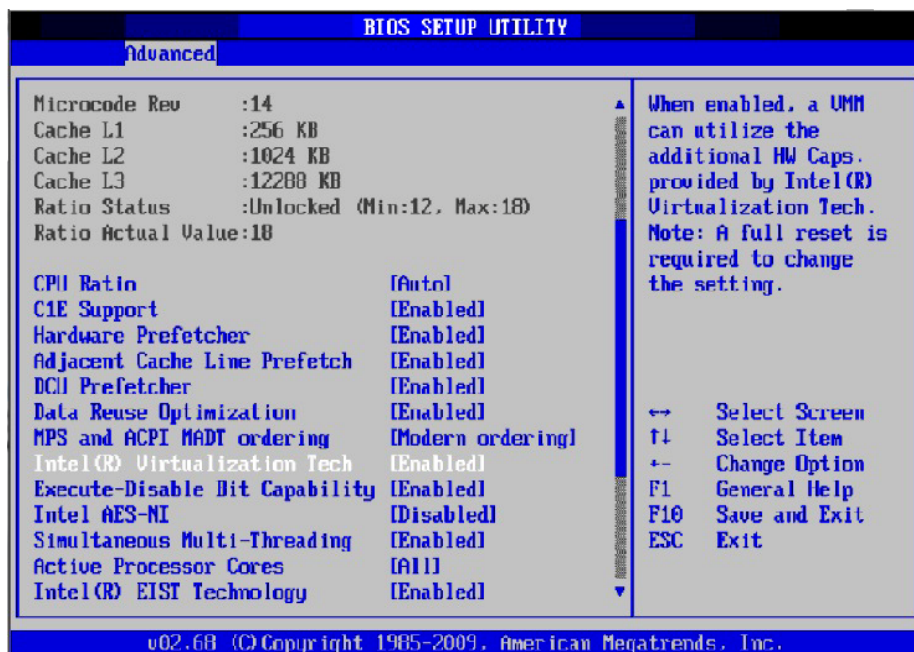
Please, consult BIOS vendor website for SR-IOV supported BIOS versions list. Update the BIOS version if necessary.

**Step 2.** Follow BIOS vendor guidelines to enable SR-IOV according to BIOS User Manual.  
For example,

- a. Enable SR-IOV.



- b. Enable “Intel Virtualization Technology” Support



For further details, please refer to the vendor's website.

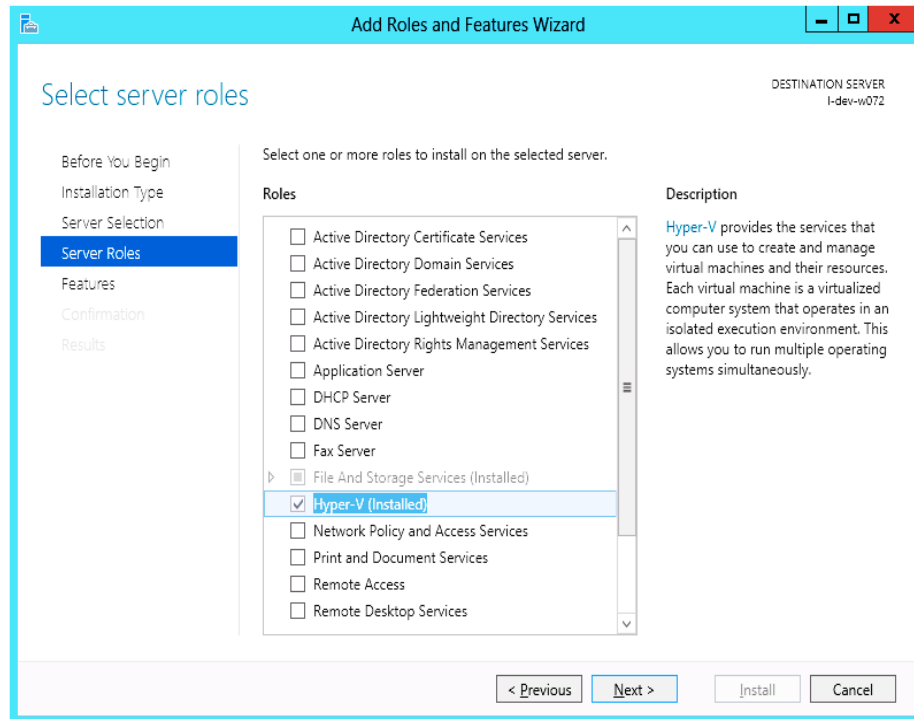
### 8.10.3.2 Installing Hypervisor Operating System

➤ *To install Hypervisor Operating System:*

- Step 1. Install Windows Server 2012 R2 and above.
- Step 2. Install Hyper-V role:

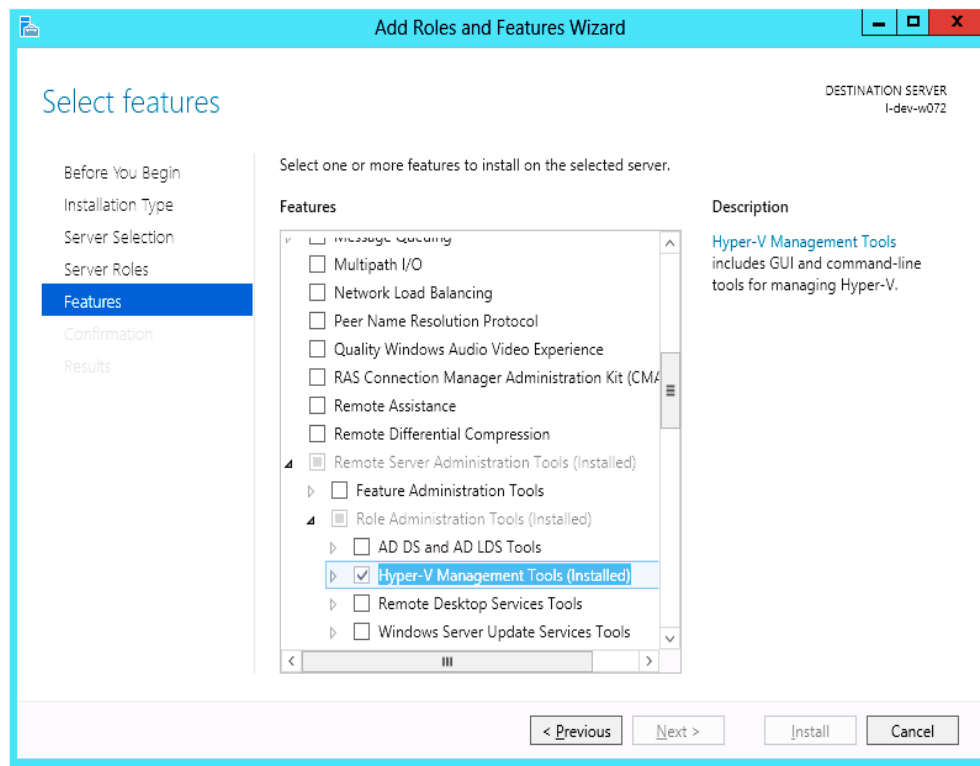
- a. Go to: Server Manager -> Manage -> Add Roles and Features -> Installation Type-> Role-based or Feature-based Installation -> Server Selection <local server>
- b. Go to: Server Roles -> Hyper-V

**Figure 5: Hyper-V Server Roles Selection**

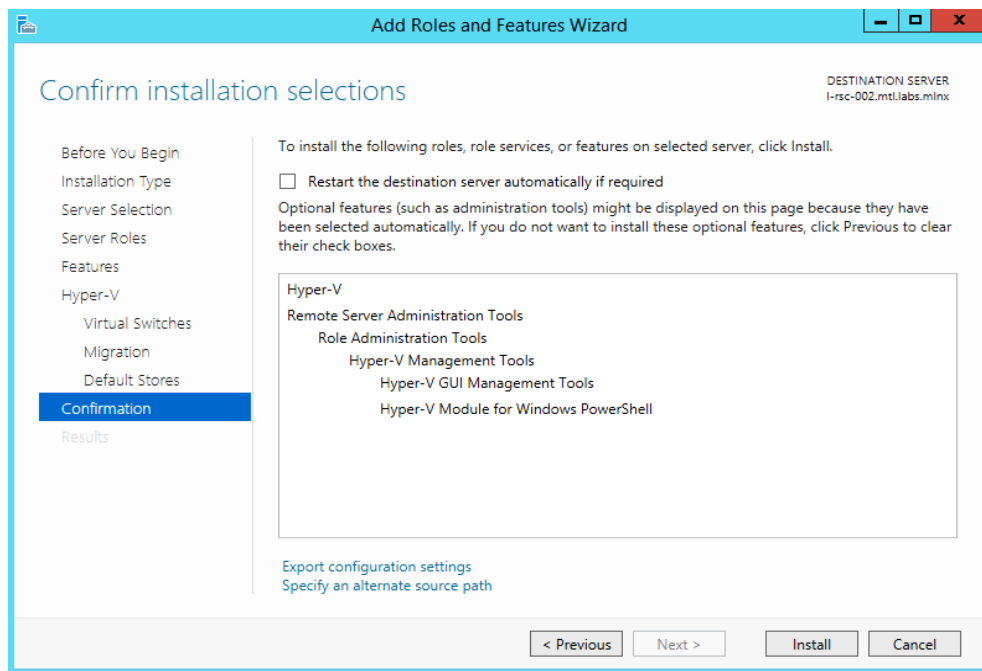


**Step 3. Install Hyper-V Management Tools.**

- a. Go to: Features -> Remote Server Administration Tools -> Role Administration Tools -> Hyper-V Administration Tool

**Figure 6: Hyper-V Features Selection**

**Step 4.** Confirm the Installation.

**Figure 7: Hyper-V Confirming Installation**

**Step 5.** Reboot the system.

### 8.10.3.3 Verifying SR-IOV Support within the Host Operating System

➤ *To verify that the system is properly configured for SR-IOV*

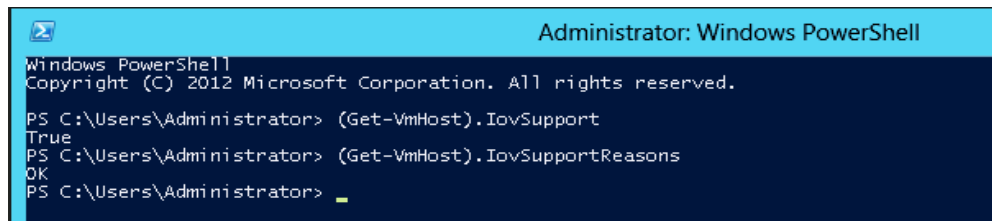
**Step 1.** Go to: Start-> Windows Powershell.

**Step 2.** Run the following PowerShell commands.

```
(Get-VmHost).IovSupport
(Get-VmHost).IovSupportReasons
```

In case that SR-IOV is supported by the OS, the output in the PowerShell is as in Figure 5.

**Figure 8: Operating System Supports SR-IOV**

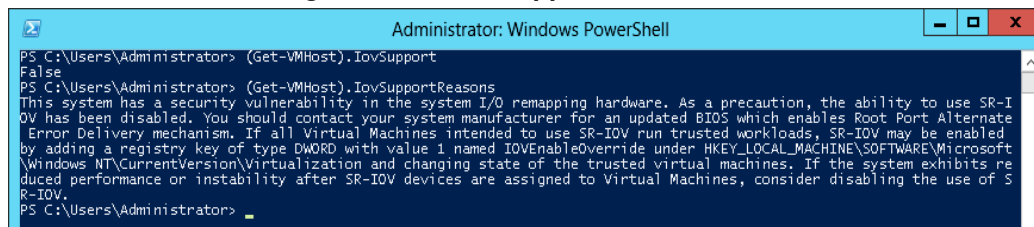


```
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) 2012 Microsoft Corporation. All rights reserved.

PS C:\Users\Administrator> (Get-VmHost).IovSupport
True
PS C:\Users\Administrator> (Get-VmHost).IovSupportReasons
OK
PS C:\Users\Administrator> _
```

**Step 3.** Update the registry configuration as described in the (Get-VmHost).IovSupportReasons message, if BIOS was updated according to BIOS vendor instructions and you see the message as in the figure below.

**Figure 9: SR-IOV Support**



```
Administrator: Windows PowerShell
PS C:\Users\Administrator> (Get-VmHost).IovSupport
False
PS C:\Users\Administrator> (Get-VmHost).IovSupportReasons
This system has a security vulnerability in the system I/O remapping hardware. As a precaution, the ability to use SR-IOV has been disabled. You should contact your system manufacturer for an updated BIOS which enables Root Port Alternate Error Delivery mechanism. If all Virtual Machines intended to use SR-IOV run trusted workloads, SR-IOV may be enabled by adding a registry key of type DWORD with value 1 named IOVEnableOverride under HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Virtualization and changing state of the trusted virtual machines. If the system exhibits reduced performance or instability after SR-IOV devices are assigned to Virtual Machines, consider disabling the use of SR-IOV.
PS C:\Users\Administrator> _
```

**Step 4.** Reboot

**Step 5.** Verify the system is configured correctly for SR-IOV as described in Steps 1/2.

### 8.10.3.4 Creating a Virtual Machine

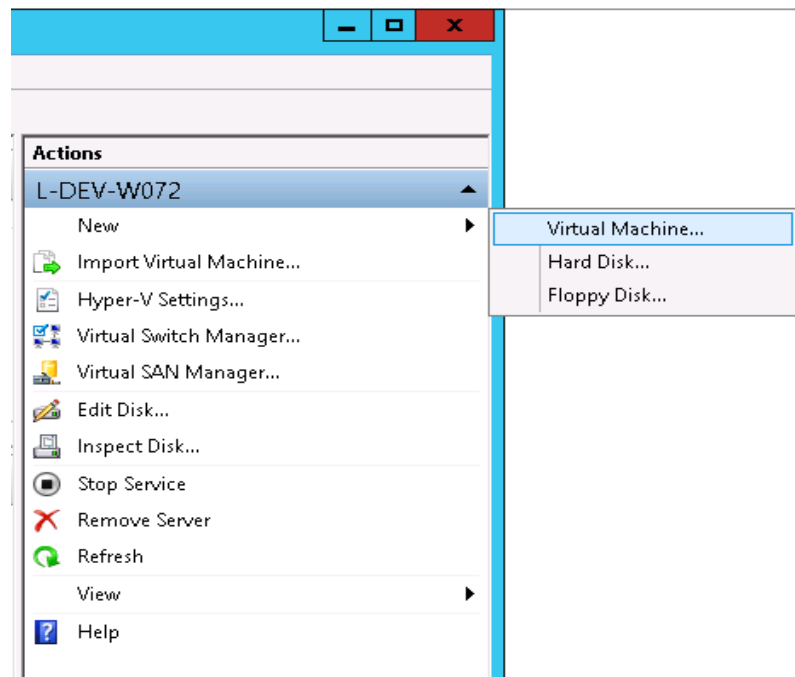
➤ *To create a virtual machine*

**Step 1.** Open the Hyper-V Manager.

**Step 2.** Go to: New->Virtual Machine and set the following:

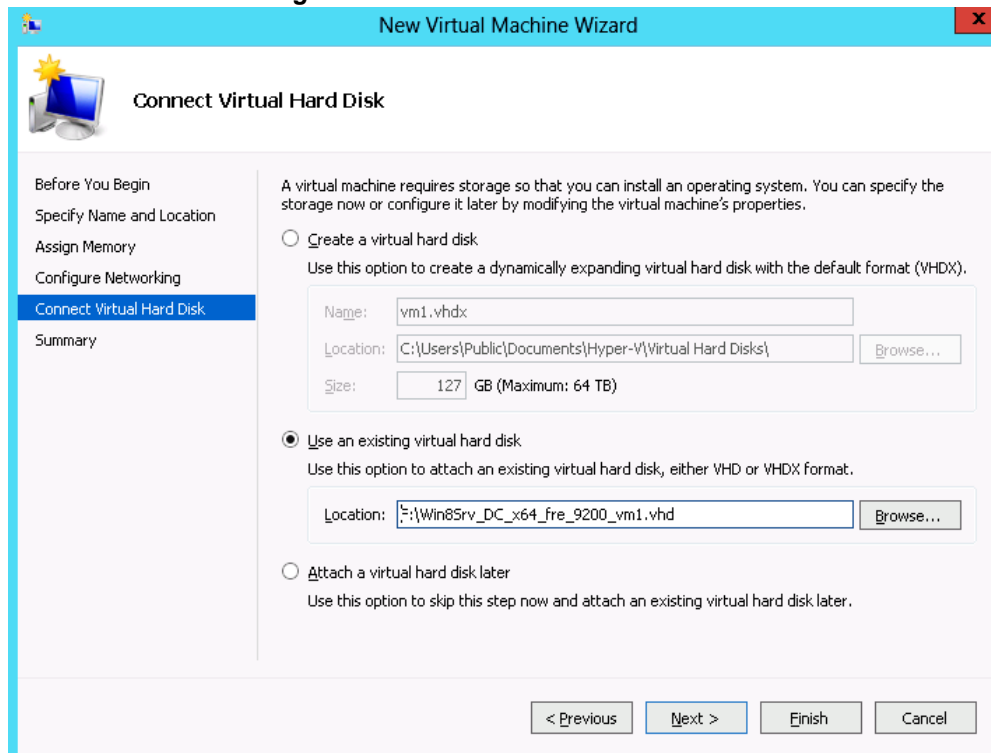
- Name: <name>
- Startup memory: 4096 MB
- Connection: Not Connected

Figure 10: Hyper-V Manager



- Step 3.** Connect the virtual hard disk in the New Virtual Machine Wizard.
- Step 4.** Go to: Connect Virtual Hard Disk -> Use an existing virtual hard disk.
- Step 5.** Select the location of the vhd file.

Figure 11: Connect Virtual Hard Disk





## 8.10.4 Configuring Mellanox Network Adapter for SR-IOV

The following are the steps for configuring Mellanox Network Adapter for SR-IOV:

### 8.10.4.1 Enabling SR-IOV in Firmware

SR-IOV can be enabled and managed by using one of the following methods:

➤ **To burn firmware with SR-IOV support:**

- Step 1.** Verify that HCA is configured for SR-IOV by dumping the device configuration file to user-chosen location <ini device file>.ini..

```
flint -d <device> dc > <ini device file>.ini
```

- Step 2.** Verify in the [HCA] section of the .ini that the following fields appear:

```
[HCA]
num_pfs = 1
total_vfs = 16
sriov_en = true
```

- Step 3.** If the fields do not appear, please, edit the .ini file and add them manually.

| Parameter | Recommended Value                                                                      |
|-----------|----------------------------------------------------------------------------------------|
| num_pfs   | 1<br><b>Note:</b> This field is optional and might not always appear.                  |
| total_vfs | <0-126> (The chosen value should be within BIOS limit of MMIO available address space) |
| sriov_en  | true                                                                                   |



**Warning:** Care should be taken in increasing the number of VFs. All servers are guaranteed to support 16 VFs. More VFs can lead to exceeding the BIOS limit of MMIO available address space.

- Step 4.** Create a binary image using the modified ini file.

```
mlxburn -fw <fw name>.mlx -conf <ini device file>.ini -wimage <file name>.bin
```

- Step 5.** Burn the firmware.

The file <file name>.bin is a firmware binary file with SR-IOV enabled that has 16 VFs.

```
flint -dev <PCI device> -image <file name>.bin b
```

- Step 6.** Reboot the system for changes to take effect.

For more information, please, contact Mellanox Support.

➤ **To enable SR-IOV using mlxconfig tool (beta)**

mlxconfig is part of MFT tools used to simplify firmware configuration. The tool is available with MFT tools 3.6.0 or higher in beta version.

- Step 1.** Download MFT.

www.mellanox.com > Products > Software > Firmware Tools

- Step 2.** Check the current SR-IOV configuration.

```
mlxconfig -d mt4099_pciconf0 q
```

**Example output:**

```
Device #1:
-----

Device type:   ConnectX3
PCI device:    mt4099_pciconf0

Configurations:      Current
                    SRIOV_EN      N/A
                    NUM_OF_VFS     N/A
                    WOL_MAGIC_EN_P2 N/A
```

**Step 3. Enable SR-IOV with 8 VFs.**

```
mlxconfig -d mt4099_pciconf0 s SRIOV_EN=1 NUM_OF_VFS=8
```

**Example output:**

```
Device #1:
-----

Device type:   ConnectX3
PCI device:    mt4099_pciconf0

Configurations:      Current New
                    SRIOV_EN      N/A   1
                    NUM_OF_VFS     N/A   8
                    WOL_MAGIC_EN_P2 N/A   N/A

Apply new Configuration? ? (y/n) [n] :
```

**8.10.4.2 Enabling SR-IOV in Mellanox WinOF Package****➤ To enable SR-IOV in Mellanox WinOF Package****Step 1.** Install Mellanox WinOF package that supports SR-IOV.**Step 2.** Configure HCA ports' type to Ethernet.

SR-IOV cannot be enabled if one of the ports is Infiniband.

**Step 3.** Query SR-IOV configuration with Powershell.

```
PS> Get-MlnxPCIDeviceSriovSetting
```

**Example output:**

```
Caption      : MLNX_PCIDeviceSriovSettingData 'Mellanox ConnectX-3 VPI (MT04099) Network Adapter
Description   : Mellanox ConnectX-3 VPI (MT04099) Network Adapter
ElementName   : HCA 0
InstanceID    : PCI\VEN_15B3&DEV_1003&SUBSYS_002815B3&REV_00\0002C90300A0AA6000
Name          : HCA 0
Source        : 3
SystemName    : L-DEV-W068
SriovEnable   : False
SriovPort1NumVFs :
SriovPort2NumVFs :
SriovPortMode :
PSComputerName :
```

**Step 4.** Enable SR-IOV through Powershell.

```
Set-MlnxPCIDeviceSriovSetting -Name "HCA 0" -SriovEnable $true
```

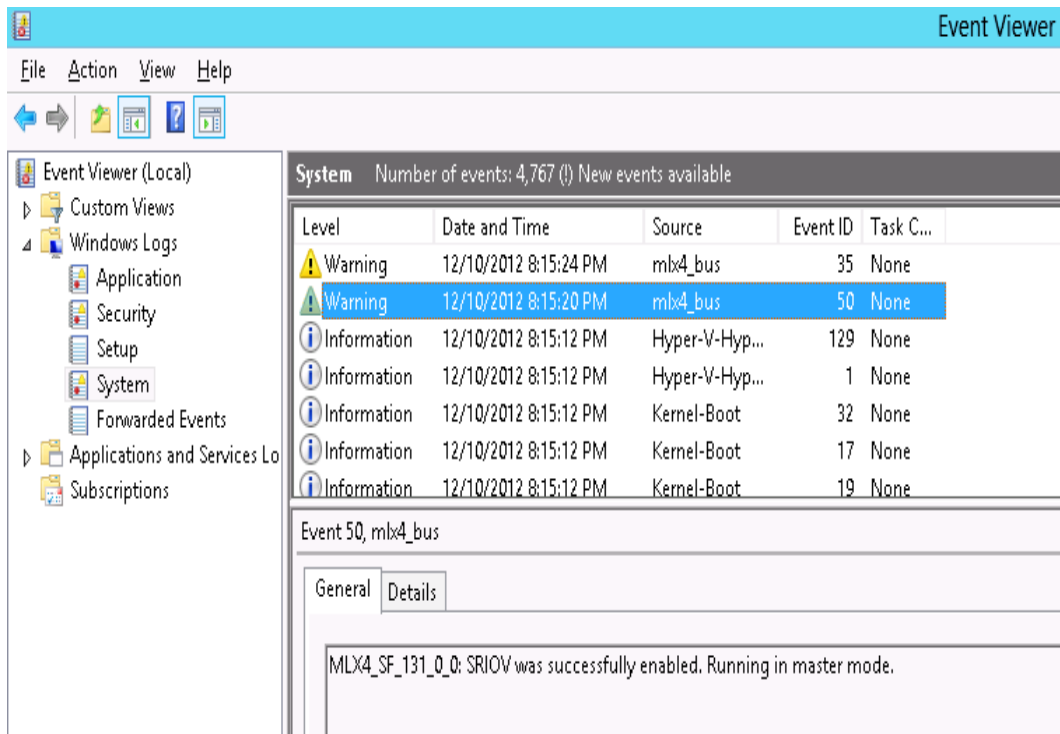
SR-IOV mode configuration parameters:

| Parameter Name                       | Values                                                                                                                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| SriovEnable                          | <ul style="list-style-type: none"> <li>0 = RoCE (default)</li> <li>1 = SR-IOV</li> </ul>                               | Configures the RDMA or SR-IOV mode.<br><b>Note:</b> RDMA is not supported in SR-IOV mode.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| SriovPortMode                        | <ul style="list-style-type: none"> <li>0 = auto_port1 (default)</li> <li>1 = auto_port2</li> <li>2 = manual</li> </ul> | Configures the number of VFs to be enabled by the bus driver to each port.<br><b>Note:</b> In auto_portX mode, port X will have the number of VFs according to the burnt value in the device and the other port will have no SR-IOV and it will support native Ethernet (i.e. no RoCE). Setting this parameter to "Manual" will configure the number of VFs for each port according to the registry key MaxVFPortX.<br><b>Note:</b> The number of VFs can be configured both on a Mellanox bus driver level and Network Interface level (i.e. using Set-NetAdapterSriov Powershell cmdlet). The number of VFs actually available to the Network Interface is the minimum value between mellanox bus driver configuration and Network Interface configuration. For example, if 8 VFs support was burnt in firmware, SriovPortMode is auto_port1, and Network Interface was allowed 32 VFs using SetNetAdapterSriov Powershell cmdlet, the actual number of VFs available to Network Interface will be 8. |
| SriovPort1NumVFs<br>SriovPort2NumVFs | <ul style="list-style-type: none"> <li>16=(default)</li> </ul>                                                         | SriovPort<i>NumVFs The maximum number of VFs that are allowed per port. This is the number of VFs the bus driver will open when working in manual mode.<br><b>Note:</b> If the total number of VFs requested is larger than the number of VFs burnt in firmware, each port X(1\2) will have the number of VFs according to the following formula:<br>$\frac{\text{SriovPortXNumVFs}}{(\text{SriovPort1NumVFs} + \text{SriovPort2NumVFs})} * \text{number of VFs burnt in firmware.}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

**Step 5.** Check in the System Event Log that SR-IOV is enabled:

Go to: Start -> Control Panel-> System and Security-> Administrative Tools-> View Event Logs

Figure 12: System Event Log



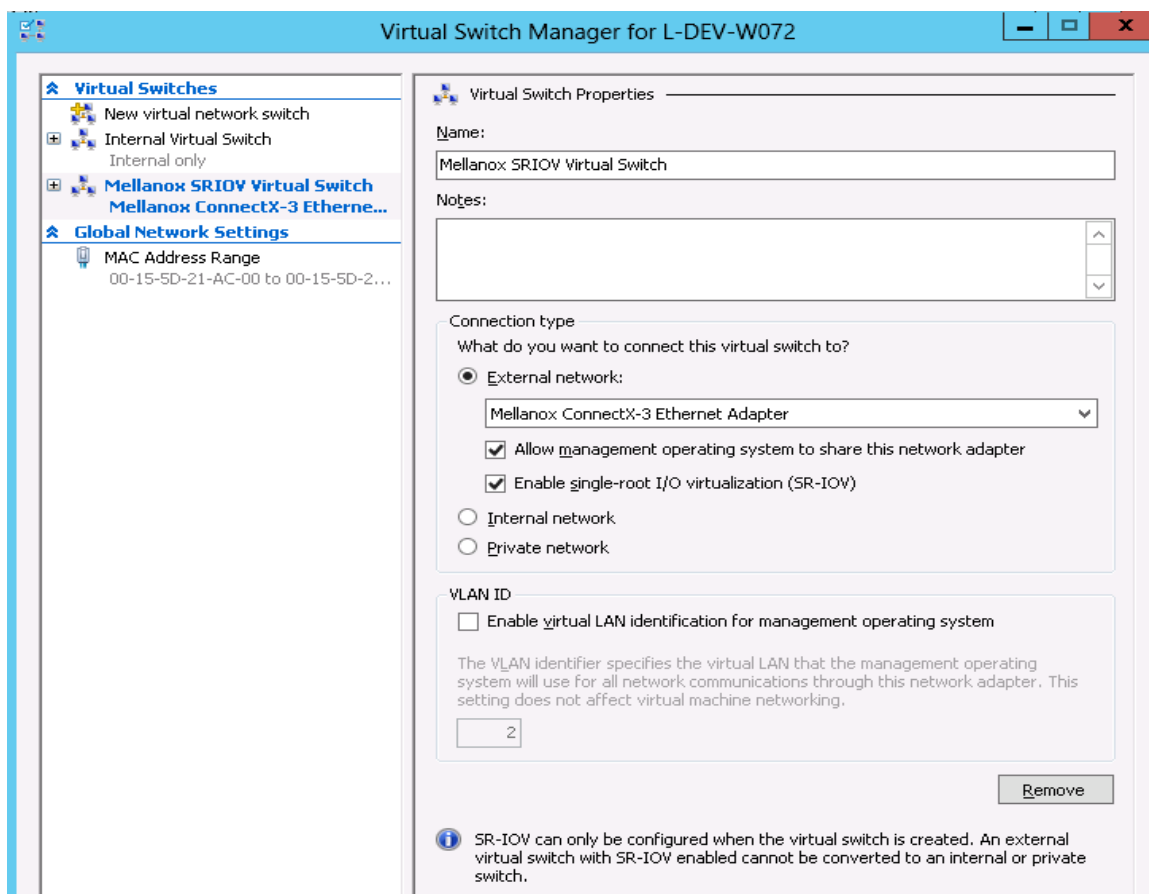
### 8.10.5 Configuring Virtual Machine Networking

➤ *To configure Virtual Machine networking:*

**Step 1.** Create an SR-IOV-enabled Virtual Switch over Mellanox Ethernet Adapter.

Go to: Hyper-V Manager-> Actions -> Virtual Switch-> external-> Create virtual Switch-> Apply.

**Figure 13: Virtual Switch with SR-IOV**

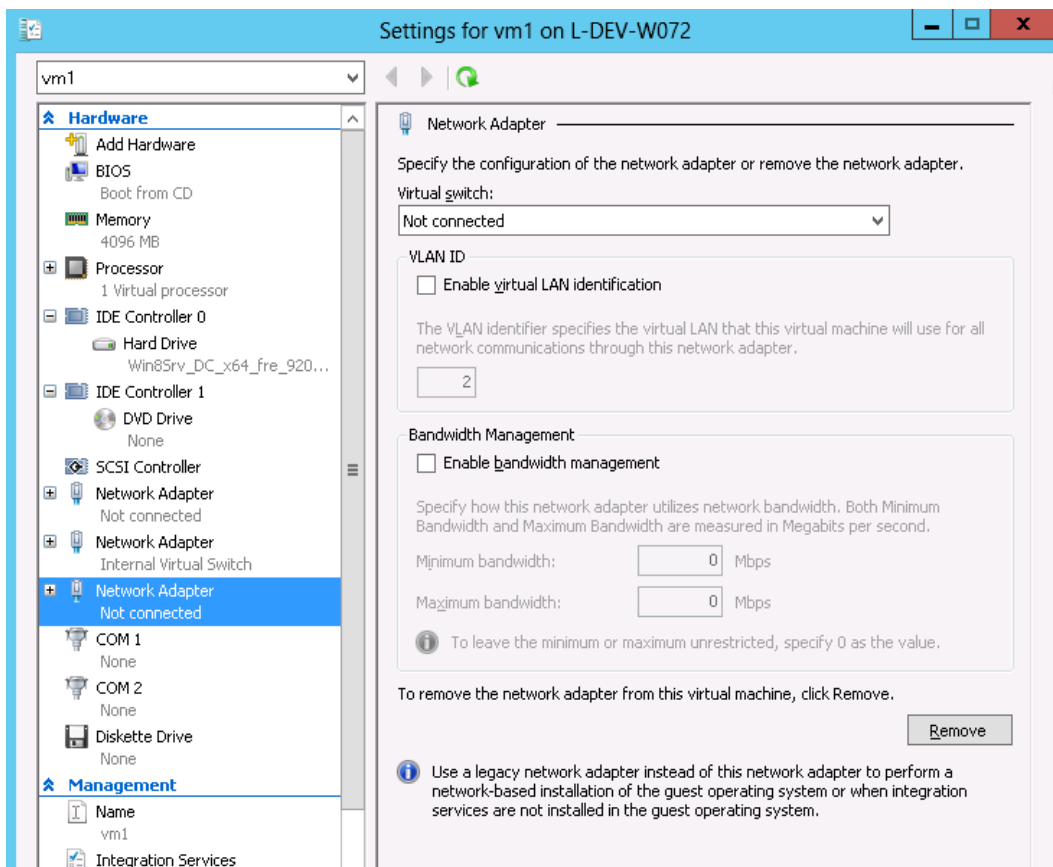


**Step 2.** Add a VMNIC connected to a Mellanox vSwitch.

Go to: Hyper-V Manager-> Settings-> Add New Hardware-> Network Adapter-> OK.

In “Virtual Switch” dropdown box, choose Mellanox SR-IOV Virtual Switch.

**Figure 14: Adding a VMNIC to a Mellanox V-switch**



**Step 3.** Start and connect to the Virtual Machine:

Select the newly created Virtual Machine and go to: Actions panel-> Connect.  
In the virtual machine window go to: Actions-> Start

**Step 4.** Assign IP address to the Mellanox VMNIC.

1. To go to Network Connections, enter the following command in the command prompt:

```
ncpa.cpl
```

2. Right-click the Hyper-V adapter and choose properties.
3. Mark the “Use the following IP address” checkbox.
4. Enter the IP address.

**Step 5.** Copy the WinOF driver package to the VM using Mellanox VMNIC IP address.

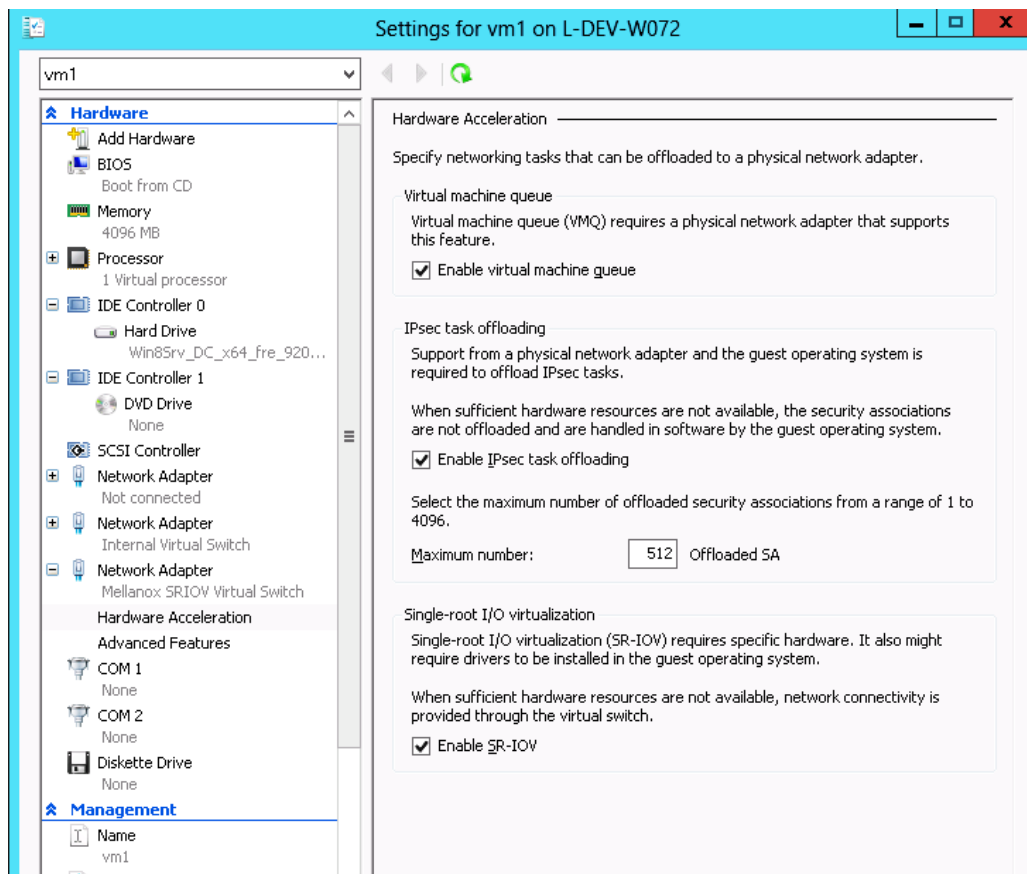
**Step 6.** Install WinOF driver package on the VM.

**Step 7.** Reboot the VM at the end of installation.

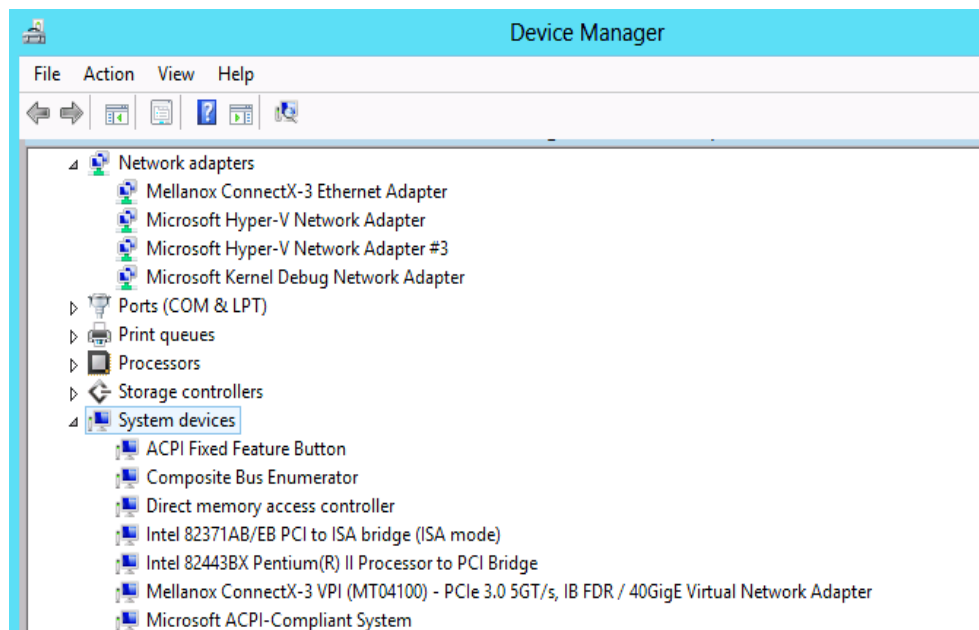
**Step 8.** Enable the SR-IOV for Mellanox VMNIC.

1. Open VM settings Wizard.
2. Right-click the Network Adapter and choose Hardware Acceleration Settings.

**Figure 15: Enable SR-IOV on VMNIC**



- Step 9.** Verify that Mellanox Virtual Function appears in the device manager. Virtual Function is configured with DHCP IP address. It can also be assigned a static IP address.

**Figure 16: Virtual Function in the VM**

To achieve best performance on SR-IOV VF, please run the following powershell commands on the host:

For 10Gbe:

```
Set-VMNetworkAdapter -Name "Network Adapter" -VMName vm1 -IovQueuePairsRequested 4
```

For 40Gbe:

```
Set-VMNetworkAdapter -Name "Network Adapter" -VMName vm1 -IovQueuePairsRequested 8
```

## 8.11 Virtual Ethernet Adapter

The Virtual Ethernet Adapter (VEA) provides a mechanism enabling multiple ethernet adapters on the same physical port. Each of these multiple adapters is referred to as a virtual ethernet adapter (VEA).

At present, one can have a total of two VEAs per port. The first VEA, normally the only adapter for the physical port, is referred to as a “physical VEA.” The second VEA, if present, is called a “virtual VEA”. currently only a single "Virtual VEA" is supported. The difference between a virtual and a physical VEA is that RDMA is only available through the physical VEA. In addition, certain settings for the port can only be configured on the physical VEA (see [Figure 8.11.2 on page 73](#)).

The user can manage VEAs using the "vea\_man" tool. vea\_man set of commands allows you to add or remove a VEA, or query the existing Mellanox ethernet adapters and see which are virtual and which are physical.

### 8.11.1 System Requirements

- Operating System: Windows 2012 and Windows 2012 R2



- Firmware version: 2.31.5050

### 8.11.2 VEA Feature Limitations

- RoCE (RDMA) is supported only on the physical VEA
- MTU (\*JumboFrame registry key), QoS and, Flow Control are only configured from physical VEA
- No bandwidth allocation between the two interfaces
- Both interfaces share the same link speed
- SR-IOV and VEA are not supported simultaneously. Only one of the features can be used at any given time.

### 8.11.3 Adding a New Virtual Adapter

- *To add a new virtual adapter, run the following command:*

```
vea_man -a <adapter name>
```



<adapter name> is the name of the existing physical adapter which will be, essentially, cloned. The new adapter will be named by system default rules.

### 8.11.4 Removing a Virtual Ethernet Adapter

- *To remove a virtual ethernet adapter, run the following command:*

```
vea_man -r <adapter name>
```

### 8.11.5 Querying the Virtual Ethernet Database

Querying the virtual ethernet database reports all physical and virtual ethernet adapters on all Mellanox cards in the system.

- *To query the virtual ethernet database, run the following command:*

```
vea_man -q  
vea_man
```

### 8.11.6 Help Message

- *To view the help message, run the following command:*

```
vea_man -?  
vea_man -h
```



If your adapter name has spaces in it, you need to surround it with quotes.

Examples:

```
vea_man -a "Ethernet 9" - Adds a new adapter as a virtual duplicate of Ethernet 9  
vea_man -r "Ethernet 13" - Removes virtual ethernet adapter Ethernet 13
```

## 8.12 IPoIB SR-IOV over KVM

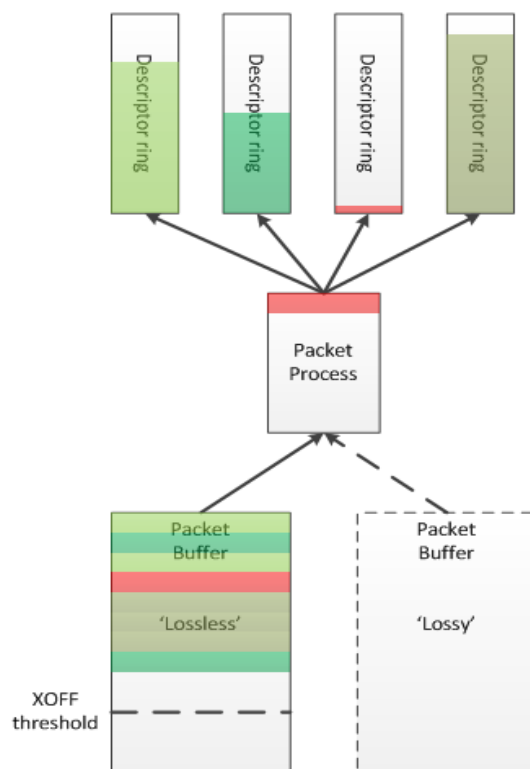
This feature is in Beta quality. For more details on how to configure IPoIB SR-IOV over KVM, please contact Mellanox support.

## 8.13 Lossless TCP

### 8.13.1 Introduction

Inbound packets are stored in the data buffers. They are split into 'Lossy' and 'Lossless' according to the priority field in the 802.1Q VLAN tag. In DSCP based PFC, all traffic is directed to the 'Lossless' buffer. Packets are taken out of the packet buffer in the same order they were stored, and moved into processing, where a destination descriptor ring is selected. The packet is then scattered into the appropriate memory buffer, pointed by the first free descriptor.

**Figure 17: Lossless TCP**



When the 'Lossless' packet buffer crosses the XOFF threshold, the adapter sends 802.3x pause frames according to the port configuration: Global pause, or per-priority 802.1Qbb pause (PFC), where only the priorities configured as 'Lossless' will be noted in the pause frame. Packets arriving while the buffer is full are dropped immediately.

During packet processing, if the selected descriptor ring has no free descriptors, two modes for handling are available:

### 8.13.2 Drop Mode

In this mode, a packet arriving to a descriptor ring with no free descriptors is dropped, after verifying that there are really no free descriptors. This allows isolation of the host driver execution delays from the network, as well as isolation between different SW entities sharing the adapter (e.g. SR-IOV VMs).

### 8.13.3 Poll Mode

In this mode, a packet arriving to a descriptor ring with no free descriptors will patiently wait until a free descriptor is posted. All processing for this packet and the following packets is halted, while free descriptor status is polled. This behavior will propagate the backpressure into the Rx buffer which will accumulate incoming packets. When XOFF threshold is crossed, Flow Control mechanisms mentioned earlier will stop the remote transmitters, thus avoiding packets from being dropped.

Since this mode breaks the aforementioned isolation, the adapter offers a mitigation mechanism that limits the amount of time a packet may wait for a free descriptor, while halting all packet processing. When the allowed time expires the adapter reverts to the 'Drop Mode' behavior.

### 8.13.4 Default behavior

By default the adapter works in 'Drop Mode'. The adapter reverts to this mode upon initialization/restart.

### 8.13.5 Known Limitations

- The feature is not available for SR-IOV Virtual Functions
- It is recommended that the feature be used only when the port is configured to maintain flow control.
- It is recommended not to exceed typical timeout values of management protocols, usually in the order of several seconds.
- In order for the feature to effectively prevent packet drops, the DPC load duration needs to be lower than the TCP retransmission timeout.
- The feature is only activated if neither of the ports is IB.

### 8.13.6 System Requirements

- Operating System: Windows 2012 or Windows 2012 R2
- Firmware: 2.31.5050

### 8.13.7 Enabling/Disabling Lossless TCP

This feature is controlled using the registry key `DelayDropTimeout` that enables Lossless TCP capability in hardware and by Set OID `OID_MLX_DROPLESS_MODE` which triggers transition to/from Lossless (poll) mode.

### 8.13.7.1 Enabling Lossless TCP Using The Registry Key `DelayDropTimeout`:

Registry Key location:

```
HKLM\SYSTEM\CurrentControlSet\Control\Class\Class\{4d36e972-
e325-11ce-bfc1-08002be10318}\<nn>\DelayDropTimeout
```

For instructions on how to find interface index in registry <nn>, Please refer to C.2 “Finding the Index Value of the Network Interface,” on page 175

| Key Name          | Key Type | Values                                                                                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------|----------|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DelayDropTime-out | REG_SZ   | <ul style="list-style-type: none"> <li>0= disabled (default)</li> <li>1-65535=enabled</li> </ul> | <p>Choosing values between 1-65534 enables the feature, but the chosen value limits the amount of time a packet may wait for a free descriptor. The value is in units of 100 microseconds with inaccuracy of up to 2 units. The chosen time ranges between 100 microseconds and ~6.5 seconds. For example, DelayDropTimeout=3000 limits the wait time to 300 milliseconds (+/- 200 microseconds)</p> <p>Choosing the value of 65535 enables the feature but the amount of time a packet may wait for a free descriptor is infinite.</p> <p><b>Note:</b> Changing the value of the DelayDropTimeout registry key requires restart of the network interface</p> |

### 8.13.7.2 Entering/Exiting Lossless Mode Using Set OID `OID_MLX_DROPLESS_MODE`:

In order to enter poll mode, registry value of DelayDropTimeout should be non-zero and `OID_MLX_DROPLESS_MODE` Set OID should be called with Information Buffer containing 1.

- `OID_MLX_DROPLESS_MODE` value: 0xFFA0C932
- `OID` Information Buffer Size: 1 byte
- `OID` Information Buffer Contents: 0 - exit poll mode; 1 - enter poll mode

### 8.13.8 Monitoring Lossless TCP State

In order to allow state transition monitoring, events are written to event log with `mlx4_bus` as the source. The associated events are listed in Table 9.

**Table 9 - Lossless TCP Associated Events**

| Event ID             | Event Description                                                                       |
|----------------------|-----------------------------------------------------------------------------------------|
| 0x0057 <Device Name> | Dropless mode entered on port <X>. Packets will not be dropped.                         |
| 0x0058 <Device Name> | Dropless mode exited on port <X>. Drop mode entered; packets may now be dropped.        |
| 0x0059 <Device Name> | Delay drop timeout occurred on port <X>. Drop mode entered; packets may now be dropped. |

## 9 Booting Windows from an iSCSI Target

### 9.1 Configuring the WDS, DHCP and iSCSI Servers

#### 9.1.1 Configuring the WDS Server

➤ *To configure the WDS server:*

1. Install the WDS server.
2. Extract the Mellanox drivers to a local directory using the '-a' parameter.

For boot over Ethernet, when using adapter cards with older firmware version than 2.30.8000, you need to extract the PXE package, otherwise use Mellanox WinOF VPI package.

Example:

```
Mellanox.msi.exe -a
```

3. Add the Mellanox driver to boot.wim<sup>1</sup>.

```
dism /Mount-Wim /WimFile:boot.wim /index:2 /MountDir:mnt
dism /Image:mnt /Add-Driver /Driver:drivers /recurse
dism /Unmount-Wim /MountDir:mnt /commit
```

4. Add the Mellanox driver to install.wim<sup>2</sup>.

```
dism /Mount-Wim /WimFile:install.wim /index:4 /MountDir:mnt
dism /Image:mnt /Add-Driver /Driver:drivers /recurse
dism /Unmount-Wim /MountDir:mnt /commit
```

5. Add the new boot and install images to WDS.

For additional details on WDS, please refer to:

<http://technet.microsoft.com/en-us/library/jj648426.aspx>

#### 9.1.2 Configuring iSCSI Target

➤ *To configure iSCSI Target:*

1. Install iSCSI Target (e.g StartWind).
2. Add to the iSCSI target initiators the IP addresses of the iSCSI clients.

#### 9.1.3 Configuring the DHCP Server

➤ *To configure the DHCP server:*

1. Install a DHCP server.
2. Add to IPv4 a new scope.
3. Add iSCSI boot client identifier (MAC/GUID) to the DHCP reservation.

---

1. Use 'index:2' for Windows setup and 'index:1' for WinPE.  
 2. When adding the Mellanox driver to install.wim, verify you are using the appropriate index for your OS flavor. To check the OS run 'imagex /info install.win'.

4. Add to the reserved IP address the following options:

**Table 10 - Reserved IP Address Options**

| Option | Name                  | Value                                                                                                                                                   |
|--------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| 017    | Root Path             | <b>iscsi:11.4.12.65:::iqn:2011-01:iscsiboot</b><br>Assuming the iSCSI target IP is: <b>11.4.12.65</b> and the Target Name: <b>iqn:2011-01:iscsiboot</b> |
| 060    | PXEClient             | PXEClient                                                                                                                                               |
| 066    | Boot Server Host Name | WDS server IP address                                                                                                                                   |
| 067    | Boot File Name        | boot\x86\wdsnbp.com                                                                                                                                     |

## 9.2 Configuring the Client Machine

### ➤ *To configuring your client:*

1. Verify the Mellanox adapter card is burned with the correct Mellanox FlexBoot version.  
For boot over Ethernet, when using adapter cards with older firmware version than 2.30.8000, you need to burn the adapter card with Ethernet FlexBoot, otherwise use the VPI FlexBoot.
2. Verify the Mellanox adapter card is burned with the correct firmware version.
3. Set the “Mellanox Adapter Card” as the first boot device in the BIOS settings boot order.

## 9.3 Installing iSCSI

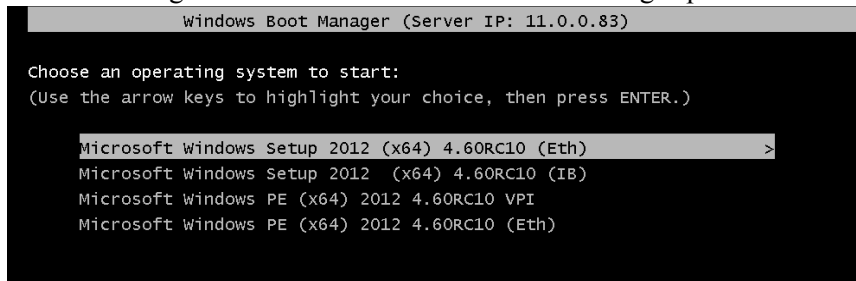
1. Reboot your iSCSI client.
2. Press F12 when asked to proceed to iSCSI boot.

```

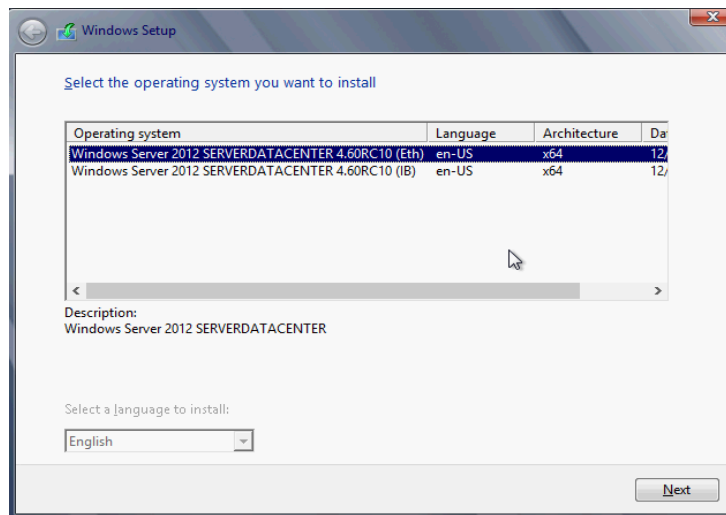
Virtual Media File View Macros Tools Power Chat Performance Help
[Link:down, TX:0 TXE:0 RX:0 RXE:0]
Waiting for link-up on net1... ok
DHCP (net1 00:c9:00:b5:92:22)... ok
net1: 11.0.0.21/255.255.0.0
net0: 11.0.0.20/255.255.0.0 (inaccessible)
Next server: 11.0.0.83
Filename: boot\x86\wdsnbp.com
Root path: iscsi:11.0.0.83:::iqn.1991-05.com.microsoft:l-winqa-083-l-winqa-083-
target
Registered SAN device 0x80
tftp://11.0.0.83/boot%5Cx86%5Cwdsnbp.com... ok
Downloaded WDSNBP from 11.0.0.83 11.0.0.83
WDSNBP started using DHCP Referral.
Contacting Server: 11.0.0.83 (Gateway: 0.0.0.0).
Architecture: x64
Contacting Server: 11.0.0.83.
TFTP Download: boot\x86\wdsnbp.com
Downloaded WDSNBP from 11.0.0.83 l-winqa-083
Press F12 for network service boot
Architecture: x64
Contacting Server: 11.0.0.83.
TFTP Download: boot\x64\pxeboot.n12
Current User(s): rcon: 10.0.72.43

```

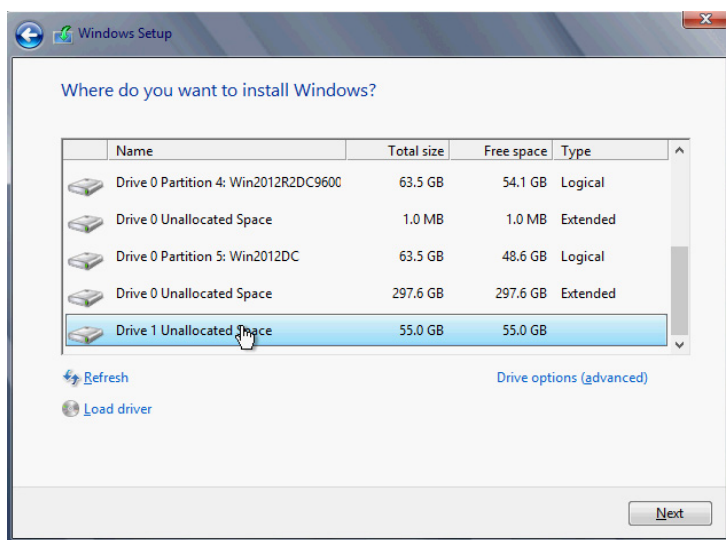
- Choose the relevant boot image from the list of all available boot images presented.



- Choose the Operating System you wish to install.



- Run the Windows Setup Wizard.
- Choose iSCSI target drive to install Windows and follow the instructions presented by the installation Wizard.



Installation process will start once completing all the required steps in the Wizard, the Client will reboot and will boot from the iSCSI target.

## 10 Deploying Windows Server 2012 and Above with SMB Direct

### 10.1 Overview

The Server Message Block (SMB) protocol is a network file sharing protocol implemented in Microsoft Windows. The set of message packets that defines a particular version of the protocol is called a dialect.

The Microsoft SMB protocol is a client-server implementation and consists of a set of data packets, each containing a request sent by the client or a response sent by the server.

SMB protocol is used on top of the TCP/IP protocol or other network protocols. Using the SMB protocol allows applications to access files or other resources on a remote server, to read, create, and update them. In addition, it enables communication with any server program that is set up to receive an SMB client request.

### 10.2 Hardware and Software Prerequisites

The following are hardware and software prerequisites:

- Two or more machines running Windows Server 2012 and above
- One or more Mellanox ConnectX®-2, ConnectX®-3, or ConnectX®-3 Pro adapters for each server
- One or more Mellanox InfiniBand switches
- Two or more QSFP cables required for InfiniBand

### 10.3 SMB Configuration Verification

#### 10.3.1 Verifying Network Adapter Configuration

Use the following PowerShell cmdlets to verify Network Direct is globally enabled and that you have NICs with the RDMA capability.

- Run on both the SMB server and the SMB client.

```
Get-NetOffloadGlobalSetting | Select NetworkDirect
Get-NetAdapterRDMA
Get-NetAdapterHardwareInfo
```

#### 10.3.2 Verifying SMB Configuration

Use the following PowerShell cmdlets to verify SMB Multichannel is enabled, confirm the adapters are recognized by SMB and that their RDMA capability is properly identified.

- On the SMB client, run the following PowerShell cmdlets:

```
Get-SmbClientConfiguration | Select EnableMultichannel
Get-SmbClientNetworkInterface
```

- On the SMB server, run the following PowerShell cmdlets<sup>1</sup>:

```
Get-SmbServerConfiguration | Select EnableMultichannel
```



```
Get-SmbServerNetworkInterface  
netstat.exe -xan | ? {$_ -match "445"}
```

- 
1. The NETSTAT command confirms if the File Server is listening on the RDMA interfaces.

### 10.3.3 Verifying SMB Connection

➤ *To verify the SMB connection on the SMB client:*

- Step 1.** Copy the large file to create a new session with the SMB Server.
- Step 2.** Open a PowerShell window while the copy is ongoing.
- Step 3.** Verify the SMB Direct is working properly and that the correct SMB dialect is used.

```
Get-SmbConnection
Get-SmbMultichannelConnection
netstat.exe -xan | ? {$_ -match "445"}
```



If you have no activity while you run the commands above, you might get an empty list due to session expiration and no current connections.

### 10.4 Verifying SMB Events that Confirm RDMA Connection

➤ *To confirm RDMA connection, verify the SMB events:*

- Step 1.** Open a PowerShell window on the SMB client.
- Step 2.** Run the following cmdlets.  
NOTE: Any RDMA-related connection errors will be displayed as well.

```
Get-WinEvent -LogName Microsoft-Windows-SMBClient/Operational | ? Message -match "RDMA"
```

# 11 Performance Tuning

This section describes how to modify Windows registry parameters in order to improve performance.



Please note that modifying the registry incorrectly might lead to serious problems, including the loss of data, system hang, and you may need to reinstall Windows. As such it is recommended to back up the registry on your system before implementing recommendations included in this section. If the modifications you apply lead to serious problems, you will be able to restore the original registry state. For more details about backing up and restoring the registry, please visit [www.microsoft.com](http://www.microsoft.com).

## 11.1 General Performance Optimization and Tuning

To achieve the best performance for Windows, you may need to modify some of the Windows registries.

### 11.1.1 Registry Tuning

The registry entries that may be added/changed by this “General Tuning” procedure are:

Under HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters:

- Disable TCP selective acks option for better cpu utilization:

```
SackOpts, type REG_DWORD, value set to 0.
```

Under HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services\AFD\Parameters:

- Enable fast datagram sending for UDP traffic:

```
FastSendDatagramThreshold, type REG_DWORD, value set to 64K.
```

Under HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services\Ndis\Parameters:

- Set RSS parameters:

```
RssBaseCpu, type REG_DWORD, value set to 1.
```

### 11.1.2 Enable RSS

Enabling Receive Side Scaling (RSS) is performed by means of the following command:

```
"netsh int tcp set global rss = enabled"
```

### 11.1.3 Tuning the IPoIB Network Adapter

The IPoIB Network Adapter tuning can be performed either during installation by modifying some of Windows registries as explained in [Section 11.1.1, “Registry Tuning”, on page 83](#). or can be set post-installation manually.

➤ *To improve the network adapter performance, activate the performance tuning tool as follows:*

- Step 1.** Start the "Device Manager" (open a command line window and enter: devmgmt.msc).
- Step 2.** Open "Network Adapters".
- Step 3.** Select Mellanox IPoIB adapter, right click and select Properties.
- Step 4.** Select the “Performance tab”.
- Step 5.** Choose one of the tuning scenarios:

- Single port traffic - Improves performance for running single port traffic each time.
- Dual port traffic - Improves performance for running traffic on both ports simultaneously.
- Forwarding traffic - Improves performance for running scenarios that involve both ports (for example: via IXIA)
- Multicast traffic - Improves performance when the main traffic runs on multicast.

**Step 6.** Click on “Run Tuning” button.

Clicking the “Run Tuning” button changes several registry entries (described below), and checks for system services that may decrease network performance. It also generates a log including the applied changes.

Users can view this log to restore the previous values. The log path is:

```
%HOMEDRIVE%\Windows\System32\LogFiles\PerformanceTunning.log
```

This tuning is required to be performed only once after the installation is completed, and on one adapter only (as long as these entries are not changed directly in the registry, or by some other installation or script).



A reboot may be required for the changes to take effect.

#### 11.1.4 Tuning the Ethernet Network Adapter

The Ethernet Network Adapter general tuning can be performed during installation by modifying some of Windows registries as explained in section "Registry Tuning" on page 32. Specific scenarios tuning can be set post-installation manually.

➤ ***To improve the network adapter performance, activate the performance tuning tool as follows:***

**Step 1.** Start the "Device Manager" (open a command line window and enter: devmgmt.msc).

**Step 2.** Open "Network Adapters".

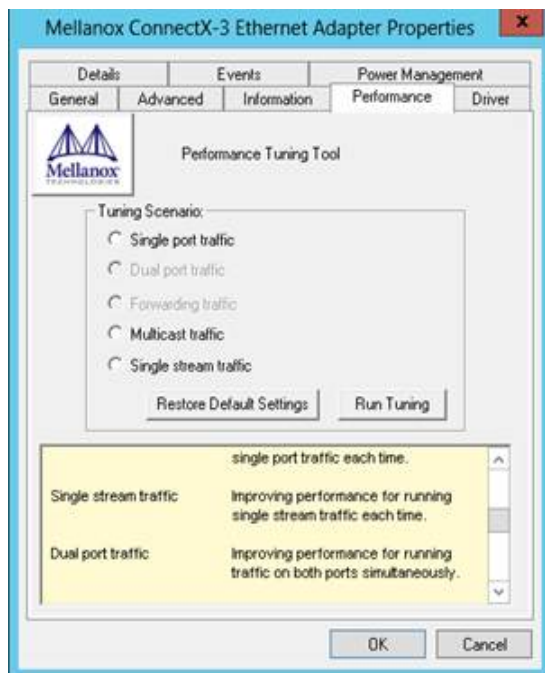
**Step 3.** Select Mellanox Ethernet adapter, right click and select Properties.

**Step 4.** Select the "Performance tab".

**Step 5.** Choose one of the tuning scenarios:

- Single port traffic - Improves performance for running single port traffic each time.
- Single stream traffic - Optimizes tuning for applications with single connection.
- Dual port traffic - Improves performance for running traffic on both ports simultaneously.
- Forwarding traffic - Improves performance for running scenarios that involve both ports (for example: via IXIA)
- Multicast traffic - Improves performance when the main traffic runs on multicast.

7. Click on “Run Tuning” button.



Clicking the "Run Tuning" button activates the general tuning as explained above and changes several driver registry entries for the current adapter and its sibling device once the sibling is an Ethernet device as well. It also generates a log including the applied changes.

Users can view this log to restore the previous values. The log path is:

```
%HOMEDRIVE%\Windows\System32\LogFiles\PerformanceTunning.log
```

This tuning is required to be performed only once after the installation is completed, and on one adapter only (as long as these entries are not changed directly in the registry, or by some other installation or script).



Please note that a reboot may be required for the changes to take effect.

#### 11.1.4.1 Performance Tuning Tool Application

You can also activate the performance tuning through a script called `perf_tuning.exe`. This script has 4 options, which include the 3 scenarios described above and an additional manual tuning through which you can set the RSS base and number of processors for each Ethernet adapter. The adapters you wish to tune are supplied to the script by their name according to the “Network Connections”.

## Synopsis

```
perf_tuning.exe -s -c1 <first connection name> [-c2 <second connection name>]
perf_tuning.exe -d -c1 <first connection name> -c2 <second connection name>
perf_tuning.exe -f -c1 <first connection name> -c2 <second connection name>
perf_tuning.exe -m -c1 <first connection name> -b <base RSS processor number> -n
<number of RSS processors>
perf_tuning -st -c1 <first connection name> [-c2 <second connection name>]
```

## Options

| Flag | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -s   | <p>Single port traffic scenario.</p> <p>This option can be followed by one or two connection names. The tuning will restore the default settings on the second connection and performed on the first connection.</p> <p>This option automatically sets:</p> <ul style="list-style-type: none"> <li>• SendCompletionMethod = 0</li> <li>• RecvCompletionMethod = 2</li> <li>• *ReceiveBuffers = 1024</li> <li>• In Operating Systems support NDIS6.3:<br/>RssProfile = 4</li> </ul> <p>Additionally, this option chooses the best processors to assign to:</p> <ul style="list-style-type: none"> <li>• DefaultRecvRingProcessor</li> <li>• TxInterruptProcessor</li> <li>• TxForwardingProcessor</li> <li>• In Operating Systems support NDIS6.2:<br/>RssBaseProcNumber<br/>MaxRssProcessors</li> <li>• In Operating Systems support NDIS6.3:<br/>NumRSSQueues<br/>RssMaxProcNumber</li> </ul> |
| -d   | <p>Dual port traffic scenario.</p> <p>This option must be followed by two connection names. The tuning in this case is code-dependent.</p> <p>This option automatically sets:</p> <ul style="list-style-type: none"> <li>• SendCompletionMethod = 0</li> <li>• RecvCompletionMethod = 2</li> <li>• *ReceiveBuffers = 1024</li> <li>• In Operating Systems support NDIS6.3:<br/>RssProfile = 4</li> </ul> <p>Additionally, this option chooses the best processors to assign to:</p> <ul style="list-style-type: none"> <li>• DefaultRecvRingProcessor</li> <li>• TxForwardingProcessor</li> <li>• In Operating Systems support NDIS6.2:<br/>RssBaseProcNumber<br/>MaxRssProcessors</li> <li>• In Operating Systems support NDIS6.3:<br/>NumRSSQueues<br/>RssMaxProcNumber</li> </ul>                                                                                                           |

| Flag | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -f   | <p>Forwarding traffic scenario.<br/>This option must be followed by two connection names. The tuning in this case is code-dependent.</p> <p>This option automatically sets:</p> <ul style="list-style-type: none"> <li>• SendCompletionMethod = 1</li> <li>• RecvCompletionMethod = 0</li> <li>• *ReceiveBuffers = 4096</li> <li>• UseRSSForRawIP = 0</li> <li>• UseRSSForUDP = 0</li> </ul> <p>Additionally, this option chooses the best processors to assign to:</p> <ul style="list-style-type: none"> <li>• DefaultRecvRingProcessor</li> <li>• TxInterruptProcessor</li> <li>• TxForwardingProcessor</li> <li>• In Operating Systems support NDIS6.2:<br/>RssBaseProcNumber<br/>MaxRssProcessors</li> <li>• In Operating Systems support NDIS6.3:<br/>NumRSSQueues<br/>RssMaxProcNumber</li> </ul> |
| -m   | <p>Manual configuration<br/>This option must be followed by one connection name.<br/>This option assigns the provided base and number of CPUs to:</p> <ul style="list-style-type: none"> <li>• *RssBaseProcNumber</li> <li>• *MaxRssProcessors</li> </ul> <p>Additionally, this option assigns the following with processors inside the range:</p> <ul style="list-style-type: none"> <li>• DefaultRecvRingProcessor</li> <li>• TxInterruptProcessor</li> </ul>                                                                                                                                                                                                                                                                                                                                          |
| -r   | <p>Restore default settings.<br/>This option can be followed by one or two connection names.<br/>This option automatically sets the driver registry values back to their default values:</p> <ul style="list-style-type: none"> <li>• SendCompletionMethod = 0 - IPoIB; 1 - ETH</li> <li>• RecvCompletionMethod = 2</li> <li>• *ReceiveBuffers = 1024</li> <li>• UseRSSForRawIP = 1</li> <li>• DefaultRecvRingProcessor = -1</li> <li>• TxInterruptProcessor = -1</li> <li>• TxForwardingProcessor = -1</li> <li>• UseRSSForUDP = 1</li> <li>• In Operating Systems support NDIS6.2:<br/>MaxRssProcessors = 8</li> <li>• In Operating Systems support NDIS6.3:<br/>NumRSSQueues = 8</li> </ul>                                                                                                           |
| -c1  | Specifies first connection name. See examples                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| -c2  | Specifies second connection name. See examples                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| -b   | Specifies base RSS processor number. See examples.<br>Used for manual option (-m) only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| -n   | Specifies number of RSS processors. See examples.<br>Used for manual option (-m) only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Flag | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -st  | <p>Single stream traffic scenario.<br/>This option must be followed by one or two connection names for an Ethernet adapter. The tuning will restore the default settings on the second connection and performed on the first connection.</p> <p>This option automatically sets:</p> <ul style="list-style-type: none"> <li>• SendCompletionMethod = 0</li> <li>• RecvCompletionMethod = 2</li> <li>• *ReceiveBuffers = 1024</li> <li>• In Operating Systems support NDIS6.3:<br/>RssProfile = 4</li> </ul> <ul style="list-style-type: none"> <li>• Additionally, this option chooses the best processors to assign to:</li> <li>• DefaultRecvRingProcessor</li> <li>• TxInterruptProcessor</li> <li>• TxForwardingProcessor</li> <li>• In Operating Systems support NDIS6.2:<br/>RssBaseProcNumber<br/>MaxRssProcessors</li> <li>• In Operating Systems support NDIS6.3:<br/>NumRSSQueues<br/>RssMaxProcNumber</li> </ul> |

## Examples

For example, if the adapter is represented by "Local Area Connection 6" and "Local Area Connection 7"

```

For single port stream tuning type:
perf_tuning.exe -s -c1 "Local Area Connection 6" -c2 "Local Area Connection 7"
or to set one adapter only:
perf_tuning.exe -s -c1 "Local Area Connection 6"

For single stream tuning type:
perf_tuning.exe -st -c1 "Local Area Connection 6" -c2 "Local Area Connection 7"
or to set one adapter only:
perf_tuning.exe -st -c1 "Local Area Connection 6"

For dual port streams tuning type:
perf_tuning.exe -d -c1 "Local Area Connection 6" -c2 "Local Area Connection 7"

For forwarding streams tuning type:
perf_tuning.exe -f -c1 "Local Area Connection 6" -c2 "Local Area Connection 7"

For manual tuning of the first adapter to use RSS on CPUs 0-3:
perf_tuning.exe -m -c1 "Local Area Connection 6" -b 0 -n 4

In order to restore defaults type:
perf_tuning.exe -r -c1 "Local Area Connection 6" -c2 "Local Area Connection 7"

```



### 11.1.5 SR-IOV Tuning

To achieve best performance on SR-IOV VF, please run the following powershell commands on the host:

```
Set-VMNetworkAdapter -Name "Network Adapter" -VMName vm1 -IovQueuePairsRequested 4
OR
Set-VMNetworkAdapter -Name "Network Adapter" -VMName vm1 -IovQueuePairsRequested 8
for 40GbE
```

### 11.1.6 Improving Live Migration

In order to improve live migration over SMB direct performance, please set the following registry key to 0 and reboot the machine:

```
HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\LanmanServer\Parameters\RequireSecuritySignature
```

For further details, please refer to:

<http://blogs.technet.com/b/josebda/archive/2010/12/01/the-basics-of-smb-signing-covering-both-smb1-and-smb2.aspx>

## 11.2 Application Specific Optimization and Tuning

### 11.2.1 Ethernet Performance Tuning

The user can configure the Ethernet adapter by setting some registry keys. The registry keys may affect Ethernet performance.

➤ *To improve performance, activate the performance tuning tool as follows:*

- Step 1. Start the "Device Manager" (open a command line window and enter: devmgmt.msc).
- Step 2. Open "Network Adapters".
- Step 3. Right click the relevant Ethernet adapter and select Properties.
- Step 4. Select the "Advanced" tab
- Step 5. Modify performance parameters (properties) as desired.

#### 11.2.1.1 Performance Known Issues

- On Intel I/OAT supported systems, it is highly recommended to install and enable the latest I/OAT driver (download from [www.intel.com](http://www.intel.com)).
- With I/OAT enabled, sending 256-byte messages or larger will activate I/OAT. This will cause a significant latency increase due to I/OAT algorithms. On the other hand, throughput will increase significantly when using I/OAT.

### 11.2.2 IPoIB Performance Tuning

The user can configure the IPoIB adapter by setting some registry keys. The registry keys may affect IPoIB performance.

For the complete list of registry entries that may be added/changed by the performance tuning procedure, see MLNX\_VPI\_WinOF Registry Keys following the path below:

[http://www.mellanox.com/page/products\\_dyn?product\\_family=32&mtag=windows\\_sw\\_drivers](http://www.mellanox.com/page/products_dyn?product_family=32&mtag=windows_sw_drivers)

➤ **To improve performance, activate the performance tuning tool as follows:**

- Step 1.** Start the "Device Manager" (open a command line window and enter: devmgmt.msc).
- Step 2.** Open "Network Adapters".
- Step 3.** Right click the relevant IPoIB adapter and select Properties.
- Step 4.** Select the "Advanced" tab
- Step 5.** Modify performance parameters (properties) as desired.

## 11.3 Tunable Performance Parameters

The following is a list of key parameters for performance tuning.

- **Jumbo Packet**

The maximum available size of the transfer unit, also known as the Maximum Transmission Unit (MTU). For IPoIB, the MTU should not include the size of the IPoIB header (=4B). For example, if the network adapter card supports a 4K MTU, the upper threshold for payload MTU is 4092B and not 4096B. The MTU of a network can have a substantial impact on performance. A 4K MTU size improves performance for short messages, since it allows the OS to coalesce many small messages into a large one.

- Valid MTU values range for an Ethernet driver is between 614 and 9614.
- Valid MTU values range for an IPoIB driver is between 1500 and 4092.



All devices on the same physical network, or on the same logical network, must have the same MTU.

- **Receive Buffers**

The number of receive buffers (default 1024).

- **Send Buffers**

The number of sent buffers (default 2048).

- **Performance Options**

Configures parameters that can improve adapter performance.

- **Interrupt Moderation**

Moderates or delays the interrupts' generation. Hence, optimizes network throughput and CPU utilization (default Enabled).

- When the interrupt moderation is enabled, the system accumulates interrupts and sends a single interrupt rather than a series of interrupts. An interrupt is generated after receiving 5 packets or after 10ms from the first packet received. It improves performance and reduces CPU load however, it increases latency.
- When the interrupt moderation is disabled, the system generates an interrupt each time a packet is received or sent. In this mode, the CPU utilization data rates increase, as the system handles a larger number of interrupts. However, the latency decreases as the packet is handled faster.
- **Receive Side Scaling (RSS Mode)**

Improves incoming packet processing performance. RSS enables the adapter port to utilize the multiple CPUs in a multi-core system for receiving incoming packets and steering them to the des-

ignated destination. RSS can significantly improve the number of transactions, the number of connections per second, and the network throughput.

This parameter can be set to one of the following values:

- Enabled (default): Set RSS Mode
- Disabled: The hardware is configured once to use the Toeplitz hash function, and the indirection table is never changed.



IOAT is not used while in RSS mode.

- **Receive Completion Method**  
Sets the completion methods of the received packets, and can affect network throughput and CPU utilization.
- **Polling Method**  
Increases the CPU utilization as the system polls the received rings for the incoming packets. However, it may increase the network performance as the incoming packet is handled faster.
- **Interrupt Method**  
Optimizes the CPU as it uses interrupts for handling incoming messages. However, in certain scenarios it can decrease the network throughput.
- **Adaptive (Default Settings)**  
A combination of the interrupt and polling methods dynamically, depending on traffic type and network usage. Choosing a different setting may improve network and/or system performance in certain configurations.
- **Interrupt Moderation RX Packet Count**  
Number of packets that need to be received before an interrupt is generated on the receive side (default 5).
- **Interrupt Moderation RX Packet Time**  
Maximum elapsed time (in usec) between the receiving of a packet and the generation of an interrupt, even if the moderation count has not been reached (default 10).
- **Rx Interrupt Moderation Type**  
Sets the rate at which the controller moderates or delays the generation of interrupts making it possible to optimize network throughput and CPU utilization. The default setting (Adaptive) adjusts the interrupt rates dynamically depending on the traffic type and network usage. Choosing a different setting may improve network and system performance in certain configurations.
- **Send completion method**  
Sets the completion methods of the Send packets and it may affect network throughput and CPU utilization.
- **Interrupt Moderation TX Packet Count**  
Number of packets that need to be sent before an interrupt is generated on the send side (default 0).
- **Interrupt Moderation TX Packet Time**  
Maximum elapsed time (in usec) between the sending of a packet and the generation of an interrupt even if the moderation count has not been reached (default 0).

- **Offload Options**

Allows you to specify which TCP/IP offload settings are handled by the adapter rather than the operating system.

Enabling offloading services increases transmission performance as the offload tasks are performed by the adapter hardware rather than the operating system. Thus, freeing CPU resources to work on other tasks.

- IPv4 Checksums Offload

Enables the adapter to compute IPv4 checksum upon transmit and/or receive instead of the CPU (default Enabled).

- TCP/UDP Checksum Offload for IPv4 packets

Enables the adapter to compute TCP/UDP checksum over IPv4 packets upon transmit and/or receive instead of the CPU (default Enabled).

- TCP/UDP Checksum Offload for IPv6 packets

Enables the adapter to compute TCP/UDP checksum over IPv6 packets upon transmit and/or receive instead of the CPU (default Enabled).

- Large Send Offload (LSO)

Allows the TCP stack to build a TCP message up to 64KB long and sends it in one call down the stack. The adapter then re-segments the message into multiple TCP packets for transmission on the wire with each pack sized according to the MTU. This option offloads a large amount of kernel processing time from the host CPU to the adapter.

- **IB Options**

Configures parameters related to InfiniBand functionality.

- SA Query Retry Count

Sets the number of SA query retries once a query fails. The valid values are 1 - 64 (default 10).

- SA Query Timeout

Sets the waiting timeout (in millisecond) of an SA query completion. The valid values are 500 - 60000 (default 1000 ms).

## 11.4 Adapter Proprietary Performance Counters

Proprietary Performance Counters are used to provide information on Operating System, application, service or the drivers' performance. Counters can be used for different system debugging purposes, help to determine system bottlenecks and fine-tune system and application performance. The Operating System, network, and devices provide counter data that the application can consume to provide users with a graphical view of the system's performance quality. WinOF counters hold the standard Windows CounterSet API that includes:

- Network Interface
- RDMA activity
- SMB Direct Connection

## 11.4.1 Supported Standard Performance Counters

### 11.4.1.1 Proprietary Mellanox Adapter Traffic Counters

Proprietary Mellanox adapter traffic counter set consists of global traffic statistics which gather information from ConnectX®-3 and ConnectX®-3 Pro network adapters, and includes traffic statistics, and various types of error and indications from both the Physical Function and Virtual Function.

**Table 11 - Mellanox Adapter Traffic Counters**

| Mellanox Adapter Traffic Counters          | Description                                                                                                            |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| <b>Bytes IN</b>                            |                                                                                                                        |
| Bytes Received                             | Shows the number of bytes received by the adapter. The counted bytes include framing characters.                       |
| Bytes Received/Sec                         | Shows the rate at which bytes are received by the adapter. The counted bytes include framing characters.               |
| Packets Received                           | Shows the number of packets received by ConnectX-3 and ConnectX-3Pro network interface.                                |
| Packets Received/Sec                       | Shows the rate at which packets are received by ConnectX-3 and ConnectX-3Pro network interface.                        |
| <b>Bytes/ Packets OUT</b>                  |                                                                                                                        |
| Bytes Sent                                 | Shows the number of bytes sent by the adapter. The counted bytes include framing characters.                           |
| Bytes Sent/Sec                             | Shows the rate at which bytes are sent by the adapter. The counted bytes include framing characters.                   |
| Packets Sent                               | Shows the number of packets sent by ConnectX-3 and ConnectX-3Pro network interface.                                    |
| Packets Sent/Sec                           | Shows the rate at which packets are sent by ConnectX-3 and ConnectX-3Pro network interface.                            |
| <b>Bytes' TOTAL</b>                        |                                                                                                                        |
| Bytes Total                                | Shows the total of bytes handled by the adapter. The counted bytes include framing characters.                         |
| Bytes Total/Sec                            | Shows the total rate of bytes that are sent and received by the adapter. The counted bytes include framing characters. |
| Packets Total                              | Shows the total of packets handled by ConnectX-3 and ConnectX-3Pro network interface.                                  |
| Packets Total/Sec                          | Shows the rate at which packets are sent and received by ConnectX-3 and ConnectX-3Pro network interface.               |
| Control Packets                            | The total number of successfully received control frames                                                               |
| <b>ERRORS, DROP, AND MISC. INDICATIONS</b> |                                                                                                                        |

**Table 11 - Mellanox Adapter Traffic Counters**

| Mellanox Adapter Traffic Counters        | Description                                                                                                                                                                                                                                                    |
|------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Packets Outbound Errors                  | Shows the number of outbound packets that could not be transmitted because of errors.                                                                                                                                                                          |
| Packets Outbound Discarded               | Shows the number of outbound packets to be discarded even though no errors had been detected to prevent transmission. One possible reason for discarding packets could be to free up buffer space.                                                             |
| Packets Received Errors                  | Shows the total number of inbound packets that contained errors preventing them from being deliverable to a higher-layer protocol.                                                                                                                             |
| Packets Received with Frame Length Error | Shows the number of inbound packets that contained error where the frame has length error. Packets received with frame length error are a subset of packets received errors.                                                                                   |
| Packets Received with Symbol Error       | Shows the number of inbound packets that contained symbol error or an invalid block. Packets received with symbol error are a subset of packets received errors.                                                                                               |
| Packets Received with Bad CRC Error      | Shows the number of inbound packets that failed the CRC check. Packets received with bad CRC error are a subset of packets received errors.                                                                                                                    |
| Packets Received Discarded               | Shows the number of inbound packets that were chosen to be discarded even though no errors had been detected to prevent their being deliverable to a higher-layer protocol. One possible reason for discarding such a packet could be to free up buffer space. |

#### 11.4.1.2 Proprietary Mellanox Adapter Diagnostics Counters

Proprietary Mellanox adapter diagnostics counter set consists of the NIC diagnostics. These counters collect information from ConnectX®-3 and ConnectX®-3 Pro firmware flows.

**Table 12 - Mellanox Adapter Diagnostics Counters**

| Mellanox Adapter Diagnostics Counters | Description                                                                            |
|---------------------------------------|----------------------------------------------------------------------------------------|
| Requester length errors               | Number of local length errors when the local machine generates outbound traffic.       |
| Responder length errors               | Number of local length errors when the local machine receives inbound traffic.         |
| Requester QP operation errors         | Number of local QP operation errors when the local machine generates outbound traffic. |
| Responder QP operation errors         | Number of local QP operation errors when the local machine receives inbound traffic.   |
| Requester protection errors           | Number of local protection errors when the local machine generates outbound traffic.   |
| Responder protection errors           | Number of local protection errors when the local machine receives inbound traffic.     |

**Table 12 - Mellanox Adapter Diagnostics Counters**

| Mellanox Adapter Diagnostics Counters       | Description                                                                                                                                                                                                   |
|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Requester CQE errors                        | Number of local CQE with errors when the local machine generates out-bound traffic.                                                                                                                           |
| Responder CQE errors                        | Number of local CQE with errors when the local machine receives inbound traffic.                                                                                                                              |
| Requester Invalid request errors            | Number of remote invalid request errors when the local machine generates outbound traffic, i.e. NAK was received indicating that the other end detected invalid OpCode request.                               |
| Responder Invalid request errors            | Number of remote invalid request errors when the local machine receives inbound traffic.                                                                                                                      |
| Requester Remote access errors              | Number of remote access errors when the local machine generates out-bound traffic, i.e. NAK was received indicating that the other end detected wrong rkey.                                                   |
| Responder Remote access errors              | Number of remote access errors when the local machine receives inbound traffic, i.e. the local machine received RDMA request with wrong rkey.                                                                 |
| Requester RNR NAK                           | Number of RNR (Receiver Not Ready) NAKs received when the local machine generates outbound traffic.                                                                                                           |
| Responder RNR NAK                           | Number of RNR (Receiver Not Ready) NAKs sent when the local machine receives inbound traffic.                                                                                                                 |
| Requester out of order sequence NAK         | Number of Out of Sequence NAK received when the local machine generates outbound traffic, i.e. the number of times the local machine received NAKs indicating OOS on the receiving side.                      |
| Responder out of order sequence received    | Number of Out of Sequence packet received when the local machine receives inbound traffic, i.e. the number of times the local machine received messages that are not consecutive.                             |
| Requester resync                            | Number of resync operations when the local machine generates outbound traffic.                                                                                                                                |
| Responder resync                            | Number of resync operations when the local machine receives inbound traffic.                                                                                                                                  |
|                                             |                                                                                                                                                                                                               |
| Requester Remote operation errors           | Number of remote operation errors when the local machine generates out-bound traffic, i.e. NAK was received indicating that the other end encountered an error that prevented it from completing the request. |
| Requester transport retries exceeded errors | Number of transport retries exceeded errors when the local machine generates outbound traffic.                                                                                                                |
| Requester RNR NAK retries exceeded errors   | Number of RNR (Receiver Not Ready) NAKs retries exceeded errors when the local machine generates outbound traffic.                                                                                            |
| Bad multicast received                      | Number of bad multicast packet received.                                                                                                                                                                      |

**Table 12 - Mellanox Adapter Diagnostics Counters**

| Mellanox Adapter Diagnostics Counters                                   | Description                                                                                                                                                                                       |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Discarded UD packets                                                    | Number of UD packets silently discarded on the receive queue due to lack of receives descriptor.                                                                                                  |
| Discarded UC packets                                                    | Number of UC packets silently discarded on the receive queue due to lack of receives descriptor.                                                                                                  |
| CQ overflows                                                            | Number of CQ overflows.<br><b>NOTE:</b> this value is evaluated for the entire NIC since there are cases where CQ might be associated with both ports (i.e. the value on all ports is identical). |
| EQ overflows                                                            | Number of EQ overflows.<br><b>NOTE:</b> this value is evaluated for the entire NIC since there are cases where EQ might be associated with both ports (i.e. the value on all ports is identical). |
| Bad doorbells                                                           | Number of bad DoorBells                                                                                                                                                                           |
| Responder duplicate request received (pending firmware implementation). | Number of duplicate requests received when the local machine receives inbound traffic.                                                                                                            |
| Requester time out received (pending firmware implementation).          | Number of time out received when the local machine generates outbound traffic.                                                                                                                    |

#### 11.4.1.3 Proprietary Mellanox QoS Counters

Proprietary Mellanox QoS counter set consists of flow statistics per (VLAN) priority. Each QoS policy is associated with a priority. The counter presents the priority's traffic, pause statistic.

**Table 13 - Mellanox QoS Counters**

| Mellanox QoS Counters     | Description                                                                                                                      |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------|
| <b>Bytes/ Packets IN</b>  |                                                                                                                                  |
| Bytes Received            | The number of bytes received that are covered by this priority. The counted bytes include framing characters (modulo $2^{64}$ ). |
| Bytes Received/Sec        | The number of bytes received per second that are covered by this priority. The counted bytes include framing characters.         |
| Packets Received          | The number of packets received that are covered by this priority (modulo $2^{64}$ ).                                             |
| Packets Received/Sec      | The number of packets received per second that are covered by this priority.                                                     |
| <b>Bytes/ Packets OUT</b> |                                                                                                                                  |
| Bytes Sent                | The number of bytes sent that are covered by this priority. The counted bytes include framing characters (modulo $2^{64}$ ).     |



**Table 13 - Mellanox QoS Counters**

| Mellanox QoS Counters           | Description                                                                                                                          |
|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Bytes Sent/Sec                  | The number of bytes sent per second that are covered by this priority. The counted bytes include framing characters.                 |
| Packets Sent                    | The number of packets sent that are covered by this priority (modulo 2 <sup>64</sup> ).                                              |
| Packets Sent/Sec                | The number of packets sent per second that are covered by this priority.                                                             |
| <b>Bytes and Packets' TOTAL</b> |                                                                                                                                      |
| Bytes Total                     | The total number of bytes that are covered by this priority. The counted bytes include framing characters (modulo 2 <sup>64</sup> ). |
| Bytes Total/Sec                 | The total number of bytes per second that are covered by this priority. The counted bytes include framing characters.                |
| Packets Total                   | The total number of packets that are covered by this priority (modulo 2 <sup>64</sup> ).                                             |
| Packets Total/Sec               | The total number of packets per second that are covered by this priority.                                                            |
| <b>PAUSE INDICATION</b>         |                                                                                                                                      |
| Per prio sent pause frames      | The number of pause frames that were sent to priority i. The untagged instance indicates global pause that were sent.                |
| Per prio sent pause duration    | The total duration in microseconds of pause that was sent to the other end to freeze the transmission on priority i.                 |
| Per prio rcv pause frames       | The number of pause frames that were received for priority i. The untagged instance indicates global pause that were received        |
| Per prio rcv pause duration     | The total duration in microseconds of pause that was requested by the other end to freeze transmission on priority i.                |

## 12 OpenSM - Subnet Manager

OpenSM v3.3.11 is an InfiniBand Subnet Manager. In order to operate one host machine or more in the InfiniBand cluster, at least one Subnet Manager is required in the fabric.



Please use the embedded OpenSM in the WinOF package for testing purpose in small cluster. Otherwise, we recommend using OpenSM from FabricIT EFM™ or UFM® or MLNX-OS®.

OpenSM can run as a Windows service and can be started manually from the following directory: <installation\_directory>\tools. OpenSM as a service will use the first active port, unless it receives a specific GUID.

OpenSM can be registered as a service from either the Command Line Interface (CLI) or the PowerShell.

The following are commands used from the CLI:

➤ **To register it as a service execute the OpenSM service:**

```
sc create OpenSM binPath= "c:\Program Files\Mellanox\MLNX_VPI\IB\Tools\opensm.exe
-service" start= auto
```

➤ **To start OpenSM as a service:**

```
sc start OpenSM
```

➤ **To run OpenSM manually:**

```
opensm.exe
```

For additional run options, enter: "opensm.exe -h"

The following are commands used from the PowerShell:

➤ **To register it as a service execute the OpenSM service:**

```
New-Service -Name "OpenSM" -BinaryPathName "`C:\Program Files\Mella-
nox\MLNX_VPI\IB\Tools\opensm.exe`" --service -L 128" -DisplayName "OpenSM" -
Description "OpenSM for IB subnet" -StartupType Automatic
```

➤ **To start OpenSM as a service run:**

```
Start-Service OpenSM1
```

### Notes

- For long term running, please avoid using the '-v' (verbosity) option to avoid exceeding disk quota.
- Running OpenSM on multiple servers may lead to incorrect OpenSM behavior. Please do not run more than two instances of OpenSM in the subnet.

## 13 Software Development Kit (SDK)

Software Development Kit (SDK) a set of development tools that allows the creation of Infini-Band applications for MLNX\_VPI software package.

The SDK package contains, header files, libraries, and code examples.

To compile the examples provided with the SDK you must install Windows Driver Kit (WDK) version 8.1 and higher over Visual Studio 2013

To open the SDK package you must run the sdk.exe file and get the complete list of files. SDK package can be found under <installation\_directory>\IB\SDK



It is highly recommended to program the applications over the ND API and not over the IBAL API.

## 14 InfiniBand Fabric Utilities

### 14.1 Network Direct Interface

The Network Direct Interface (NDI) architecture provides application developers with a networking interface that enables zero-copy data transfers between applications, kernel-bypass I/O generation and completion processing, and one-sided data transfer operations.

NDI is supported by Microsoft and is the recommended method to write InfiniBand application. NDI exposes the advanced capabilities of the Mellanox networking devices and allows applications to leverage advances of InfiniBand.

For further information please refer to:

[http://msdn.microsoft.com/en-us/library/cc904397\(v=vs.85\).aspx](http://msdn.microsoft.com/en-us/library/cc904397(v=vs.85).aspx)

### 14.2 part\_man - Virtual IPoIB Port Creation Utility

part\_man is used to add/remove virtual IPoIB ports. Currently, each Mellanox IPoIB port can have a single virtual IPoIB only which is created with a default PKey value of 0xffff.

#### ➤ Usage

```
part_man.exe [-v] <show|add|rem> ["Local area connection #"] [name]
```

- -v: increases verbosity level.
- Show: shows the currently configured virtual ipoib ports.
- Add: adds new virtual IPoIB port. Where add should be used with interface name, as it appears in Network connection in the control panel.
- Name: any printable name without quotations marks (“ ”), commas, and starting with i.
- Rem: removes existing virtual IPoIB port. Therefore, it requires running it with Show, then copy the parameters.

#### ➤ Example

Adding and removing virtual port:

```
part_man add "Ethernet 4" ipoib_4_1
Done...
Part_man show
Ethernet 6                ipoib_4_1
part_man rem "Ethernet 6" ipoib_4_1
Done
```

### 14.3 InfiniBand Fabric Diagnostic Utilities

The diagnostic utilities described in this chapter provide means for debugging the connectivity and status of InfiniBand (IB) devices in a fabric.

#### 14.3.1 Utilities Usage

This section first describes common configuration, interface, and addressing for all the tools in the package. Then it provides detailed descriptions of the tools themselves including: operation, synopsis and options descriptions, error codes, and examples.

### 14.3.1.1 Common Configuration, Interface and Addressing

#### Topology File (Optional)

An InfiniBand fabric is composed of switches and channel adapter (HCA/TCA) devices. To identify devices in a fabric (or even in one switch system), each device is given a GUID (a MAC equivalent). Since a GUID is a non-user-friendly string of characters, it is better to alias it to a meaningful, user-given name. For this objective, the IB Diagnostic Tools can be provided with a “topology file”, which is an optional configuration file specifying the IB fabric topology in user-given names.

For diagnostic tools to fully support the topology file, the user may need to provide the local system name (if the local hostname is not used in the topology file).

To specify a topology file to a diagnostic tool use one of the following two options:

1. On the command line, specify the file name using the option ‘-t <topology file name>’
2. Define the environment variable `IBDIAG_TOPO_FILE`

To specify the local system name to a diagnostic tool, use one of the following two options:

1. On the command line, specify the system name using the option ‘-s <local system name>’
2. Define the environment variable `IBDIAG_SYS_NAME`

### 14.3.1.2 IB Interface Definition

The diagnostic tools installed on a machine connect to the IB fabric by means of an HCA port through which they send MADs. To specify this port to an IB diagnostic tool use one of the following options:

1. On the command line, specify the port number using the option ‘-p <local port number>’ (see below)
2. Define the environment variable `IBDIAG_PORT_NUM`

In case more than one HCA device is installed on the local machine, it is necessary to specify the device’s index to the tool as well. For this use one of the following options:

1. On the command line, specify the index of the local device using the following option: ‘-i <index of local device>’
2. Define the environment variable `IBDIAG_DEV_IDX`

### 14.3.1.3 Addressing



This section applies to the `ibdiagpath` tool only. A tool command may require defining the destination device or port to which it applies.

The following addressing modes can be used to define the IB ports:

- Using a Directed Route to the destination: (Tool option ‘-d’)
 

This option defines a directed route of output port numbers from the local port to the destination.
- Using port LIDs: (Tool option ‘-l’):

In this mode, the source and destination ports are defined by means of their LIDs. If the fabric is configured to allow multiple LIDs per port, then using any of them is valid for defining a port.

- Using port names defined in the topology file: (Tool option '-n')

This option refers to the source and destination ports by the names defined in the topology file. (Therefore, this option is relevant only if a topology file is specified to the tool.) In this mode, the tool uses the names to extract the port LIDs from the matched topology, then the tool operates as in the '-l' option.

## 14.3.2 ibdiagnet

```
ibdiagnet [-c <count>] [-v] [-r] [-o <out-dir>]
          [-t <topo-file>] [-s <sys-name>] [-i <dev-index>] [-p <port-num>]
          [-pm] [-pc] [-P <<PM counter>=<Trash Limit>>]
          [-lw <1x|4x|12x>] [-ls <2.5|5|10>]
          [-skip <dup_guids|zero_guids|pm|logical_state>]
```

### 14.3.2.1 ibdiagnet Options

**Table 14 - ibdiagnet Options**

| Flag                   | Description                                                                                                                                   |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|
| -c <count>             | Min number of packets to be sent across each link (default = 10)                                                                              |
| -v                     | Enable verbose mode                                                                                                                           |
| -r                     | Provides a report of the fabric qualities                                                                                                     |
| -o <out-dir>           | Specifies the directory where the output files will be placed (default = /tmp)                                                                |
| -t <topo-file>         | Specifies the topology file name                                                                                                              |
| -s <sys-name>          | Specifies the local system name. Meaningful only if a topology file is specified                                                              |
| -i <dev-index>         | Specifies the index of the device of the port used to connect to the IB fabric (in case of multiple devices on the local system)              |
| -p <port-num>          | Specifies the local device's port num used to connect to the IB fabric                                                                        |
| -pm                    | Dump all the fabric links, pm Counters into ibdiagnet.pm                                                                                      |
| -pc                    | Reset all the fabric links pmCounters                                                                                                         |
| -P <PM=<Trash>>        | If any of the provided pm is greater than its provided value, print it to screen                                                              |
| -lw <1x 4x 12x>        | Specifies the expected link width                                                                                                             |
| -ls <2.5 5 10>         | Specifies the expected link speed                                                                                                             |
| -skip <skip-option(s)> | Skip the executions of the selected checks. Skip options (one or more can be specified): dup_guids zero_guids pm logical_state part ipoib all |

### 14.3.2.2 ibdiagnet Output Files

**Table 15 - ibdiagnet Output Files**

| Output File      | Description                                                                                             |
|------------------|---------------------------------------------------------------------------------------------------------|
| ibdiagnet.log    | A dump of all the application reports generate according to the provided flags                          |
| ibdiagnet.lst    | List of all the nodes, ports and links in the fabric                                                    |
| ibdiagnet.fdb    | A dump of the unicast forwarding tables of the fabric switches                                          |
| ibdiag-net.mcfdb | A dump of the multicast forwarding tables of the fabric switches                                        |
| ibdiag-net.masks | In case of duplicate port/node GUIDs, these file include the map between masked Guid and real GUIDs     |
| ibdiagnet.sm     | List of all the SM (state and priority) in the fabric                                                   |
| ibdiagnet.pm     | A dump of the pm Counters values, of the fabric links                                                   |
| ibdiagnet.pkey   | A dump of the existing partitions and their member host ports                                           |
| ibdiagnet.mcg    | A dump of the multicast groups, their properties and member host ports                                  |
| ibdiagnet.db     | A dump of the internal subnet database. This file can be loaded in later runs using the -load_db option |

In addition to generating the files above, the discovery phase also checks for duplicate node/port GUIDs in the IB fabric. If such an error is detected, it is displayed on the standard output. After the discovery phase is completed, directed route packets are sent multiple times (according to the -c option) to detect possible problematic paths on which packets may be lost. Such paths are explored, and a report of the suspected bad links is displayed on the standard output.

After scanning the fabric, if the -r option is provided, a full report of the fabric qualities is displayed. This report includes:

- SM report
- Number of nodes and systems
- Hop-count information: maximal hop-count, an example path, and a hop-count histogram
- All CA-to-CA paths traced
- Credit loop report
- mgid-mlid-HCAs multicast group and report
- Partitions report
- IPoIB report



In case the IB fabric includes only one CA, then CA-to-CA paths are not reported. Furthermore, if a topology file is provided, ibdiagnet uses the names defined in it for the output reports.

### 14.3.2.3 ibdiagnet Error Codes

```

1 - Failed to fully discover the fabric
2 - Failed to parse command line options
3 - Failed to interact with IB fabric
4 - Failed to use local device or local port
5 - Failed to use Topology File
6 - Failed to load required Package

```

### 14.3.3 ibportstate

Enables querying the logical (link) and physical port states of an InfiniBand port. It also allows adjusting the link speed that is enabled on any InfiniBand port.

If the queried port is a *switch* port, then `ibportstate` can be used to

- Disable, enable or reset the port
- Validate the port's link width and speed against the peer port

#### 14.3.3.1 ibportstate Applicable Hardware

All InfiniBand devices.

#### 14.3.3.2 ibportstate Synopsis

```

ibportstate [-d] [-e] [-v] [-V] [-D] [-L] [-G] [-s <smid>] \          [-C
<ca_name>] [-P <ca_port>] [-u] [-t <timeout_ms>]          \          [<dest
dr_path|lid|guid>] <portnum> [<op> [<value>]]

```

#### 14.3.3.3 ibportstate Options

The table below lists the various flags of the command.

**Table 16 - *ibportstate* Flags and Options**

| Flag         | Description                                                                                                                                                        |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -h/--help    | Print the help menu                                                                                                                                                |
| -d/--debug   | Raise the IB debug level. May be used several times for higher debug levels (-ddd or -d -d -d)                                                                     |
| -e/--errors  | Show send and receive errors (timeouts and others)                                                                                                                 |
| -v/--verbose | Increase verbosity level. May be used several times for additional verbosity (-vvv or -v -v -v)                                                                    |
| -V/--version | Show version info                                                                                                                                                  |
| -D/--Direct  | Use directed path address arguments. The path is a comma separated list of out ports.<br>Examples:<br>'0' – self port<br>'0,1,2,1,4' – out via port 1, then 2, ... |
| -L/--Lid     | Use Lid address argument                                                                                                                                           |



**Table 16 - ibportstate Flags and Options (Continued)**

| Flag                        | Description                                                                            |
|-----------------------------|----------------------------------------------------------------------------------------|
| -G/--Guid                   | Use GUID address argument. In most cases, it is the Port GUID. Example: '0x08f1040023' |
| -s/--sm_port                | Use <smlid> as the target lid for SM/SA queries                                        |
| -C/--Ca                     | Use the specified channel adapter or router                                            |
| -P/--Port                   | Use the specified port                                                                 |
| -u/--usage                  | Usage message                                                                          |
| -t/--timeout                | Override the default timeout for the solicited MADs [msec]                             |
| <dest dr_path   lid   guid> | Destination's directed path, LID, or GUID.                                             |
| <portnum>                   | Destination's port number                                                              |
| <op> [<value>]              | Define the allowed port operations: enable, disable, reset, speed, and query           |

In case of multiple channel adapters (CAs) or multiple ports without a CA/port being specified, a port is chosen by the utility according to the following criteria:

1. The first ACTIVE port that is found.
2. If not found, the first port that is UP (physical link state is LinkUp).

#### Examples

1. Query the status of Port 1 of CA mlx4\_0 (using ibstatus) and use its output (the LID – 3 in this case) to obtain additional link information using ibportstate.

```
> ibstat
CA type: MT4099
Number of ports: 2
Firmware version: 2.11.536
Hardware version: 0
Node GUID: 0x0002c903002e6670
System image GUID: 0x0002c903002e6673
Port 1:
Physical state: Disabled
Rate: 10
Base lid: 4
LMC: 0
SM lid: 2
Capability mask: 0x0251486a
Port GUID: 0x0002c903002e6671
Link layer: InfiniBand

> ibportstate -C mlx4_0 4 1 query
PortInfo:
# Port info: Lid 3 port 1
LinkState:.....Initialize
PhysLinkState:.....LinkUp
LinkWidthSupported:.....1X or 4X
```

```

LinkWidthEnabled:.....1X or 4X
LinkWidthActive:.....4X
LinkSpeedSupported:.....2.5 Gbps or 5.0 Gbps
LinkSpeedEnabled:.....2.5 Gbps or 5.0 Gbps
LinkSpeedActive:.....5.0 Gbps

```

## 2. Query the status of two channel adapters using directed paths.

```

> ibportstate -C mlx4_0 -D 0 1
PortInfo:
# Port info: DR path slid 65535; dlid 65535; 0 port 1
LinkState:.....Initialize
PhysLinkState:.....LinkUp
LinkWidthSupported:.....1X or 4X
LinkWidthEnabled:.....1X or 4X
LinkWidthActive:.....4X
LinkSpeedSupported:.....2.5 Gbps or 5.0 Gbps
LinkSpeedEnabled:.....2.5 Gbps or 5.0 Gbps
LinkSpeedActive:.....5.0 Gbps

> ibportstate -C mthca0 -D 0 1
PortInfo:
# Port info: DR path slid 65535; dlid 65535; 0 port 1
LinkState:.....Down
PhysLinkState:.....Polling
LinkWidthSupported:.....1X or 4X
LinkWidthEnabled:.....1X or 4X
LinkWidthActive:.....4X
LinkSpeedSupported:.....2.5 Gbps
LinkSpeedEnabled:.....2.5 Gbps
LinkSpeedActive:.....2.5 Gbps

```

## 3. Change the speed of a port.

```

# First query for current configuration
> ibportstate -C mlx4_0 -D 0 1
PortInfo:
# Port info: DR path slid 65535; dlid 65535; 0 port 1
LinkState:.....Initialize
PhysLinkState:.....LinkUp
LinkWidthSupported:.....1X or 4X
LinkWidthEnabled:.....1X or 4X
LinkWidthActive:.....4X
LinkSpeedSupported:.....2.5 Gbps or 5.0 Gbps
LinkSpeedEnabled:.....2.5 Gbps or 5.0 Gbps
LinkSpeedActive:.....5.0 Gbps

# Now change the enabled link speed
> ibportstate -C mlx4_0 -D 0 1 speed 2
ibportstate -C mlx4_0 -D 0 1 speed 2
Initial PortInfo:
# Port info: DR path slid 65535; dlid 65535; 0 port 1

```

```

LinkSpeedEnabled:.....2.5 Gbps

After PortInfo set:
# Port info: DR path slid 65535; dlid 65535; 0 port 1
LinkSpeedEnabled:.....5.0 Gbps (IBA extension)

# Show the new configuration
> ibportstate -C mlx4_0 -D 0 1
PortInfo:
# Port info: DR path slid 65535; dlid 65535; 0 port 1
LinkState:.....Initialize
PhysLinkState:.....LinkUp
LinkWidthSupported:.....1X or 4X
LinkWidthEnabled:.....1X or 4X
LinkWidthActive:.....4X
LinkSpeedSupported:.....2.5 Gbps or 5.0 Gbps
LinkSpeedEnabled:.....5.0 Gbps (IBA extension)
LinkSpeedActive:.....5.0 Gbps

```

### 14.3.4 ibroute

Uses SMPs to display the forwarding tables for unicast (LinearForwardingTable or LFT) or multicast (MulticastForwardingTable or MFT) for the specified switch LID and the optional lid (mlid) range. The default range is all valid entries in the range of 1 to FDBTop.

#### 14.3.4.1 ibroute Applicable Hardware

InfiniBand switches.

#### 14.3.4.2 ibroute Synopsis

```

ibroute [-h] [-d] [-v] [-V] [-a] [-n] [-D] [-G] [-M] [-L] [-e] [-u] [-s <smid>] \
[-C <ca_name>] [-P <ca_port>] [-t <timeout_ms>] \      [<dest_dr_path|lid|guid>
[<startlid> [<endlid>]]]

```

#### 14.3.4.3 ibroute Options

The table below lists the various ibroute flags of the command.

**Table 17 - ibroute Flags and Options**

| Flag         | Description                                                                                     |
|--------------|-------------------------------------------------------------------------------------------------|
| -h/--help    | Print the help menu                                                                             |
| -d/--debug   | Raise the IB debug level. May be used several times for higher debug levels (-ddd or -d -d -d)  |
| -a/--all     | Show all LIDs in range, including invalid entries                                               |
| -v/--verbose | Increase verbosity level. May be used several times for additional verbosity (-vvv or -v -v -v) |
| -V/--version | Show version info                                                                               |

**Table 17 - ibroute Flags and Options**

| Flag                        | Description                                                                                                                                                        |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -n/--no_dests               | Do not try to resolve destinations                                                                                                                                 |
| -D/--Direct                 | Use directed path address arguments. The path is a comma separated list of out ports.<br>Examples:<br>'0' – self port<br>'0,1,2,1,4' – out via port 1, then 2, ... |
| -G/--Guid                   | Use GUID address argument. In most cases, it is the Port GUID. Example:<br>'0x08f1040023'                                                                          |
| -M/--Multicast              | Show multicast forwarding tables. The parameters <startlid> and <endlid> specify the MLID range.                                                                   |
| -L/--Lid                    | Use Lid address argument                                                                                                                                           |
| -u/--usage                  | Usage message                                                                                                                                                      |
| -e/--errors                 | Show send and receive errors (timeouts and others)                                                                                                                 |
| -s/--sm_port <smlid>        | Use <smlid> as the target LID for SM/SA queries                                                                                                                    |
| -C/--Ca <ca_name>           | Use the specified channel adapter or router                                                                                                                        |
| -P/--Port <ca_port>         | Use the specified port                                                                                                                                             |
| -t/--timeout<timeout_ms>    | Override the default timeout for the solicited MADs [msec]                                                                                                         |
| <dest dr_path   lid   guid> | Destination's directed path, LID, or GUID                                                                                                                          |
| <startlid>                  | Starting LID in an MLID range                                                                                                                                      |
| <endlid>                    | Ending LID in an MLID range                                                                                                                                        |

**Examples**

1. Dump all Lids with valid out ports of the switch with Lid 2.

```
> ibroute 2
Unicast lids [0x0-0x8] of switch Lid 2 guid 0x0002c902fffff00a (MT47396 Infiniscale-III Mellanox Technologies):
  Lid  Out  Destination
  Port  Info
0x0002 000 : (Switch portguid 0x0002c902fffff00a: 'MT47396 Infiniscale-III Mellanox Technologies')
0x0003 021 : (Switch portguid 0x000b8cffff004016: 'MT47396 Infiniscale-III Mellanox Technologies')
0x0006 007 : (Channel Adapter portguid 0x0002c90300001039: 'sw137 HCA-1')
0x0007 021 : (Channel Adapter portguid 0x0002c9020025874a: 'sw157 HCA-1')
0x0008 008 : (Channel Adapter portguid 0x0002c902002582cd: 'sw136 HCA-1')
5 valid lids dumped
```

2. Dump all Lids in the range 3 to 7 with valid out ports of the switch with Lid 2.

```
> ibroute 2 3 7
```

```
Unicast lids [0x3-0x7] of switch Lid 2 guid 0x0002c902ffff00a (MT47396 Infiniscale-III Mellanox Technologies):
  Lid  Out  Destination
      Port   Info
0x0003 021 : (Switch portguid 0x000b8cffff004016: 'MT47396 Infiniscale-III Mellanox Technologies')
0x0006 007 : (Channel Adapter portguid 0x0002c90300001039: 'sw137 HCA-1')
0x0007 021 : (Channel Adapter portguid 0x0002c9020025874a: 'sw157 HCA-1')
3 valid lids dumped
```

### 3. Dump all Lids with valid out ports of the switch with portguid 0x000b8cffff004016.

```
> ibroute -G 0x000b8cffff004016
Unicast lids [0x0-0x8] of switch Lid 3 guid 0x000b8cffff004016 (MT47396 Infiniscale-III Mellanox Technologies):
  Lid  Out  Destination
      Port   Info
0x0002 023 : (Switch portguid 0x0002c902ffff00a: 'MT47396 Infiniscale-III Mellanox Technologies')
0x0003 000 : (Switch portguid 0x000b8cffff004016: 'MT47396 Infiniscale-III Mellanox Technologies')
0x0006 023 : (Channel Adapter portguid 0x0002c90300001039: 'sw137 HCA-1')
0x0007 020 : (Channel Adapter portguid 0x0002c9020025874a: 'sw157 HCA-1')
0x0008 024 : (Channel Adapter portguid 0x0002c902002582cd: 'sw136 HCA-1')
5 valid lids dumped
```

### 4. Dump all non-empty mlids of switch with Lid 3.

```
> ibroute -M 3
Multicast mlids [0xc000-0xc3ff] of switch Lid 3 guid 0x000b8cffff004016 (MT47396 Infiniscale-III Mellanox Technologies):
      0          1          2
Ports: 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4
MLid
0xc000                                x
0xc001                                x
0xc002                                x
0xc003                                x
0xc020                                x
0xc021                                x
0xc022                                x
0xc023                                x
0xc024                                x
0xc040                                x
0xc041                                x
0xc042                                x
12 valid mlids dumped
```

## 14.3.5 ibdump

The ibdump tool dumps InfiniBand, Ethernet and all RoCE versions' traffic that flows to and from Mellanox ConnectX®-3/ConnectX®-3 Pro NIC's ports. It provides a similar functionality to the tcpdump tool on a 'standard' Ethernet port. The ibdump tool generates packet dump file in

.pcap format. This file can be loaded by the Wireshark tool ([www.wireshark.org](http://www.wireshark.org)) for graphical traffic analysis.

This provides the ability to analyze network behavior and performance, and to debug applications that send or receive RDMA network traffic. Run "ibdump -h" to display a help message which details the tools options.

### 14.3.5.1 ibdump Synopsis

```
- ibdump
```

### 14.3.5.2 ibdump Options

The table below lists the various ibdump flags of the command.

**Table 18 - ibdump Flags and Options**

| Flag                         | Description                                                                                                                                                                                                                    |
|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -d, --ib-dev=<dev>           | Use RDMA device <dev> (default first device found)<br>The relevant devices can be listed by running the 'ibv_devinfo' command.                                                                                                 |
| -i, --ib-port=<port>         | Use port <port> of IB device (default 1)                                                                                                                                                                                       |
| -w, --write=<file>           | Dump file name (default "sniffer.pcap")<br>'-' stands for stdout - enables piping to tcpdump or tshark.                                                                                                                        |
| -o, --output=<file>          | Alias for the '-w' option. Do not use - for backward compatibility                                                                                                                                                             |
| -b, --max-burst=<log2 burst> | log2 of the maximal burst size that can be captured with no packets loss.<br>Each entry takes ~ MTU bytes of memory (default 12 - 4096 entries)                                                                                |
| -s, --silent                 | Do not print progress indication.                                                                                                                                                                                              |
| --mem-mode <size>            | When specified, packets are written to file only after the capture is stopped. It is faster than default mode (less chance for packet loss), but takes more memory. In this mode, ibdump stops after <size> bytes are captured |
| --decap                      | Decapsulate port mirroring headers. Should be used when capturing RSPAN traffic.                                                                                                                                               |
| -h, --help                   | Display this help screen.                                                                                                                                                                                                      |
| -v, --version                | Print version information.                                                                                                                                                                                                     |

### 14.3.6 smpquery

Provides a basic subset of standard SMP queries to query Subnet management attributes such as node info, node description, switch info, and port info.

#### 14.3.6.1 smpquery Applicable Hardware

All InfiniBand devices.

### 14.3.6.2 smpquery Synopsis

```
smpquery [-h] [-d] [-e] [-c] [-v] [-D] [-G] [-s <smlid>] [-L] [-u] [-V] [-C]
<ca_name>] [-P <ca_port>] [-t <timeout_ms>] [--node-name-map <node-name-map>]
<op> <dest dr_path|lid|guid> [op params]
```

### 14.3.6.3 smpquery Options

The table below lists the various flags of the command.

**Table 19 - smpquery Flags and Options**

| Flag                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -h/--help                 | Print the help menu                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| -d/--debug                | Raise the IB debug level. May be used several times for higher debug levels (-ddd or -d -d -d)                                                                                                                                                                                                                                                                                                                                                                            |
| -e/--errors               | Show send and receive errors (timeouts and others)                                                                                                                                                                                                                                                                                                                                                                                                                        |
| -v/--verbose              | Increase verbosity level. May be used several times for additional verbosity (-vvv or -v -v -v)                                                                                                                                                                                                                                                                                                                                                                           |
| -D/--Direct               | Use directed path address arguments. The path is a comma separated list of out ports.<br>Examples:<br>'0' – self port<br>'0,1,2,1,4' – out via port 1, then 2, ...                                                                                                                                                                                                                                                                                                        |
| -G/--Guid                 | Use GUID address argument. In most cases, it is the Port GUID.<br>Example:<br>'0x08f1040023'                                                                                                                                                                                                                                                                                                                                                                              |
| -s/--sm_port <smlid>      | Use <smlid> as the target LID for SM/SA queries                                                                                                                                                                                                                                                                                                                                                                                                                           |
| -V/--version              | Show version info                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| -L/--Lid                  | Use Lid address argument                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| -c/--combined             | Use combined route address argument                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| -u/--usage                | Usage message                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| -C/--Ca <ca_name>         | Use the specified channel adapter or router                                                                                                                                                                                                                                                                                                                                                                                                                               |
| -P/--Port <ca_port>       | Use the specified port                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| -t/--timeout <timeout_ms> | Override the default timeout for the solicited MADs [msec]                                                                                                                                                                                                                                                                                                                                                                                                                |
| <op>                      | Supported operations: <ul style="list-style-type: none"> <li>• NodeInfo (NI) &lt;addr&gt;</li> <li>• NodeDesc (ND) &lt;addr&gt;</li> <li>• PortInfo (PI) &lt;addr&gt; [&lt;portnum&gt;]</li> <li>• SwitchInfo (SI) &lt;addr&gt;</li> <li>• PKeyTable (PKeys) &lt;addr&gt; [&lt;portnum&gt;]</li> <li>• SL2VLTable (SL2VL) &lt;addr&gt; [&lt;portnum&gt;]</li> <li>• VLArbitration (VLArb) &lt;addr&gt; [&lt;portnum&gt;]</li> <li>• GUIDInfo (GI) &lt;addr&gt;</li> </ul> |

**Table 19 - smpquery Flags and Options**

| Flag                        | Description                               |
|-----------------------------|-------------------------------------------|
| <dest dr_path   lid   guid> | Destination's directed path, LID, or GUID |
| --node-name-map <file>      | Node name map file                        |
| -x/--extended               | Use extended speeds                       |

**Examples**

## 1. Query PortInfo by LID, with port modifier.

```

> smpquery portinfo 1 1
# Port info: Lid 1 port 1
Mkey:.....0x0000000000000000
GidPrefix:.....0xfe80000000000000
Lid:.....0x0001
SMLid:.....0x0001
CapMask:.....0x251086a
          IsSM
          IsTrapSupported
          IsAutomaticMigrationSupported
          IsSLMappingSupported
          IsSystemImageGUIDsupported
          IsCommunicationManagementSupported
          IsVendorClassSupported
          IsCapabilityMaskNoticeSupported
          IsClientRegistrationSupported
DiagCode:.....0x0000
MkeyLeasePeriod:.....0
LocalPort:.....1
LinkWidthEnabled:.....1X or 4X
LinkWidthSupported:.....1X or 4X
LinkWidthActive:.....4X
LinkSpeedSupported:.....2.5 Gbps or 5.0 Gbps
LinkState:.....Active
PhysLinkState:.....LinkUp
LinkDownDefState:.....Polling
ProtectBits:.....0
LMC:.....0
LinkSpeedActive:.....5.0 Gbps
LinkSpeedEnabled:.....2.5 Gbps or 5.0 Gbps
NeighborMTU:.....2048
SMSL:.....0
VLCap:.....VL0-7
InitType:.....0x00
VLHighLimit:.....4
VLArbHighCap:.....8
VLArbLowCap:.....8
InitReply:.....0x00

```



```

MtuCap:.....2048
VLStallCount:.....0
HoqLife:.....31
OperVLs:.....VL0-3
PartEnforceInb:.....0
PartEnforceOutb:.....0
FilterRawInb:.....0
FilterRawOutb:.....0
MkeyViolations:.....0
PkeyViolations:.....0
QkeyViolations:.....0
GuidCap:.....128
ClientReregister:.....0
SubnetTimeout:.....18
RespTimeVal:.....16
LocalPhysErr:.....8
OverrunErr:.....8
MaxCreditHint:.....0
RoundTrip:.....0

```

## 2. Query SwitchInfo by GUID.

```

> smpquery -G switchinfo 0x000b8cffff004016
# Switch info: Lid 3
LinearFdbCap:.....49152
RandomFdbCap:.....0
McastFdbCap:.....1024
LinearFdbTop:.....8
DefPort:.....0
DefMcastPrimPort:.....0
DefMcastNotPrimPort:.....0
LifeTime:.....18
StateChange:.....0
LidsPerPort:.....0
PartEnforceCap:.....32
InboundPartEnf:.....1
OutboundPartEnf:.....1
FilterRawInbound:.....1
FilterRawOutbound:.....1
EnhancedPort0:.....0

```

## 3. Query NodeInfo by direct route.

```

> smpquery -D nodeinfo 0
# Node info: DR path slid 65535; dlid 65535; 0
BaseVers:.....1
ClassVers:.....1
NodeType:.....Channel Adapter
NumPorts:.....2
SystemGuid:.....0x0002c9030000103b
Guid:.....0x0002c90300001038
PortGuid:.....0x0002c90300001039

```

```
PartCap:.....128
DevId:.....0x634a
Revision:.....0x00000a0
LocalPort:.....1
VendorId:.....0x0002c9
```

### 14.3.7 perfquery

Queries InfiniBand ports' performance and error counters. Optionally, it displays aggregated counters for all ports of a node. It can also reset counters after reading them or simply reset them.

#### 14.3.7.1 perfquery Applicable Hardware

All InfiniBand devices.

#### 14.3.7.2 perfquery Synopsis

```
perfquery [-h] [-d] [-G] [--xmtsl, -X] [--xmtdisc, -D] [--rcvsl, -S] [--rcverr, -E]
[--smplctl, -c] [-a] [--Lid, -L] [--sm_port, -s <lid>] [--errors, -e] [--verbose, -v]
[--usage, -u] [-l] [-r] [-C <ca_name>] [-P <ca_port>] [-R] [-t <timeout_ms>] [-V]
[<lid|guid> [[port][reset_mask]]]
```

The table below lists the various flags of the command.

**Table 20 - perfquery Flags and Options**

| Flag                | Description                                                                                    |
|---------------------|------------------------------------------------------------------------------------------------|
| --help, -h          | Print the help menu                                                                            |
| --debug, -d         | Raise the IB debug level. May be used several times for higher debug levels (-ddd or -d -d -d) |
| --Guid, -G          | Use GUID address argument. In most cases, it is the Port GUID.<br>Example:<br>'0x08f1040023'   |
| --xmtsl, -X         | Show Xmt SL port counters                                                                      |
| --rcvsl, -S         | Show Rev SL port counters                                                                      |
| --xmtdisc, -D       | Show Xmt Discard Details                                                                       |
| --rcverr, -E        | Show Rcv Error Details                                                                         |
| --smplctl, -c       | Show samples control                                                                           |
| --all_ports, -a     | Apply query to all ports                                                                       |
| --Lid, -L           | Use LID address argument                                                                       |
| --sm_port, -s <lid> | SM port lid                                                                                    |
| --errors, -e        | Show send and receive errors                                                                   |
| --verbose, -v       | Increase verbosity level                                                                       |
| --usage, -u         | Usage message                                                                                  |

**Table 20 - perfquery Flags and Options**

| Flag                                 | Description                                                |
|--------------------------------------|------------------------------------------------------------|
| --loop_ports, -l                     | Loop ports                                                 |
| --reset_after_read, -r               | Reset the counters after reading them                      |
| --Ca, -C <ca_name>                   | Use the specified channel adapter or router                |
| --Port, -P <ca_port>                 | Use the specified port                                     |
| --Reset_only, -R                     | Reset the counters                                         |
| --timeout, -t <timeout_ms>           | Override the default timeout for the solicited MADs [msec] |
| --version, -V                        | Show version info                                          |
| <lid   guid><br>[[port][reset_mask]] | LID or GUID                                                |
| --extended, -x                       | show extended port counters                                |
| --extended_speeds, -T                | show port extended speeds counters                         |
| --oprcvcounters                      | show Rcv Counters per Op code                              |
| --flowctlcounters                    | show flow control counters                                 |
| --vloppackets                        | show packets received per Op code per VL                   |
| --vlopdata                           | show data received per Op code per VL                      |
| --vlxmitflowctlerrors                | show flow control update errors per VL                     |
| --vlxmitcounters                     | show ticks waiting to transmit counters per VL             |
| --swportvlcong                       | show sw port VL congestion                                 |
| --rcvcc                              | show Rcv congestion control counters                       |
| --slrcvfecn                          | show SL Rcv FECN counters                                  |
| --slrcvbecn                          | show SL Rcv BECN counters                                  |
| --xmitcc                             | show Xmit congestion control counters                      |
| --vlxmittimecc                       | show VL Xmit Time congestion control counters              |

**Examples**

```

perfquery -r 32 1 # read performance counters and reset
perfquery -e -r 32 1# read extended performance counters and reset
perfquery -R 0x20 1 # reset performance counters of port 1 only
perfquery -e -R 0x20 1# reset extended performance counters of port 1 only
perfquery -R -a 32 # reset performance counters of all ports
perfquery -R 32 2 0x0fff# reset only error counters of port 2
perfquery -R 32 2 0xf000# reset only non-error counters of port 2

```

**1. Read local port's performance counters.**

```
> perfquery
```

```
# Port counters: Lid 6 port 1
PortSelect:.....1
CounterSelect:.....0x1000
SymbolErrors:.....0
LinkRecovers:.....0
LinkDowned:.....0
RcvErrors:.....0
RcvRemotePhysErrors:.....0
RcvSwRelayErrors:.....0
XmtDiscards:.....0
XmtConstraintErrors:.....0
RcvConstraintErrors:.....0
LinkIntegrityErrors:.....0
ExcBufOverrunErrors:.....0
VL15Dropped:.....0
XmtData:.....55178210
RcvData:.....55174680
XmtPkts:.....766366
RcvPkts:.....766315
```

## 2. Read performance counters from LID 2, all ports.

```
> smpquery -a 2
# Port counters: Lid 2 port 255
PortSelect:.....255
CounterSelect:.....0x0100
SymbolErrors:.....65535
LinkRecovers:.....255
LinkDowned:.....16
RcvErrors:.....657
RcvRemotePhysErrors:.....0
RcvSwRelayErrors:.....70
XmtDiscards:.....488
XmtConstraintErrors:.....0
RcvConstraintErrors:.....0
LinkIntegrityErrors:.....0
ExcBufOverrunErrors:.....0
VL15Dropped:.....0
XmtData:.....129840354
RcvData:.....129529906
XmtPkts:.....1803332
RcvPkts:.....1799018
```

## 3. Read then reset performance counters from LID 2, port 1.

```
> perfquery -r 2 1
# Port counters: Lid 2 port 1
PortSelect:.....1
CounterSelect:.....0x0100
SymbolErrors:.....0
LinkRecovers:.....0
LinkDowned:.....0
```

```

RcvErrors:.....0
RcvRemotePhysErrors:.....0
RcvSwRelayErrors:.....0
XmtDiscards:.....3
XmtConstraintErrors:.....0
RcvConstraintErrors:.....0
LinkIntegrityErrors:.....0
ExcBufOverrunErrors:.....0
VL15Dropped:.....0
XmtData:.....0
RcvData:.....0
XmtPkts:.....0
RcvPkts:.....0

```

### 14.3.8 ibping

ibping uses vendor MADs to validate connectivity between IB nodes. On exit, (IP) ping like output is shown. ibping is run as client/server, however the default is to run it as a client. Note also that in addition to ibping, a default server is implemented within the kernel.

#### 14.3.8.1 ibping Synopsis

```

ibping [-d(efug)] [-e(rr_show)] [-v(erbose)] [-G(uid)] [-C ca_name] [-P ca_port]
[-s smlid] [-t(imeout)timeout_ms] [-V(ersion)] [-L(id)][-u(sage)] [-c ping_count] [-f
flood)] [-o oui] [-S(erver)] [-h(elp)] <dest lid | guid>

```

#### 14.3.8.2 ibping Options

The table below lists the various flags of the command.

**Table 21 - ibping Flags and Options**

| Flag                        | Description                                                 |
|-----------------------------|-------------------------------------------------------------|
| --count, -c <num>           | Stops after count packets                                   |
| -f, (--flood)               | Floods destination: send packets back to back without delay |
| -o, (--oui)                 | Uses specified OUI number to multiplex vendor mads          |
| --Server, -S                | Starts in server mode (do not return)                       |
| --debug, -d/-ddd/ -d -d -d  | Raises the IB debugging level                               |
| --errors, -e                | Shows send and receive errors (timeouts and others)         |
| --help, -h                  | Shows the usage message                                     |
| --verbose, -v/-vvv/-v -v -v | Increases the application verbosity level                   |
| --version, -V               | Shows the version info                                      |
| --Lid, -L                   | Use LID address argument                                    |
| --usage, -u                 | Usage message                                               |

**Table 21 - ibping Flags and Options**

| Flag                       | Description                                                                                 |
|----------------------------|---------------------------------------------------------------------------------------------|
| --Guid, -G                 | Uses GUID address argument. In most cases, it is the Port GUID. For example: "0x08f1040023" |
| --sm_port, -s <smlid>      | Uses 'smlid' as the target lid for SM/SA queries                                            |
| --Ca, -C <ca_name>         | Uses the specified ca_name                                                                  |
| --Port, -P <ca_port>       | Uses the specified ca_port                                                                  |
| --timeout, -t <timeout_ms> | Overrides the default timeout for the solicited mads                                        |

### 14.3.9 ibnetdiscover

ibnetdiscover performs IB subnet discovery and outputs a readable topology file. GUIDs, node types, and port numbers are displayed as well as port LIDs and NodeDescriptions. All nodes (and links) are displayed (full topology). Optionally, this utility can be used to list the current connected nodes by node-type. The output is printed to standard output unless a topology file is specified.

#### 14.3.9.1 ibnetdiscover Synopsis

```
ibnetdiscover [-d(ebug)] [-e(rr_show)] [-v(erbose)] [-s(how)] [-l(ist)] [-g(rouping)] [-H(ca_list)][-S(witch_list)] [-R(outer_list)] [-C ca_name] [-P ca_port] [-t(imeout) timeout_ms] [-V(ersion)] [--outstanding_smps -o <val>] [-u(sage)] [--node-name-map <node-name-map>] [--cache <filename>] [--load-cache <filename>] [-p(orts)] [-m(ax_hops)] [-h(elp)] [<topology-file>]
```

#### 14.3.9.2 ibnetdiscover Options

The table below lists the various flags of the command.

Most OpenIB diagnostics take the following common flags. The exact list of supported flags per utility can be found in the usage message and can be shown using the util\_name -h syntax.

**Table 22 - ibnetdiscover Flags and Options**

| Flag              | Description                                                                                                                                           |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| -l, --list        | Lists of connected nodes                                                                                                                              |
| -g, --grouping    | Shows grouping. Grouping correlates InfiniBand nodes by different vendor specific schemes. It may also show the switch external ports correspondence. |
| -H, --Hca_list    | Lists of connected CAs                                                                                                                                |
| -S, --Switch_list | Lists of connected switches                                                                                                                           |
| -R, --Router_list | Lists of connected routers                                                                                                                            |
| -s, --show        | Shows progress information during discovery                                                                                                           |

**Table 22 - ibnetdiscover Flags and Options**

| Flag                            | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| --node-name-map <node-name-map> | Specifies a node name map. The node name map file maps GUIDs to more user friendly names. See “Topology File Format” on page 120.                                                                                                                                                                                                                                                                                                                                                                       |
| --cache <filename>              | Caches the ibnetdiscover network data in the specified filename. This cache may be used by other tools for later analysis                                                                                                                                                                                                                                                                                                                                                                               |
| --load-cache <filename>         | Loads and use the cached ibnetdiscover data stored in the specified filename. May be useful for outputting and learning about other fabrics or a previous state of a fabric                                                                                                                                                                                                                                                                                                                             |
| --diff <filename>               | Loads cached ibnetdiscover data and do a diff comparison to the current network or another cache. A special diff output for ibnetdiscover output will be displayed showing differences between the old and current fabric. By default, the following are compared for differences: switches, channel adapters, routers, and port connections                                                                                                                                                            |
| --diffcheck <key(s)>            | Specifies what diff checks should be done in the --diff option above. Comma separate multiple diff check key(s). The available diff checks are: sw = switches, ca = channel adapters, router = routers, port = port connections, lid = lids, nodedesc = node descriptions. Note that port, lid, and nodedesc are checked only for the node types that are specified (e.g. sw, ca, router). If port is specified alongside lid or nodedesc, remote port lids and node descriptions will also be compared |
| -p, --ports                     | Obtains a ports report which is a list of connected ports with relevant information (like LID, port-num, GUID, width, speed, and NodeDescription)                                                                                                                                                                                                                                                                                                                                                       |
| -m, --max_hops                  | Reports max hops discovered                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| --debug, -d/-ddd/ -d -d -d      | Raises the IB debugging level                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| --errors, -e                    | Shows send and receive errors (timeouts and others)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| --help, -h                      | Shows the usage message                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| --verbose, -v/-vv/ -v -v -v     | Increases the application verbosity level                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| --version, -V                   | Shows the version info                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| --outstanding_smps -o <val>     | Specifies the number of outstanding SMPs which should be issued during the scan                                                                                                                                                                                                                                                                                                                                                                                                                         |
| -usage, -u                      | Usages message                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| --Ca, -C <ca_name>              | Uses the specified ca_name                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| --Port, -P <ca_port>            | Uses the specified ca_port                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| --timeout, -t <timeout_ms>      | Overrides the default timeout for the solicited mads                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| --full, -f                      | Shows full information (ports' speed and width)                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| --show, -s                      | Shows more information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

### 14.3.9.3 Topology File Format

The topology file format is largely intuitive. Most identifiers are given textual names like vendor ID (vendid), device ID (device ID), GUIDs of various types (sysimgguid, caguid, switchguid, etc.). PortGUIDs are shown in parentheses (). For switches, this is shown on the switchguid line. For CA and router ports, it is shown on the connectivity lines. The IB node is identified followed by the number of ports and the node GUID. On the right of this line is a comment (#) followed by the NodeDescription in quotes. If the node is a switch, this line also contains whether switch port 0 is base or enhanced, and the LID and LMC of port 0. Subsequent lines pertaining to this node show the connectivity. On the left is the port number of the current node. On the right is the peer-node (node at other end of link). It is identified in quotes with nodetype followed by - followed by NodeGUID with the port number in square brackets. Further on the right is a comment (#). What follows the comment is dependent on the node type. If it is a switch node, it is followed by the NodeDescription in quotes and the LID of the peer node. If it is a CA or router node, it is followed by the local LID and LMC and then followed by the NodeDescription in quotes and the LID of the peer node. The active link width and speed are then appended to the end of this output line.

#### Example

```
# Topology file: generated on Tue Jun  5 14:15:10 2007
#
# Max of 3 hops discovered
# Initiated from node 0008f10403960558 port 0008f10403960559
```

#### Non-Chassis Nodes

When grouping is used, InfiniBand nodes are organized into chassis which are numbered. Nodes which cannot be determined to be in a chassis are displayed as "Non-Chassis Nodes". External ports are also shown on the connectivity lines.

```
vendid=0x8f1
devid=0x5a06
sysimgguid=0x5442ba00003000
switchguid=0x5442ba00003080 (5442ba00003080)
Switch 24 "S-005442ba00003080" # "ISR9024 Voltaire" base port 0 lid 6 lmc 0
[22] "H-0008f10403961354"[1] (8f10403961355) # "MT23108 InfiniHost Mellanox
Technologies" lid 4 4xSDR
[10] "S-0008f10400410015"[1] # "SW-6IB4 Voltaire" lid 3 4xSDR
[8] "H-0008f10403960558"[2] (8f1040396055a) # "MT23108 InfiniHost Mellanox
Technologies" lid 14 4xSDR
[6] "S-0008f10400410015"[3] # "SW-6IB4 Voltaire" lid 3 4xSDR
[12] "H-0008f10403960558"[1] (8f10403960559) # "MT23108 InfiniHost Mellanox
Technologies" lid 10 4xSDR
vendid=0x8f1
devid=0x5a05
switchguid=0x8f10400410015 (8f10400410015)
Switch 8 "S-0008f10400410015" # "SW-6IB4 Voltaire" base port 0 lid 3 lmc 0
[6] "H-0008f10403960984"[1] (8f10403960985) # "MT23108 InfiniHost Mellanox
Technologies" lid 16 4xSDR
[4] "H-005442b100004900"[1] (5442b100004901) # "MT23108 InfiniHost Mellanox
Technologies" lid 12 4xSDR
[1] "S-005442ba00003080"[10] # "ISR9024 Voltaire" lid 6 1xSDR
```



```

[3]      "S-005442ba00003080"[6]          # "ISR9024 Voltaire" lid 6 4xSDR
vendid=0x2c9
devid=0x5a44
caguid=0x8f10403960984
Ca      2 "H-0008f10403960984"          # "MT23108 InfiniHost Mellanox Technologies"
[1] (8f10403960985)      "S-0008f10400410015"[6]          # lid 16 lmc 1 "SW-6IB4 Vol-
taire" lid 3 4xSDR
vendid=0x2c9
devid=0x5a44
caguid=0x5442b100004900
Ca      2 "H-005442b100004900"          # "MT23108 InfiniHost Mellanox Technologies"
[1] (5442b100004901)      "S-0008f10400410015"[4]          # lid 12 lmc 1 "SW-6IB4 Vol-
taire" lid 3 4xSDR
vendid=0x2c9
devid=0x5a44
caguid=0x8f10403961354
Ca      2 "H-0008f10403961354"          # "MT23108 InfiniHost Mellanox Technologies"
[1] (8f10403961355)      "S-005442ba00003080"[22]          # lid 4 lmc 1 "ISR9024
Voltaire" lid 6 4xSDR
vendid=0x2c9
devid=0x5a44
caguid=0x8f10403960558
Ca      2 "H-0008f10403960558"          # "MT23108 InfiniHost Mellanox Technologies"
[2] (8f1040396055a)      "S-005442ba00003080"[8]          # lid 14 lmc 1 "ISR9024 Vol-
taire" lid 6 4xSDR
[1] (8f10403960559)      "S-005442ba00003080"[12]          # lid 10 lmc 1 "ISR9024
Voltaire" lid 6 1xSDR

```

## Node Name Map File Format

The node name map is used to specify user friendly names for nodes in the output. GUIDs are used to perform the lookup.

```

# comment
<guid> "<name>"

```

## Example

```
# IB1
# Line cards
0x0008f104003f125c "IB1 (Rack 11 slot 1 ) ISR9288/ISR9096 Voltaire sLB-24D"
0x0008f104003f125d "IB1 (Rack 11 slot 1 ) ISR9288/ISR9096 Voltaire sLB-24D"
0x0008f104003f10d2 "IB1 (Rack 11 slot 2 ) ISR9288/ISR9096 Voltaire sLB-24D"
0x0008f104003f10d3 "IB1 (Rack 11 slot 2 ) ISR9288/ISR9096 Voltaire sLB-24D"
0x0008f104003f10bf "IB1 (Rack 11 slot 12 ) ISR9288/ISR9096 Voltaire sLB-24D"
# Spines
0x0008f10400400e2d "IB1 (Rack 11 spine 1 ) ISR9288 Voltaire sFB-12D"
0x0008f10400400e2e "IB1 (Rack 11 spine 1 ) ISR9288 Voltaire sFB-12D"
0x0008f10400400e2f "IB1 (Rack 11 spine 1 ) ISR9288 Voltaire sFB-12D"
0x0008f10400400e31 "IB1 (Rack 11 spine 2 ) ISR9288 Voltaire sFB-12D"
0x0008f10400400e32 "IB1 (Rack 11 spine 2 ) ISR9288 Voltaire sFB-12D"
# GUID Node Name
0x0008f10400411a08 "SW1 (Rack 3) ISR9024 Voltaire 9024D"
0x0008f10400411a28 "SW2 (Rack 3) ISR9024 Voltaire 9024D"
0x0008f10400411a34 "SW3 (Rack 3) ISR9024 Voltaire 9024D"
0x0008f104004119d0 "SW4 (Rack 3) ISR9024 Voltaire 9024D"
```

### 14.3.10 ibtracert

ibtracert uses SMPs to trace the path from a source GID/LID to a destination GID/LID. Each hop along the path is displayed until the destination is reached or a hop does not respond. By using the `-m` option, multicast path tracing can be performed between source and destination nodes.

#### 14.3.10.1 ibtracert Synopsis

```
ibtracert [-d(efug)] [-v(erbos)] [-D(irect)] [-L(id)] [-e(errors)] [-u(sage)] [-G(uids)] [-f(orce)] [-n(o_info)] [-m(mlid)] [-s(smlid)] [-C(ca_name)] [-P(ca_port)] [-t(imeout) timeout_ms] [-V(ersion)] [--node-name--map <node-name-map>] [-h(elp)]
[<dest_dr_path|lid|guid> [<startlid> [<endlid>]]
```

#### 14.3.10.2 ibtracert Options

The table below lists the various flags of the command.

Most OpenIB diagnostics take the following common flags. The exact list of supported flags per utility can be found in the usage message and can be shown using the `util_name -h` syntax.

**Table 23 - ibtracert Flags and Options**

| Flag                                               | Description                                                                                                                                        |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| <code>--force, -f</code>                           | Force                                                                                                                                              |
| <code>-n, --no_info</code>                         | Simple format; do not show additional information                                                                                                  |
| <code>--mlid, -m &lt;mlid&gt;</code>               | Shows the multicast trace of the specified mlid                                                                                                    |
| <code>--node-name-map &lt;node-name-map&gt;</code> | Specifies a node name map. The node name map file maps GUIDs to more user friendly names. See <a href="#">“Topology File Format” on page 120</a> . |
| <code>--debug, -d/-ddd/-d -d</code>                | Raises the IB debugging level                                                                                                                      |

**Table 23 - ibtracert Flags and Options**

| Flag                       | Description                                                                                   |
|----------------------------|-----------------------------------------------------------------------------------------------|
| --Lid, -L                  | Uses LID address argument                                                                     |
| --errors, -e               | Shows send and receive errors                                                                 |
| --usage, -u                | Usage message                                                                                 |
| --Guid, -G                 | Uses GUID address argument. In most cases, it is the Port GUID.<br>Example:<br>"0x08f1040023" |
| --sm_port, -s <smlid>      | Uses 'smlid' as the target lid for SM/SA queries                                              |
| --help, -h                 | Shows the usage message                                                                       |
| -verbose, -v/-vv/-v -v -v  | Increases the application verbosity level                                                     |
| --version, -V              | Shows the version info                                                                        |
| --Ca, -C <ca_name>         | Uses the specified ca_name                                                                    |
| --Port, -P <ca_port>       | Uses the specified ca_port                                                                    |
| --timeout, -t <timeout_ms> | Overrides the default timeout for the solicited mads                                          |

**Examples**

## • Unicast examples

```
ibtracert 4 16          # show path between lids 4 and 16
ibtracert -n 4 16     # same, but using simple output format
ibtracert -G 0x8f1040396522d 0x002c9000100d051 # use guid addresses
```

## • Multicast example

```
ibtracert -m 0xc000 4 16 # show multicast path of mlid 0xc000 between lids 4 and 16
```

**14.3.11 sminfo**

Optionally sets and displays the output of a sminfo query in a readable format. The target SM is the one listed in the local port info, or the SM specified by the optional SM lid or by the SM direct routed path.



Using sminfo for any purposes other than simple query may result in a malfunction of the target SM.

### 14.3.11.1sminfo Synopsis

```
sminfo [-d(ebug)] [-e(rr_show)] [-s state] [-p prio] [-a activity] [-D(irect)]
[-L(id)] [-u(sage)] [-G(uid)] [-C ca_name] [-P ca_port] [-t(imeout) timeout_ms] [-V(ersion)] [-h(elp)] sm_lid | sm_dr_path [modifier]
```

### 14.3.11.2sminfo Options

The table below lists the various flags of the command.

Most OpenIB diagnostics take the following common flags. The exact list of supported flags per utility can be found in the usage message and can be shown using the `util_name -h` syntax..

**Table 24 - sminfo Flags and Options**

| Flag                       | Description                                                                                                                                                                                                                  |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| --state, -s                | Sets SM state: <ul style="list-style-type: none"> <li>• 0 - not active</li> <li>• 1 - discovering</li> <li>• 2 - standby</li> <li>• 3 - master</li> </ul>                                                                    |
| --priority, -p             | Sets priority (0-15)                                                                                                                                                                                                         |
| --activity, -a             | Sets activity count                                                                                                                                                                                                          |
| --debug, -d/-ddd/-d -d -d  | Raises the IB debugging level                                                                                                                                                                                                |
| --Direct, -D               | Uses directed path address arguments. The path is a comma separated list of out ports.<br>Examples: <ul style="list-style-type: none"> <li>• "0" # self port</li> <li>• "0,1,2,1,4" # out via port 1, then 2, ...</li> </ul> |
| --Lid, -L                  | Uses LID address argument                                                                                                                                                                                                    |
| --usage, -u                | Usage message                                                                                                                                                                                                                |
| --errors, -e               | Shows send and receive errors (timeouts and others)                                                                                                                                                                          |
| --Guid, -G                 | Uses GUID address argument. In most cases, it is the Port GUID.<br>Example:<br>"0x08f1040023"                                                                                                                                |
| --help, -h                 | Shows the usage message                                                                                                                                                                                                      |
| -verbose, -v/-vv/-v -v -v  | Increases the application verbosity level                                                                                                                                                                                    |
| --version, -V              | Shows the version info                                                                                                                                                                                                       |
| --Ca, -C <ca_name>         | Uses the specified ca_name                                                                                                                                                                                                   |
| --Port, -P <ca_port>       | Uses the specified ca_port                                                                                                                                                                                                   |
| --timeout, -t <timeout_ms> | Overrides the default timeout for the solicited mads                                                                                                                                                                         |

## Examples

```
sminfo          # local ports sminfo
sminfo 32       # show sminfo of lid 32
sminfo -G 0x8f1040023 # same but using guid address
```

### 14.3.12 ibclearerrors

ibclearerrors is a script which clears the PMA error counters in PortCounters by either waking the InfiniBand subnet topology or using an already saved topology file.

#### 14.3.12.1 ibclearerrors Synopsis

```
ibclearerrors [-h] [-N | -nocolor] [<topology-file> | -C ca_name -P ca_port -t(ime-
out) timeout_ms]
```

#### 14.3.12.2 ibclearerrors Options

The table below lists the various flags of the command.

**Table 25 - ibclearerrors Flags and Options**

| Flag            | Description                                         |
|-----------------|-----------------------------------------------------|
| -C <ca_name>    | Use the specified ca_name                           |
| -P <ca_port>    | Use the specified ca_port                           |
| -t <timeout_ms> | Override the default timeout for the solicited mads |

### 14.3.13 ibstat

ibstat is a binary which displays basic information obtained from the local IB driver. Output includes LID, SMLID, port state, link width active, and port physical state.

#### 14.3.13.1 ibstat Synopsis

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

#### 14.3.13.2 ibstat Options

The table below lists the various flags of the command.

Most OpenIB diagnostics take the following common flags. The exact list of supported flags per utility can be found in the usage message and can be shown using the util\_name -h syntax..

**Table 26 - ibstat Flags and Options**

| Flag              | Description         |
|-------------------|---------------------|
| -l, --list_of_cas | List all IB devices |
| -s, --short       | Short output        |
| -p, --port_list   | Show port list      |

**Table 26 - ibstat Flags and Options**

| Flag                      | Description                              |
|---------------------------|------------------------------------------|
| ca_name                   | InfiniBand device name                   |
| portnum                   | Port number of InfiniBand device         |
| --debug, -d/-ddd/-d -d -d | Raise the IB debugging level             |
| --help, -h                | Show the usage message                   |
| -verbose, -v/-vv/-v -v -v | Increase the application verbosity level |
| --version, -V             | Show the version info                    |
| --usage, -u               | usage message                            |

**Examples**

```

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'

```

**14.3.14 vstat**

vstat is a binary which displays information on the HCA attributes.

- vstat Synopsis is

```
vstat [-v] [-c] [-m] [-p N]
```

**14.3.14.1 vstat Options**

The table below lists the various flags of the command..

**Table 27 - vstat Flags and Options**

| Flag | Description                  |
|------|------------------------------|
| -v   | Verbose mode                 |
| -c   | HCA error/statistic counters |
| -m   | more verbose mode            |
| -p N | repeat every N sec           |

**14.3.15 osmtest**

osmtest is a test program to validate InfiniBand subnet manager and administration (SM/SA). Default is to run all flows with the exception of the QoS flow. osmtest provides a test suite for opensm. osmtest has the following capabilities and testing flows:

- It creates an inventory file of all available Nodes, Ports, and PathRecords, including all their fields.

- It verifies the existing inventory, with all the object fields, and matches it to a pre-saved one.
- A Multicast Compliancy test.
- An Event Forwarding test.
- A Service Record registration test.
- An RMPP stress test.
- A Small SA Queries stress test.

It is recommended that after installing opensm, the user should run "osmtest -f c" to generate the inventory file, and immediately afterwards run "osmtest -f a" to test OpenSM.

Additionally, it is recommended to create the inventory when the IB fabric is stable, and occasionally run "osmtest -v" to verify that nothing has changed.

### 14.3.15.1 osmtest Synopsis

```
osmtest [-f(low) <c|a|v|s|e|f|m|q|t>] [-w(ait) <trap_wait_time>] [-d(ebug) <num-
ber>] [-m(ax_lid) <LID in hex>] [-g(uid) [=]<GUID in hex>] [-p(ort)] [-i(nventory)
<filename>] [-s(tress)] [-M(ulticast_Mode)] [-t(imeout) <milliseconds>] [-l | --
log_file] [-v] [-vf <flags>] [-h(elp)]
```

### 14.3.15.2 osmtest Options

The table below lists the various flags of the command.

**Table 28 - osmtest Flags and Options**

| Flag        | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -f, --flow  | This option directs osmtest to run a specific flow. The following is the flow's description: <ul style="list-style-type: none"> <li>• c = create an inventory file with all nodes, ports and paths</li> <li>• a = run all validation tests (expecting an input inventory)</li> <li>• v = only validate the given inventory file</li> <li>• s = run service registration, deregistration, and lease test</li> <li>• e = run event forwarding test</li> <li>• f = flood the SA with queries according to the stress mode</li> <li>• m = multicast flow</li> <li>• q = QoS info: dump VLArb and SLtoVL tables</li> <li>• t = run trap 64/65 flow (this flow requires running of external tool, default is all flows except QoS)</li> </ul> |
| -w, --wait  | This option specifies the wait time for trap 64/65 in seconds It is used only when running -f t - the trap 64/65 flow (default to 10 sec)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| -d, --debug | This option specifies a debug option. These options are not normally needed. The number following -d selects the debug option to enable as follows:<br>OPT Description<br>--- -----<br>-d0 - Ignore other SM nodes<br>-d1 - Force single threaded dispatching<br>-d2 - Force log flushing after each log message<br>-d3 - Disable multicast support                                                                                                                                                                                                                                                                                                                                                                                     |

**Table 28 - osmtest Flags and Options**

| Flag                 | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -m, --max_lid        | This option specifies the maximal LID number to be searched for during inventory file build (default to 100)                                                                                                                                                                                                                                                                                                                                                                                   |
| -g, --guid           | This option specifies the local port GUID value with which OpenSM should bind. OpenSM may be bound to 1 port at a time. If GUID given is 0, OpenSM displays a list of possible port GUIDs and waits for user input. Without -g, OpenSM tries to use the default port                                                                                                                                                                                                                           |
| -p, --port           | This option displays a menu of possible local port GUID values with which osmtest could bind                                                                                                                                                                                                                                                                                                                                                                                                   |
| -i, --inventory      | This option specifies the name of the inventory file Normally, osmtest expects to find an inventory file, which osmtest uses to validate real-time information received from the SA during testing If -i is not specified, osmtest defaults to the file osmtest.dat See -c option for related information                                                                                                                                                                                      |
| -s, --stress         | This option runs the specified stress test instead of the normal test suite Stress test options are as follows:<br>OPT Description<br>--- -----<br>-s1 - Single-MAD (RMPP) response SA queries<br>-s2 - Multi-MAD (RMPP) response SA queries<br>-s3 - Multi-MAD (RMPP) Path Record SA queries<br>-s4 - Single-MAD (non RMPP) get Path Record SA queries<br>Without -s, stress testing is not performed                                                                                         |
| -M, --Multicast_Mode | This option specify length of Multicast test:<br>OPT Description<br>--- -----<br>-M1 - Short Multicast Flow (default) - single mode<br>-M2 - Short Multicast Flow - multiple mode<br>-M3 - Long Multicast Flow - single mode<br>-M4 - Long Multicast Flow - multiple mode<br>• Single mode - Osmtest is tested alone, with no other apps that interact with OpenSM MC<br>• Multiple mode - Could be run with other apps using MC with OpenSM.<br>Without -M, default flow testing is performed |
| -t                   | This option specifies the time in milliseconds used for transaction timeouts. Specifying -t 0 disables timeouts. Without -t, OpenSM defaults to a timeout value of 200 milliseconds.                                                                                                                                                                                                                                                                                                           |
| -l, --log_file       | This option defines the log to be the given file. By default the log goes to stdout.                                                                                                                                                                                                                                                                                                                                                                                                           |
| -v                   | This option increases the log verbosity level. The -v option may be specified multiple times to further increase the verbosity level. See the -vf option for more information about. log verbosity.                                                                                                                                                                                                                                                                                            |
| -V                   | This option sets the maximum verbosity level and forces log flushing. The -V is equivalent to '-vf0xFF -d 2'. See the -vf option for more information about. log verbosity.                                                                                                                                                                                                                                                                                                                    |



**Table 28 - osmtest Flags and Options**

| Flag       | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -vf        | <p>This option sets the log verbosity level. A flags field must follow the -D option. A bit set/clear in the flags enables/disables a specific log level as follows:</p> <pre>BIT  LOG LEVEL ENABLED ----  -----</pre> <p>0x01 - ERROR (error messages)<br/> 0x02 - INFO (basic messages, low volume)<br/> 0x04 - VERBOSE (interesting stuff, moderate volume)<br/> 0x08 - DEBUG (diagnostic, high volume)<br/> 0x10 - FUNCS (function entry/exit, very high volume)<br/> 0x20 - FRAMES (dumps all SMP and GMP frames)<br/> 0x40 - ROUTING (dump FDB routing information)<br/> 0x80 - currently unused.</p> <p>Without -vf, osmtest defaults to ERROR + INFO (0x3) Specifying -vf 0 disables all messages Specifying -vf 0xFF enables all messages (see -V) High verbosity levels may require increasing the transaction timeout with the -t option</p> |
| -h, --help | Display this usage info then exit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

### 14.3.16 ibaddr

Displays the lid (and range) as well as the GUID address of the port specified (by DR path, lid, or GUID) or the local port by default.



This utility can be used as simple address resolver.

#### 14.3.16.1 ibaddr Synopsis

```
ibaddr [-d(ebug)] [-D(irect)] [-G(uid)] [-l(id_show)] [-g(id_show)] [-C
ca_name] [-P ca_port] [-t(imeout) timeout_ms] [-V(ersion)] [-h(elp)]
[<lid | dr_path | guid>]
```

#### 14.3.16.2 ibaddr Options

**Table 29 - ibaddr Flags and Options**

| Flags          | Description                              |
|----------------|------------------------------------------|
| -G, --Guid     | shows lid range and gid for GUID address |
| -l, --lid_show | shows lid range only                     |
| -L, --Lid_show | shows lid range (in decimal) only        |
| -g, --gid_show | shows gid address only                   |

**Table 29 - ibaddr Flags and Options**

| Flags                                                                                                                                                                                          | Description                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Debugging Flags                                                                                                                                                                                | Description                                                                                                                                                         |
| NOTE: Most OpenIB diagnostics take the following common flags. The exact list of supported flags per utility can be found in the usage message and can be shown using the util_name -h syntax. |                                                                                                                                                                     |
| -d                                                                                                                                                                                             | Raises the IB debugging level.<br>Can be used several times (-ddd or -d -d -d).                                                                                     |
| -e                                                                                                                                                                                             | shows send and receive errors (timeouts and others)                                                                                                                 |
| -h                                                                                                                                                                                             | shows the usage message                                                                                                                                             |
| -v                                                                                                                                                                                             | Increases the application verbosity level.<br>Can be used several times (-vv or -v -v -v)                                                                           |
| -v                                                                                                                                                                                             | shows the version info.                                                                                                                                             |
| Addressing Flags                                                                                                                                                                               | Description                                                                                                                                                         |
| -D                                                                                                                                                                                             | Uses directed path address arguments. The path is a comma separated list of out ports.<br>Examples:<br>"0" # self port<br>"0,1,2,1,4" # out via port 1, then 2, ... |
| -G                                                                                                                                                                                             | Uses GUID address argument. In most cases, it is the Port GUID.<br>Example:<br>"0x08f1040023"                                                                       |
| -s <smlid>                                                                                                                                                                                     | Uses 'smlid' as the target lid for SM/SA queries.                                                                                                                   |
| Other Common Flags                                                                                                                                                                             | Description                                                                                                                                                         |
| -C <ca_name>                                                                                                                                                                                   | Uses the specified ca_name.                                                                                                                                         |
| -P <ca_port>                                                                                                                                                                                   | Uses the specified ca_port.                                                                                                                                         |
| -t <timeout_ms>                                                                                                                                                                                | Overrides the default timeout for the solicited mads.                                                                                                               |

### 14.3.16.3 Multiple CA/Multiple Port Support

When no IB device or port is specified, the port to use is selected by the following criteria:

1. The first port that is ACTIVE.
2. If not found, the first port that is UP (physical link up).

If a port and/or CA name is specified, the user request is attempted to be fulfilled, and will fail if it is not possible.

## Examples

```
ibaddr          # local port's address
ibaddr 32       # show lid range and gid of lid 32
ibaddr -G 0x8f1040023 # same but using guid address
ibaddr -l 32    # show lid range only
ibaddr -L 32    # show decimal lid range only
ibaddr -g 32    # show gid address only
```

### 14.3.17 ibcacheedit

ibcacheedit allows users to edit an ibnetdiscover cache created through the --cache option in ibnetdiscover(8).

#### 14.3.17.1 ibcacheedit Synopsis

```
ibcacheedit [--switchguid BEFOREGUID:AFTERGUID] [--caguid BEFORE:AFTER]
             [--sysimguid           BEFOREGUID:AFTERGUID]           [--port-
guid
             NODEGUID:BEFOREGUID:AFTERGUID] [-h(elp)] <orig.cache> <new.cache>
```

#### 14.3.17.2 ibcacheedit Options

**Table 30 - ibcacheedit Flags and Options**

| Flags                                                                                                                                                                                          | Description                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| --switchguid BEFOREGUID:AFTERGUID                                                                                                                                                              | Specifies a switchguid that should be changed. The before and after guid should be separated by a colon. On switches, port guids are identical to the switch guid, so port guids will be adjusted as well on switches.                                                                                                              |
| --caguid BEFOREGUID:AFTERGUID                                                                                                                                                                  | Specifies a caguid that should be changed. The before and after guid should be separated by a colon.                                                                                                                                                                                                                                |
| --sysimguid BEFOREGUID:AFTERGUID                                                                                                                                                               | Specifies a sysimguid that should be changed. The before and after guid should be separated by a colon.                                                                                                                                                                                                                             |
| --portguid NODEGUID:BEFOREGUID:AFTERGUID                                                                                                                                                       | Specifies a portguid that should be changed. The nodeguid of the port (e.g. switchguid or caguid) should be specified first, followed by a colon, the before port guid, another colon, then the after port guid. On switches, port guids are identical to the switch guid, so the switch guid will be adjusted as well on switches. |
| Debugging Flags                                                                                                                                                                                | Description                                                                                                                                                                                                                                                                                                                         |
| NOTE: Most OpenIB diagnostics take the following common flags. The exact list of supported flags per utility can be found in the usage message and can be shown using the util_name -h syntax. |                                                                                                                                                                                                                                                                                                                                     |
| -h                                                                                                                                                                                             | shows the usage message                                                                                                                                                                                                                                                                                                             |
| -v                                                                                                                                                                                             | shows the version info.                                                                                                                                                                                                                                                                                                             |

## 14.3.18 iblinkinfo

iblinkinfo reports link info for each port in an IB fabric, node by node. Optionally, iblinkinfo can do partial scans and limit its output to parts of a fabric.

### 14.3.18.1 iblinkinfo Synopsis

```
[-hcdl -C <ca_name> -P <ca_port> -p -S <port_guid> -G <port_guid> -D
<direct_route> --load-cache <filename>]
```

### 14.3.18.2 iblinkinfo Flags and Options

**Table 31 - iblinkinfo Flags and Options**

| Flags                                     | Description                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -S <port_guid> -G <port_guid> --port-guid | Starts partial scan at the port specified by <port_guid> (hex format)                                                                                                                                                                                                                                                                                                                     |
| -D <direct_route>                         | Starts partial scan at the port specified by the direct route path.                                                                                                                                                                                                                                                                                                                       |
| -l                                        | Prints all information for each link on one line. Default is to print a header with the node information and then a list for each port (useful for grep'ing output).                                                                                                                                                                                                                      |
| -d                                        | Prints only nodes which have a port in the "Down" state.                                                                                                                                                                                                                                                                                                                                  |
| -p                                        | Prints additional port settings (<Life-Time>,<HoqLife>,<VLStall-Count>)                                                                                                                                                                                                                                                                                                                   |
| -C <ca_name>                              | Uses the specified ca_name for the search.                                                                                                                                                                                                                                                                                                                                                |
| -P <ca_port>                              | Uses the specified ca_port for the search.                                                                                                                                                                                                                                                                                                                                                |
| -R                                        | (This option is obsolete and does nothing)                                                                                                                                                                                                                                                                                                                                                |
| --load-cache <filename>                   | Loads and use the cached ibnetdiscover data stored in the specified filename. May be useful for outputting and learning about other fabrics or a previous state of a fabric. Cannot be used if user specifies a direct route path. See ibnetdiscover for information on caching ibnetdiscover output.                                                                                     |
| --diff <filename>                         | Loads cached ibnetdiscover data and do a diff comparison to the current network or another cache. A special diff output for iblinkinfo output will be displayed showing differences between the old and current fabric links. Be default, the following are compared for differences: port connections and port state. See ibnetdiscover for information on caching ibnetdiscover output. |

**Table 31 - iblinkinfo Flags and Options**

| Flags                        | Description                                                                                                                                                                                                                                                                                                                                                                                                                |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| --diffcheck <key(s)>         | Specifies what diff checks should be done in the--diffoption above. Comma separate multiple diff check key(s). The available diff checks are:port = port connections,state = port state, lid = lids, nodedesc = node descriptions. If port is specified alongside lid or nodedesc, remote port lids and node descriptions will also be compared.                                                                           |
| --filterdownports <filename> | Filters downports indicated in a ibnetdiscover cache. If a port was previously indicated as down in the specified cache, and is still down, do not output it in the resulting output. This option may be particularly useful for environments where switches are not fully populated, thus much of the default iblinkinfo info is considered un-useful. See ibnetdiscover for information on caching ibnetdiscover output. |

### 14.3.19 ibqueryerrors

The default behavior is to report the port error counters which exceed a threshold for each port in the fabric. The default threshold is zero (0). Error fields can also be suppressed entirely.

In addition to reporting errors on every port. ibqueryerrors can report the port transmit and receive data as well as report full link information to the remote port if available.

#### 14.3.19.1ibqueryerrors Synopsis

```
ibqueryerrors [options]
```

#### 14.3.19.2ibqueryerrors Options

**Table 32 - ibqueryerrors Flags and Options**

| Flags                                     | Description                                                                                                                                           |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| -s <err1,err2,...>                        | Suppresses the errors listed in the comma separated list provided.                                                                                    |
| -c                                        | Suppresses some of the common "side effect" counters. These counters usually do not indicate an error condition and can be usually be safely ignored. |
| -G <port_guid> -S <port_guid> --port-guid | Report results for the port specified. For switches results are printed for all ports not just switch port 0.                                         |
| -S same as "-G"                           | Provided only for backward compatibility                                                                                                              |
| -D <direct_route>                         | Reports results for the port specified. For switches results are printed for all ports not just switch port 0.                                        |

**Table 32 - ibqueryerrors Flags and Options**

| Flags                   | Description                                                                                                                                                                                                                                                                                                                           |
|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -r                      | Reports the port information. This includes LID, port, external port (if applicable), link speed setting, remote GUID, remote port, remote external port (if applicable), and remote node description information.                                                                                                                    |
| --data                  | Includes the optional transmit and receive data counters.                                                                                                                                                                                                                                                                             |
| --threshold-file        | Specifies an alternate threshold file.<br>The default is:<br>/opt/ufm/files/conf/infiniband-diags/error_thresholds                                                                                                                                                                                                                    |
| --switch                | Prints data for switches only.                                                                                                                                                                                                                                                                                                        |
| --ca                    | Prints data for CA's only.                                                                                                                                                                                                                                                                                                            |
| --router                | Prints data for routers only                                                                                                                                                                                                                                                                                                          |
| --clear-errors-k        | Clear error counters after read. -k and -K can be used together to clear both errors and counters.                                                                                                                                                                                                                                    |
| --clear-counts -K       | Clear data counters after read.<br><br>CAUTION: clearing data counters will occur regardless of if they are printed or not. This is because data counters are only printed on ports which have errors. This means if a port has 0 errors and the -K option is specified the data counters will be cleared without any printed output. |
| -details                | Includes receive error and transmits discard details                                                                                                                                                                                                                                                                                  |
| --load-cache <filename> | Loads and uses the cached ibnetdiscover data stored in the specified filename. May be useful for outputting and learning about other fabrics or a previous state of a fabric. Cannot be used if user specifies a direct route path. See ibnetdiscover for information on caching ibnetdiscover output.                                |
| -R                      | This option is obsolete (and has no effect).                                                                                                                                                                                                                                                                                          |
| -d                      | Raises the IB debugging level. May be used several times (-ddd or -d -d -d).                                                                                                                                                                                                                                                          |
| -e                      | Shows send and receive errors (time-outs and others)                                                                                                                                                                                                                                                                                  |
| -h                      | Shows the usage message                                                                                                                                                                                                                                                                                                               |
| -v                      | Increases the application verbosity level. May be used several times (-vv or -v -v -v)                                                                                                                                                                                                                                                |
| -C <ca_name>            | Uses the specified ca_name.                                                                                                                                                                                                                                                                                                           |
| -P <ca_port>            | Uses the specified ca_port.                                                                                                                                                                                                                                                                                                           |

**Table 32 - ibqueryerrors Flags and Options**

| Flags           | Description                                           |
|-----------------|-------------------------------------------------------|
| -t <timeout_ms> | Overrides the default timeout for the solicited mads. |

### 14.3.19.3ibqueryerrors Exit Status

If a failure to scan the fabric occurs return -1. If the scan succeeds without errors beyond thresholds return 0. If errors are found on ports beyond thresholds return 1.

### 14.3.19.4ibqueryerrors Files

/opt/ufm/files/conf/infiniband-diags/error\_thresholds

Define threshold values for errors. File format is simple "name=val".

Comments begin with '#'

#### Example:

```
# Define thresholds for error counters
SymbolErrorCounter=10
LinkErrorRecoveryCounter=10
VL15Dropped=100
```

### 14.3.20 ibsysstat

ibsysstat uses vendor MADs to validate connectivity between InfiniBand nodes and obtain other information about the InfiniBand node. ibsysstat is run as client/server. Default is to run as client.

#### 14.3.20.1ibsysstat Synopsis

```
ibsysstat [-d(ebug)] [-e(rr_show)] [-v(erbose)] [-G(uid)] [-C ca_name]
[-P ca_port] [-s smlid] [-t(imeout) timeout_ms] [-V(ersion)] [-o oui]
[-S(erver)] [-h(elp)] <dest lid | guid> [<op>]
```

#### 14.3.20.2ibsysstat Options

**Table 33 - ibsysstat Flags and Options**

| Flags           | Description                                        |
|-----------------|----------------------------------------------------|
| ping            | Verifies connectivity to server (default)          |
| host            | Obtains host information from server               |
| cpu             | Obtains cpu information from server                |
| -o, --oui       | Uses specified OUI number to multiplex vendor mads |
| -S, --Server    | Starts in server mode (do not return)              |
| Debugging Flags | Description                                        |

**Table 33 - ibsysstat Flags and Options**

| Flags                                                                                                                                                                                                       | Description                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| NOTE: Most OpenIB diagnostics take the following common flags. The exact list of supported flags per utility can be found in the usage message and can be shown using the <code>util_name -h</code> syntax. |                                                                                               |
| -d                                                                                                                                                                                                          | Raises the IB debugging level.<br>Can be used several times (-ddd or -d -d -d).               |
| -e                                                                                                                                                                                                          | Shows send and receive errors (timeouts and others)                                           |
| -h                                                                                                                                                                                                          | Shows the usage message                                                                       |
| -v                                                                                                                                                                                                          | Increases the application verbosity level.<br>Can be used several times (-vv or -v -v -v).    |
| -v                                                                                                                                                                                                          | Shows the version info.                                                                       |
| Addressing Flags                                                                                                                                                                                            | Description                                                                                   |
| -G                                                                                                                                                                                                          | Uses GUID address argument. In most cases, it is the Port GUID.<br>Example:<br>"0x08f1040023" |
| -s <smlid>                                                                                                                                                                                                  | Uses 'smlid' as the target lid for SM/SA queries.                                             |
| Other Common Flags                                                                                                                                                                                          | Description                                                                                   |
| -C <ca_name>                                                                                                                                                                                                | Uses the specified ca_name.                                                                   |
| -P <ca_port>                                                                                                                                                                                                | Uses the specified ca_port.                                                                   |
| -t <timeout_ms>                                                                                                                                                                                             | Overrides the default timeout for the solicited mads.                                         |

### 14.3.20.3 Multiple CA/Multiple Port Support

When no IB device or port is specified, the port to use is selected by the following criteria:

1. The first port that is ACTIVE.
2. If not found, the first port that is UP (physical link up).

If a port and/or CA name is specified, the user request is attempted to be fulfilled, and will fail if it is not possible.



## 14.3.21 saquery

saquery issues the selected SA query. Node records are queried by default.

### 14.3.21.1saquery Synopsis

```
saquery [-h] [-d] [-p] [-N] [--list | -D] [-S] [-I] [-L] [-l] [-G] [-O]
        [-U] [-c] [-s] [-g] [-m] [-x] [-C ca_name] [-P ca_port][--smkey
val]
        [-t(imeout) <msec>] [--src-to-dst <src:dst>] [--sgid-to-dgid
<sgid-dgid>] [--node-name-map <node-name-map>] [<name> | <lid>
|
<guid>]
```

### 14.3.21.2saquery Options

**Table 34 - saquery Flags and Options**

| Flags          | Description                                                                                                                                                                                                    |
|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -p             | Gets PathRecord info.                                                                                                                                                                                          |
| -N             | Gets NodeRecord info.                                                                                                                                                                                          |
| --list   -D    | Gets NodeDescriptions of CAs only.                                                                                                                                                                             |
| -S             | Gets ServiceRecord info.                                                                                                                                                                                       |
| -I             | Gets InformInfoRecord (subscription) info.                                                                                                                                                                     |
| -L             | Returns the Lids of the name specified                                                                                                                                                                         |
| -l             | Returns the unique Lid of the name specified                                                                                                                                                                   |
| -G             | Returns the Guids of the name specified                                                                                                                                                                        |
| -O             | Returns the name for the Lid specified                                                                                                                                                                         |
| -U             | Returns the name for the Guid specified                                                                                                                                                                        |
| -C             | Gets the SA's class port info                                                                                                                                                                                  |
| -s             | Returns the PortInfoRecords with isSM or isSMdisabled capability mask bit on.                                                                                                                                  |
| -g             | Gets multicast group info                                                                                                                                                                                      |
| -m             | Gets multicast member info. If a group is specified, limit the output to the group specified and print one line containing only the GUID and node description for each entry.<br>Example:<br>saquery -m 0xc000 |
| -x             | Gets LinkRecord info.                                                                                                                                                                                          |
| --src-to-dst   | Gets a PathRecord for <src:dst> where src and dst are either node names or LIDs.                                                                                                                               |
| --sgid-to-dgid | Gets a PathRecord for sgid to dgid where both GIDs are in an IPv6 format acceptable to inet_pton(3).                                                                                                           |
| -C <ca_name>   | Uses the specified ca_name.                                                                                                                                                                                    |
| -P <ca_port>   | Uses the specified ca_port.                                                                                                                                                                                    |
| --smkey <val>  | Uses SM_Key value for the query. Will be used only with "trusted" queries. If non-numeric value (like 'x') is specified then saquery will prompt for a value.                                                  |

**Table 34 - saquery Flags and Options**

| Flags                           | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -t, -timeout <msec>             | Specifies SA query response timeout in milliseconds. Default is 100 milliseconds. You may want to use this option if IB_TIMEOUT is indicated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| --node-name-map <node-name-map> | <p>Specifies a node name map. The node name map file maps GUIDs to more user friendly names. See ibnetdiscover(8) for node name map file format. Only used with the -O and -U options.</p> <ul style="list-style-type: none"> <li>Supported query names (and aliases):           <ul style="list-style-type: none"> <li>ClassPortInfo (CPI)</li> <li>NodeRecord (NR) [lid]</li> <li>PortInfoRecord (PIR) [[lid]/[port]/[options]]</li> <li>SL2VLTableRecord (SL2VL) [[lid]/[in_port]/[out_port]]</li> <li>PKeyTableRecord (PKTR) [[lid]/[port]/[block]]</li> <li>VLArbitationTableRecord (VLAR) [[lid]/[port]/[block]]</li> <li>InformInfoRecord (IIR)</li> <li>LinkRecord (LR) [[from_lid]/[from_port]] [[to_lid]/[to_port]]</li> <li>ServiceRecord (SR)</li> <li>PathRecord (PR)</li> <li>MCMemberRecord (MCMR)</li> <li>LFTRRecord (LFTR) [[lid]/[block]]</li> <li>MFTRRecord (MFTR) [[mlid]/[position]/[block]]</li> <li>GUIDInfoRecord (GIR) [[lid]/[block]]</li> </ul> </li> </ul> |
| -d                              | enables debugging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| -h                              | Shows help.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

### 14.3.22 smpdump

smpdump is a general purpose SMP utility which gets SM attributes from a specified SMA. The result is dumped in hex by default.

#### 14.3.22.1 smpdump Synopsis

```
smpdump [-s(ring)] [-D(irect)] [-C ca_name] [-P ca_port] [-t(imeout)
timeout_ms] [-V(ersion)] [-h(elp)] <dclid|dr_path> <attr> [mod]
```

### 14.3.22.2 smpdump Options

**Table 35 - smpdump Flags and Options**

| Flags                                                                                                                                                                                          | Description                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| attr                                                                                                                                                                                           | IBA attribute ID for SM attribute                                                                                                                                   |
| mod                                                                                                                                                                                            | IBA modifier for SM attribute                                                                                                                                       |
| Debugging Flags                                                                                                                                                                                | Description                                                                                                                                                         |
| NOTE: Most OpenIB diagnostics take the following common flags. The exact list of supported flags per utility can be found in the usage message and can be shown using the util_name -h syntax. |                                                                                                                                                                     |
| -d                                                                                                                                                                                             | Raises the IB debugging level.<br>Can be used several times (-ddd or -d -d -d).                                                                                     |
| -e                                                                                                                                                                                             | Shows send and receive errors (timeouts and others)                                                                                                                 |
| -h                                                                                                                                                                                             | Shows the usage message                                                                                                                                             |
| -v                                                                                                                                                                                             | Increases the application verbosity level.<br>Can be used several times (-vv or -v -v -v)                                                                           |
| -V                                                                                                                                                                                             | Shows the version info.                                                                                                                                             |
| Addressing Flags                                                                                                                                                                               | Description                                                                                                                                                         |
| -D                                                                                                                                                                                             | Uses directed path address arguments. The path is a comma separated list of out ports.<br>Examples:<br>"0" # self port<br>"0,1,2,1,4" # out via port 1, then 2, ... |
| -G                                                                                                                                                                                             | Uses GUID address argument. In most cases, it is the Port GUID.<br>Example:<br>"0x08f1040023"                                                                       |
| -s <smlid>                                                                                                                                                                                     | Uses 'smlid' as the target lid for SM/SA queries.                                                                                                                   |
| Flags                                                                                                                                                                                          | Description                                                                                                                                                         |
| -C <ca_name>                                                                                                                                                                                   | Uses the specified ca_name.                                                                                                                                         |
| -P <ca_port>                                                                                                                                                                                   | Uses the specified ca_port.                                                                                                                                         |
| -t <timeout_ms>                                                                                                                                                                                | Overrides the default timeout for the solicited mads.                                                                                                               |

### 14.3.22.3 Multiple CA/Multiple Port Support

When no IB device or port is specified, the port to use is selected by the following criteria:

1. The first port that is ACTIVE.
2. If not found, the first port that is UP (physical link up).

If a port and/or CA name is specified, the user request is attempted to be fulfilled, and will fail if it is not possible.

## Examples

Direct Routed Examples:

```
smpdump -D 0,1,2,3,5 16 # NODE DESC
smpdump -D 0,1,2 0x15 2 # PORT INFO, port 2
```

LID Routed Examples:

```
smpdump 3 0x15 2 # PORT INFO, lid 3 port 2
smpdump 0xa0 0x11 # NODE INFO, lid 0xa0
```

## 14.4 InfiniBand Fabric Performance Utilities

The performance utilities described in this chapter are intended to be used as a performance micro-benchmark.

### 14.4.1 ib\_read\_bw

`ib_read_bw` calculates the BW of RDMA read between a pair of machines. One acts as a server and the other as a client. The client RDMA reads the server memory and calculate the BW by sampling the CPU each time it receive a successful completion. The test supports features such as Bidirectional, in which they both RDMA read from each other memory's at the same time, change of mtu size, tx size, number of iteration, message size and more. Read is available only in RC connection mode (as specified in IB spec).

#### 14.4.1.1 ib\_read\_bw Synopsis

```
ib_read_bw [-i(b_port) ib_port] [-m(tu) mtu size] [-s(ize) message_size] [-n
iteration_num] [-p(ort) PDT_port] [-b(idirectional)] [-o(uts) outstanding reads] [-
a(ll)] [-V(ersion)]
```

#### 14.4.1.2 ib\_read\_bw Options

The table below lists the various flags of the command.

**Table 36 - `ib_read_bw` Flags and Options**

| Flag                 | Description                                               |
|----------------------|-----------------------------------------------------------|
| -p, --port=<port>    | Listens on/connect to port <port> (default 18515)         |
| -d, --ib-dev=<dev>   | Uses IB device <device guid> (default first device found) |
| -i, --ib-port=<port> | Uses port <port> of IB device (default 1)                 |
| -m, --mtu=<mtu>      | The mtu size (default 1024)                               |
| -o, --outs=<num>     | The number of outstanding read/atom(default 4)            |
| -s, --size=<size>    | The size of message to exchange (default 65536)           |
| -a, --all            | Runs sizes from 2 till 2 <sup>23</sup>                    |
| -t, --tx-depth=<dep> | The size of tx queue (default 100)                        |
| -n, --iters=<iters>  | The number of exchanges (at least 2, default 1000)        |

**Table 36 - *ib\_read\_bw* Flags and Options**

| Flag                | Description                                               |
|---------------------|-----------------------------------------------------------|
| -b, --bidirectional | Measures bidirectional bandwidth (default unidirectional) |
| -V, --version       | Displays version number                                   |
| -g, --grh           | Use GRH with packets (mandatory for RoCE)                 |

## 14.4.2 *ib\_read\_lat*

*ib\_read\_lat* calculates the latency of RDMA read operation of message\_size between a pair of machines. One acts as a server and the other as a client. They perform a ping pong benchmark on which one side RDMA reads the memory of the other side only after the other side have read his memory. Each of the sides samples the CPU clock each time they read the other side memory , in order to calculate latency. Read is available only in RC connection mode (as specified in IB spec).

### 14.4.2.1 *ib\_read\_lat* Synopsis

```
ib_read_lat [-i(b_port) ib_port] [-m(tu) mtu_size] [-s(size) message_size] [-t(x-
depth) tx_size] [-n iteration_num] [-p(ort) PDT_port] [-o(uts) outstanding reads] [-
a(ll)] [-V(ersion)] [-C report cycles] [-H report histogram] [-U report unsorted]
```

### 14.4.2.2 *ib\_read\_lat* Options

The table below lists the various flags of the command.

**Table 37 - *ib\_read\_lat* Flags and Options**

| Flag                               | Description                                               |
|------------------------------------|-----------------------------------------------------------|
| -p, --port=<port>                  | Listens on/connect to port <port> (default 18515)         |
| -d, --ib-dev=<dev>                 | Uses IB device <device guid> (default first device found) |
| -i, --ib-port=<port>               | Uses port <port> of IB device (default 1)                 |
| -m, --mtu=<mtu>                    | The mtu size (default 1024)                               |
| -o, --outs=<num>                   | The number of outstanding read/atom(default 4)            |
| -s, --size=<size>                  | The size of message to exchange (default 65536)           |
| -a, --all                          | Runs sizes from 2 till 2^23                               |
| -t, --tx-depth=<dep>               | The size of tx queue (default 100)                        |
| -n, --iters=<iters>                | The number of exchanges (at least 2, default 1000)        |
| -C, --report-cycles                | Reports times in cpu cycle units (default microseconds)   |
| -H, --report-histogram             | Print out all results (default print summary only)        |
| -U, --report-unsorted (implies -H) | Print out unsorted results (default sorted)               |
| -V, --version                      | Displays version number                                   |

**Table 37 - *ib\_read\_lat* Flags and Options**

| Flag      | Description                               |
|-----------|-------------------------------------------|
| -g, --grh | Use GRH with packets (mandatory for RoCE) |

### 14.4.3 *ib\_send\_bw*

*ib\_send\_bw* calculates the BW of SEND between a pair of machines. One acts as a server and the other as a client. The server receive packets from the client and they both calculate the throughput of the operation. The test supports features such as Bidirectional, on which they both send and receive at the same time, change of mtu size, tx size, number of iteration, message size and more. Using the "-a" provides results for all message sizes.

#### 14.4.3.1 *ib\_send\_bw* Synopsis

```
ib_send_bw [-i(b_port) ib_port] [-c(connection_type) RC\UC\UD] [-m(tu) mtu_size] [-s(size) message_size] [-t(x-depth) tx_size] [-n iteration_num] [-p(ort) PDT_port] [-b(idirectional)] [-a(ll)] [-V(ersion)]
```

#### 14.4.3.2 *ib\_send\_bw* Options

The table below lists the various flags of the command.

**Table 38 - *ib\_send\_bw* Flags and Options**

| Flag                        | Description                                               |
|-----------------------------|-----------------------------------------------------------|
| -p, --port=<port>           | Listens on/connect to port <port> (default 18515)         |
| -d, --ib-dev=<dev>          | Uses IB device <device guid> (default first device found) |
| -i, --ib-port=<port>        | Uses port <port> of IB device (default 1)                 |
| -m, --mtu=<mtu>             | The mtu size (default 1024)                               |
| -c, --connection=<RC/UC/UD> | Connection type RC/UC/UD (default RC)                     |
| -s, --size=<size>           | The size of message to exchange (default 65536)           |
| -a, --all                   | Runs sizes from 2 till 2^23                               |
| -t, --tx-depth=<dep>        | The size of tx queue (default 100)                        |
| -n, --iters=<iters>         | The number of exchanges (at least 2, default 1000)        |
| -b, --bidirectional         | Measures bidirectional bandwidth (default unidirectional) |
| -V, --version               | Displays version number                                   |
| -g, --grh                   | Use GRH with packets (mandatory for RoCE)                 |

### 14.4.4 *ib\_send\_lat*

*ib\_send\_lat* calculates the latency of sending a packet in message\_size between a pair of machines. One acts as a server and the other as a client. They perform a ping pong benchmark on

which you send packet only if you receive one. Each of the sides samples the CPU each time they receive a packet in order to calculate the latency.

#### 14.4.4.1 ib\_send\_lat Synopsis

```
ib_send_lat [-i(b_port) ib_port] [-c(onnnection_type) RC\UC\UD] [-m(tu) mtu_size] [-s(size) message_size] [-t(x-depth) tx_size] [-n iteration_num] [-p(ort) PDT_port] [-a(ll)] [-V(ersion)] [-C report_cycles] [-H report_histogram] [-U report_unsorted]
```

#### 14.4.4.2 ib\_send\_lat Options

The table below lists the various flags of the command.

**Table 39 - ib\_send\_lat Flags and Options**

| Flag                               | Description                                               |
|------------------------------------|-----------------------------------------------------------|
| -p, --port=<port>                  | Listens on/connect to port <port> (default 18515)         |
| -d, --ib-dev=<dev>                 | Uses IB device <device guid> (default first device found) |
| -i, --ib-port=<port>               | Uses port <port> of IB device (default 1)                 |
| -m, --mtu=<mtu>                    | The mtu size (default 1024)                               |
| -c, --connection=<RC/UC/UD>        | Connection type RC/UC/UD (default RC)                     |
| -s, --size=<size>                  | The size of message to exchange (default 65536)           |
| -l, --signal                       | Signal completion on each msg                             |
| -a, --all                          | Runs sizes from 2 till 2 <sup>23</sup>                    |
| -t, --tx-depth=<dep>               | The size of tx queue (default 100)                        |
| -n, --iters=<iters>                | The number of exchanges (at least 2, default 1000)        |
| -C, --report-cycles                | Reports times in cpu cycle units (default microseconds)   |
| -H, --report-histogram             | Print out all results (default print summary only)        |
| -U, --report-unsorted (implies -H) | Print out unsorted results (default sorted)               |
| -V, --version                      | Displays version number                                   |
| -g, --grh                          | Use GRH with packets (mandatory for RoCE)                 |

#### 14.4.5 ib\_write\_bw

ib\_write\_bw calculates the BW of RDMA write between a pair of machines. One acts as a server and the other as a client. The client RDMA writes to the server memory and calculate the BW by sampling the CPU each time it receive a successful completion. The test supports features such as Bidirectional, in which they both RDMA write to each other at the same time, change of mtu size, tx size, number of iteration, message size and more. Using the "-a" flag provides results for all message sizes.



### 14.4.5.1 `ib_write_bw` Synopsis

```
ib_write_bw [-q num of qps] [-c(connection_type) RC\UC] [-i(b_port) ib_port] [-m(tu)
mtu_size] [-s(size) message_size] [-t(x-depth) tx_size] [-n iteration_num] [-p(ort)
PDT_port] [-b(idirectional)] [-a(ll)] [-V(ersion)]
```

### 14.4.5.2 `ib_write_bw` Options

The table below lists the various flags of the command.

**Table 40 - `ib_write_bw` Flags and Options**

| Flag                      | Description                                                     |
|---------------------------|-----------------------------------------------------------------|
| -p, --port=<port>         | Listens on/connect to port <port> (default 18515)               |
| -d, --ib-dev=<dev>        | Uses IB device <device guid> (default first device found)       |
| -i, --ib-port=<port>      | Uses port <port> of IB device (default 1)                       |
| -m, --mtu=<mtu>           | The mtu size (default 1024)                                     |
| -c, --connection=<RC/UC>  | Connection type RC/UC (default RC)                              |
| -s, --size=<size>         | The size of message to exchange (default 65536)                 |
| -a, --all                 | Runs sizes from 2 till 2 <sup>23</sup>                          |
| -t, --tx-depth=<dep>      | The size of tx queue (default 100)                              |
| -n, --iters=<iters>       | The number of exchanges (at least 2, default 1000)              |
| -b, --bidirectional       | Measures bidirectional bandwidth (default unidirectional)       |
| -V, --version             | Displays version number                                         |
| -o, --post=<num of posts> | The number of posts for each qp in the chain (default tx_depth) |
| -q, --qp=<num of qp's>    | The number of qp's (default 1)                                  |
| -g, --grh                 | Use GRH with packets (mandatory for RoCE)                       |

### 14.4.6 `ib_write_lat`

`ib_write_lat` calculates the latency of RDMA write operation of `message_size` between a pair of machines. One acts as a server and the other as a client. They perform a ping pong benchmark on which one side RDMA writes to the other side memory only after the other side wrote on his memory. Each of the sides samples the CPU clock each time they write to the other side memory, in order to calculate latency.

### 14.4.6.1 ib\_write\_lat Synopsis

```
ib_write_lat [-i(b_port) ib_port] [-c(onnexion_type) RC\UC] [-m(tu) mtu_size] [-s(size) message_size] [-t(x-depth) tx_size] [-n iteration_num] [-p(ort) PDT_port] [-a(ll)] [-V(ersion)] [-C report_cycles] [-H report_histogram] [-U report_unsorted]
```

### 14.4.6.2 ib\_write\_lat Options

The table below lists the various flags of the command.

**Table 41 - ib\_write\_lat Flags and Options**

| Flag                               | Description                                               |
|------------------------------------|-----------------------------------------------------------|
| -p, --port=<port>                  | Listens on/connect to port <port> (default 18515)         |
| -d, --ib-dev=<dev>                 | Uses IB device <device guid> (default first device found) |
| -i, --ib-port=<port>               | Uses port <port> of IB device (default 1)                 |
| -m, --mtu=<mtu>                    | The mtu size (default 1024)                               |
| -c, --connection=<RC/UC>           | Connection type RC/UC (default RC)                        |
| -s, --size=<size>                  | The size of message to exchange (default 65536)           |
| -f, --freq=<dep>                   | How often the time stamp is taken                         |
| -a, --all                          | Runs sizes from 2 till 2 <sup>23</sup>                    |
| -t, --tx-depth=<dep>               | The size of tx queue (default 100)                        |
| -n, --iters=<iters>                | The number of exchanges (at least 2, default 1000)        |
| -C, --report-cycles                | Reports times in cpu cycle units (default microseconds)   |
| -H, --report-histogram             | Prints out all results (default print summary only)       |
| -U, --report-unsorted (implies -H) | Prints out unsorted results (default sorted)              |
| -V, --version                      | Displays version number                                   |
| -g, --grh                          | Uses GRH with packets (mandatory for RoCE)                |

### 14.4.7 ibv\_read\_bw

This is a more advanced version of `ib_read_bw` and contains more flags and features than the older version and also improved algorithms. `ibv_read_bw` calculates the BW of RDMA read between a pair of machines. One acts as a server, and the other as a client. The client RDMA reads the server memory and calculate the BW by sampling the CPU each time it receive a successful completion. The test supports a large variety of features as described below, and has better performance than `ib_read_bw` in Nahalem systems. Read is available only in RC connection mode (as specified in the InfiniBand spec).

### 14.4.7.1 ibv\_read\_bw Synopsis

```
ibv_read_bw [-i(b_port) ib_port] [-d ib device] [-o(uts) outstanding reads] [-m(tu)
mtu_size] [-s(ize) message_size] [-t(x-depth) tx_size] [-n iteration_num] [-p(ort)
PDT_port] [-u qp timeout] [-S(l) sl type] [-x gid index] [-e(vents) use
events] [-F CPU freq fail] [-b(idirectional)] [-a(11)] [-V(ersion)]
```

### 14.4.7.2 ibv\_read\_bw Options

The table below lists the various flags of the command.

**Table 42 - ibv\_read\_bw Flags and Options**

| Flag                       | Description                                                                         |
|----------------------------|-------------------------------------------------------------------------------------|
| -p, --port=<port>          | Listens on/connect to port <port> (default 18515)                                   |
| -d, --ib-dev=<dev>         | Uses IB device <device guid> (default first device found)                           |
| -i, --ib-port=<port>       | Uses port <port> of IB device (default 1)                                           |
| -m, --mtu=<mtu>            | The mtu size (default 1024)                                                         |
| -o, --outs=<num>           | The number of outstanding read/atom(default for ConnectX 16 (others 4))             |
| -s, --size=<size>          | The size of message to exchange (default 65536)                                     |
| -a, --all                  | Runs sizes from 2 till 2 <sup>23</sup>                                              |
| -t, --tx-depth=<dep>       | The size of tx queue (default 100)                                                  |
| -n, --iters=<iters>        | The number of exchanges (at least 2, default 1000)                                  |
| -u, --qp-timeout=<timeout> | QP timeout. The timeout value is 4 usec * 2 <sup>^(timeout)</sup> , default 14      |
| -S, --sl=<sl>              | The service level (default 0)                                                       |
| -x, --gid-index=<index>    | Test uses GID with GID index taken from command line (for RDMAoE index should be 0) |
| -b, --bidirectional        | Measures bidirectional bandwidth (default unidirectional)                           |
| -V, --version              | Displays version number                                                             |
| -g, --post=<num of posts>  | The number of posts for each qp in the chain (default tx_depth)                     |
| -e, --events               | Inactive during CQ events (default poll)                                            |
| -F, --CPU-freq             | The CPU frequency test. It is active even if the cpufreq_ondemand module is loaded  |
| -R, --rdma_cm              | Connect QPs with rdma_cm and run test on those QPs                                  |
| -z, --com_rdma_cm          | Communicate with rdma_cm module to exchange data - use regular QPs                  |
| -c, --connection=<RC/UC>   | Connection type RC/UC (default RC)                                                  |
| -I, --inline_size=<size>   | Max size of message to be sent in inline (default 0)                                |

**Table 42 - `ibv_read_bw` Flags and Options**

| Flag             | Description                                    |
|------------------|------------------------------------------------|
| -Q, --cq-mod     | Generate Cqe only after <--cq-mod> completion  |
| -N, --no peak-bw | Cancel peak-bw calculation (default with peak) |

## 14.4.8 `ibv_read_lat`

This is a more advanced version of `ib_read_lat`, and contains more flags and features than the older version and also improved algorithms. `ibv_read_lat` calculates the latency of RDMA read operation of `message_size` between a pair of machines. One acts as a server and the other as a client. They perform a ping pong benchmark on which one side RDMA reads the memory of the other side only after the other side have read his memory. Each of the sides samples the CPU clock each time they read the other side memory, to calculate latency. Read is available only in RC connection mode (as specified in InfiniBand spec).

### 14.4.8.1 `ibv_read_lat` Synopsis

```
ibv_read_lat [-i(b_port) ib_port] [-m(tu) mtu_size] [-s(ize) message_size] [-t(x-
depth) tx_size] [-I(nline_size) inline size] [-u qp timeout] [-S(L) sl type] [-d
ib_device name] [-x gid index] [-n iteration_num] [-o(uts)
outstanding reads] [-e(vents) use events] [-
p(ort) PDT_port] [-a(ll)] [-V(ersion)] [-C report cycles] [-H
report histogram] [-U report unsorted] [-F CPU freq fail]
```

### 14.4.8.2 `ibv_read_lat` Options

The table below lists the various flags of the command.

**Table 43 - `ibv_read_lat` Flags and Options**

| Flag                       | Description                                                                    |
|----------------------------|--------------------------------------------------------------------------------|
| -p, --port=<port>          | Listens on/connect to port <port> (default 18515)                              |
| -d, --ib-dev=<dev>         | Uses IB device <device guid> (default first device found)                      |
| -i, --ib-port=<port>       | Uses port <port> of IB device (default 1)                                      |
| -m, --mtu=<mtu>            | The mtu size (default 1024)                                                    |
| -o, --outs=<num>           | The number of outstanding read/atom (default for ConnectX 16 (others 4))       |
| -s, --size=<size>          | The size of message to exchange (default 65536)                                |
| -a, --all                  | Runs sizes from 2 till 2 <sup>23</sup>                                         |
| -t, --tx-depth=<dep>       | The size of tx queue (default 100)                                             |
| -n, --iters=<iters>        | The number of exchanges (at least 2, default 1000)                             |
| -u, --qp-timeout=<timeout> | QP timeout. The timeout value is 4 usec * 2 <sup>^(timeout)</sup> , default 14 |
| -S, --sl=<sl>              | The service level (default 0)                                                  |

**Table 43 - `ibv_read_lat` Flags and Options**

| Flag                               | Description                                                                         |
|------------------------------------|-------------------------------------------------------------------------------------|
| -x, --gid-index=<index>            | Test uses GID with GID index taken from command line (for RDMAoE index should be 0) |
| -C, --report-cycles                | Reports times in cpu cycle units (default microseconds)                             |
| -H, --report-histogram             | Prints out all results (default print summary only)                                 |
| -U, --report-unsorted (implies -H) | Prints out unsorted results (default sorted)                                        |
| -V, --version                      | Displays version number                                                             |
| -e, --events                       | Inactive during CQ events (default poll)                                            |
| -F, --CPU-freq                     | The CPU frequency test. It is active even if the cpufreq_ondemand module is loaded  |
| -R, --rdma_cm                      | Connects QPs with rdma_cm and run test on those QPs                                 |
| -z, --com_rdma_cm                  | Communicates with rdma_cm module to exchange data - use regular QPs                 |
| -c, --connection=<RC/UC>           | Connection type RC/UC (default RC)                                                  |
| -I, --inline_size=<size>           | Max size of message to be sent in inline (default 400)                              |

## 14.4.9 `ibv_send_bw`

This is a more advanced version of `ib_send_bw` and contains more flags and features than the older version and also improved algorithms. `ibv_send_bw` calculates the BW of SEND between a pair of machines. One acts as a server and the other as a client. The server receive packets from the client and they both calculate the throughput of the operation. The test supports a large variety of features as described below, and has better performance than `ib_send_bw` in Nehalem systems.

### 14.4.9.1 `ibv_send_bw` Synopsis

```
ibv_send_bw [-i(b_port) ib_port] [-d ib device] [-c(onnexion_type) RC\UC\UD] [-m(tu) mtu_size] [-s(ize) message_size] [-t(x-depth) tx_size] [-r(x_dpeth) rx_size]
[-n iteration_num] [-p(ort) PDT_port] [-I(nline_size) inline size] [-u qp timeout]
[-S(l) sl type] [-x gid index] [-e(vents) use events] [-N(o_peak) use peak calc] [-F CPU freq fail] [-g num of qps in mcast group] [-M mcast gid] [-b(idirectional)] [-a(ll)] [-V(ersion)]
```

### 14.4.9.2 `ibv_send_bw` Options

The table below lists the various flags of the command.

**Table 44 - `ibv_send_bw` Flags and Options**

| Flag               | Description                                               |
|--------------------|-----------------------------------------------------------|
| -p, --port=<port>  | Listens on/connect to port <port> (default 18515)         |
| -d, --ib-dev=<dev> | Uses IB device <device guid> (default first device found) |

**Table 44 - `ibv_send_bw` Flags and Options**

| Flag                        | Description                                                                                                                                       |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| -i, --ib-port=<port>        | Uses port <port> of IB device (default 1)                                                                                                         |
| -m, --mtu=<mtu>             | The mtu size (default 1024)                                                                                                                       |
| -c, --connection=<RC/UC/UD> | Connection type RC/UC/UD (default RC)                                                                                                             |
| -s, --size=<size>           | The size of message to exchange (default 65536)                                                                                                   |
| -a, --all                   | Runs sizes from 2 till 2 <sup>23</sup>                                                                                                            |
| -t, --tx-depth=<dep>        | The size of tx queue (default 100)                                                                                                                |
| -n, --iters=<iters>         | The number of exchanges (at least 2, default 1000)                                                                                                |
| -u, --qp-timeout=<timeout>  | QP timeout. The timeout value is 4 usec * 2 <sup>^(timeout)</sup> , default 14                                                                    |
| -S, --sl=<sl>               | The service level (default 0)                                                                                                                     |
| -x, --gid-index=<index>     | Test uses GID with GID index taken from command line (for RDMAoE index should be 0)                                                               |
| -b, --bidirectional         | Measures bidirectional bandwidth (default unidirectional)                                                                                         |
| -V, --version               | Displays version number                                                                                                                           |
| -g, --post=<num of posts>   | The number of posts for each qp in the chain (default tx_depth)                                                                                   |
| -e, --events                | Inactive during CQ events (default poll)                                                                                                          |
| -F, --CPU-freq              | The CPU frequency test. It is active even if the cpufreq_ondemand module is loaded                                                                |
| -r, --rx-depth=<dep>        | Makes rx queue bigger than tx (default 600)                                                                                                       |
| -I, --inline_size=<size>    | The maximum size of message to be sent in “inline mode” (default 0)                                                                               |
| -N, --no peak-bw            | Cancel peak-bw calculation (default with peak-bw)                                                                                                 |
| -g, --mcg=<num_of_qps>      | Sends messages to multicast group with <num_of_qps> qps attached to it.                                                                           |
| -M, --MGID=<multicast_gid>  | In case of multicast, uses <multicast_gid> as the group MGID. The format must be '255:1:X:X:X:X:X:X:X:X:X:X:X', where X is a value within [0,255] |
| -R, --rdma_cm               | Connects QPs with rdma_cm and run test on those QPs                                                                                               |
| -z, --com_rdma_cm           | Communicates with rdma_cm module to exchange data - use regular QPs                                                                               |
| -Q, --cq-mod                | Generates Cqe only after <--cq-mod> completion                                                                                                    |

#### 14.4.10 `ibv_send_lat`

This is a more advanced version of `ib_send_lat` and contains more flags and features than the older version and also improved algorithms. `ibv_send_lat` calculates the latency of sending a packet in `message_size` between a pair of machines. One acts as a server and the other as a client.

They perform a ping pong benchmark on which you send packet only after you receive one. Each of the sides samples the CPU clock each time they receive a send packet, in order to calculate the latency.

#### 14.4.10.1 `ibv_send_lat` Synopsis

```
ibv_send_lat [-i(b_port) ib_port] [-c(onnexion_type) RC\UC\UD] [-d ib_device name]
[-m(tu) mtu_size] [-s(ize) message_size] [-t(x-depth) tx_size] [-
I(nline_size) inline size] [-u qp timeout] [-S(L) sl
type] [-x gid index] [-e(events) use events] [-n
iteration_num] [-g num of qps in mcast
group] [-p(ort) PDT_port] [-a(ll)] [-V(ersion)] [-C report
cycles] [-H report histogram] [-U report unsorted] [-F
CPU freq fail]
```

#### 14.4.10.2 `ibv_send_lat` Options

The table below lists the various flags of the command.

**Table 45 - `ibv_send_lat` Flags and Options**

| Flag                               | Description                                                                         |
|------------------------------------|-------------------------------------------------------------------------------------|
| -p, --port=<port>                  | Listens on/connect to port <port> (default 18515)                                   |
| -d, --ib-dev=<dev>                 | Uses IB device <device guid> (default first device found)                           |
| -i, --ib-port=<port>               | Uses port <port> of IB device (default 1)                                           |
| -m, --mtu=<mtu>                    | The mtu size (default 1024)                                                         |
| -c, --connection=<RC/UC/UD>        | Connection type RC/UC/UD (default RC)                                               |
| -s, --size=<size>                  | The size of message to exchange (default 65536)                                     |
| -a, --all                          | Runs sizes from 2 till 2 <sup>23</sup>                                              |
| -t, --tx-depth=<dep>               | The size of tx queue (default 100)                                                  |
| -n, --iters=<iters>                | The number of exchanges (at least 2, default 1000)                                  |
| -u, --qp-timeout=<timeout>         | QP timeout. The timeout value is 4 usec * 2 <sup>^(timeout)</sup> , default 14      |
| -S, --sl=<sl>                      | The service level (default 0)                                                       |
| -x, --gid-index=<index>            | Test uses GID with GID index taken from command line (for RDMAoE index should be 0) |
| -C, --report-cycles                | Reports times in cpu cycle units (default microseconds)                             |
| -H, --report-histogram             | Print out all results (default print summary only)                                  |
| -U, --report-unsorted (implies -H) | Print out unsorted results (default sorted)                                         |
| -V, --version                      | Displays version number                                                             |
| -F, --CPU-freq                     | The CPU frequency test. It is active even if the cpufreq_ondemand module is loaded  |

**Table 45 - *ibv\_send\_lat* Flags and Options**

| Flag                       | Description                                                                                                                                                                                                           |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| -g, --post=<num of posts>  | The number of posts for each qp in the chain (default tx_depth)                                                                                                                                                       |
| -I, --inline_size=<size>   | The maximum size of message to be sent in “inline mode” (default 0)                                                                                                                                                   |
| -e, --events               | Inactive during CQ events (default poll)                                                                                                                                                                              |
| -g, --mcg=<num_of_qps>     | Sends messages to multicast group with <num_of_qps> qps attached to it.                                                                                                                                               |
| -M, --MGID=<multicast_gid> | In case of multicast, uses <multicast_gid> as the group MGID. The format must be '255:1:X:X:X:X:X:X:X:X:X:X:X', where X is a value within [0,255]. You must specify a different MGID on both sides to avoid loopback. |
| -R, --rdma_cm              | Connect QPs with rdma_cm and run test on those QPs                                                                                                                                                                    |
| -z, --com_rdma_cm          | Communicate with rdma_cm module to exchange data - use regular QPs                                                                                                                                                    |

#### 14.4.11 *ibv\_write\_bw*

This is a more advanced version of *ib\_write\_bw*, and contains more flags and features than the older version and also improved algorithms. *ibv\_write\_bw* calculates the BW of RDMA write between a pair of machines. One acts as a server and the other as a client. The client RDMA writes to the server memory and calculate the BW by sampling the CPU each time it receives a successful completion. The test supports a large variety of features as described below, and has better performance than *ib\_write\_bw* in Nehalem systems.

##### 14.4.11.1 *ibv\_write\_bw* Synopsis

```
ibv_write_bw [-i(b_port) ib_port] [-d ib device] [-c(onnexion_type) RC\UC] [-m(tu)
mtu_size] [-s(ize) message_size] [-t(x-depth) tx_size] [-n iteration_num] [-p(ort)
PDT_port] [-I(nline_size) inline size] [-u qp timeout] [-S(l) sl
type] [-x gid index] [-e(vents) use events] [-N(o_peak) use peak
calc] [-F CPU freq fail] [-g num
of posts] [-q num of qps] [-b(idirectional)] [-a(11)]
[-V(ersion)]
```

##### 14.4.11.2 *ibv\_write\_bw* Options

The table below lists the various flags of the command.

**Table 46 - *ibv\_write\_bw* Flags and Options**

| Flag                 | Description                                               |
|----------------------|-----------------------------------------------------------|
| -p, --port=<port>    | Listens on/connect to port <port> (default 18515)         |
| -d, --ib-dev=<dev>   | Uses IB device <device guid> (default first device found) |
| -i, --ib-port=<port> | Uses port <port> of IB device (default 1)                 |
| -m, --mtu=<mtu>      | The mtu size (default 1024)                               |



**Table 46 - ibv\_write\_bw Flags and Options**

| Flag                       | Description                                                                         |
|----------------------------|-------------------------------------------------------------------------------------|
| -c, --connection=<RC/UC>   | Connection type RC/UC(default RC)                                                   |
| -s, --size=<size>          | The size of message to exchange (default 65536)                                     |
| -a, --all                  | Runs sizes from 2 till 2 <sup>23</sup>                                              |
| -t, --tx-depth=<dep>       | The size of tx queue (default 100)                                                  |
| -n, --iters=<iters>        | The number of exchanges (at least 2, default 1000)                                  |
| -u, --qp-timeout=<timeout> | QP timeout. The timeout value is 4 usec * 2 <sup>^(timeout)</sup> , default 14      |
| -S, --sl=<sl>              | The service level (default 0)                                                       |
| -x, --gid-index=<index>    | Test uses GID with GID index taken from command line (for RDMAoE index should be 0) |
| -b, --bidirectional        | Measures bidirectional bandwidth (default unidirectional)                           |
| -V, --version              | Displays version number                                                             |
| -g, --post=<num of posts>  | The number of posts for each qp in the chain (default tx_depth)                     |
| -F, --CPU-freq             | The CPU frequency test. It is active even if the cpufreq_ondemand module is loaded  |
| -q, --qp=<num of qp's>     | The number of qp's (default 1)                                                      |
| -I, --inline_size=<size>   | The maximum size of message to be sent in “inline mode” (default 0)                 |
| -N, --no peak-bw           | Cancel peak-bw calculation (default with peak-bw)                                   |
| -R, --rdma_cm              | Connect QPs with rdma_cm and run test on those QPs                                  |
| -z, --com_rdma_cm          | Communicate with rdma_cm module to exchange data - use regular QPs                  |
| -Q, --cq-mod               | Generate Cqe only after <--cq-mod> completion                                       |

#### 14.4.12 ibv\_write\_lat

This is a more advanced version of `ib_write_lat` and contains more flags and features than the older version and also improved algorithms. `ibv_write_lat` calculates the latency of RDMA write operation of message\_size between a pair of machines. One acts as a server, and the other as a client. They perform a ping pong benchmark on which one side RDMA writes to the other side memory only after the other side wrote on his memory. Each of the sides samples the CPU clock each time they write to the other side memory to calculate latency.

### 14.4.12.1 `ibv_write_lat` Synopsis

```
ibv_write_lat [-i(b_port) ib_port] [-c(connection_type) RC\UC\UD] [-m(tu) mtu_size]
[-s(ize) message_size] [-t(x-depth) tx_size] [-I(nline_size) inline
size] [-u qp timeout] [-S(L) sl type] [-d ib_device name] [-x gid index] [-n
iteration_num] [-p(ort) PDT_port] [-a(ll)]
[-V(ersion)] [-C report cycles] [-H report histogram] [-U
report unsorted]
```

### 14.4.12.2 `ibv_write_lat` Options

The table below lists the various flags of the command.

**Table 47 - `ibv_write_lat` Flags and Options**

| Flag                               | Description                                                                         |
|------------------------------------|-------------------------------------------------------------------------------------|
| -p, --port=<port>                  | Listens on/connect to port <port> (default 18515)                                   |
| -d, --ib-dev=<dev>                 | Uses IB device <device guid> (default first device found)                           |
| -i, --ib-port=<port>               | Uses port <port> of IB device (default 1)                                           |
| -m, --mtu=<mtu>                    | The mtu size (default 1024)                                                         |
| -c, --connection=<RC/UC>           | Connection type RC/UC (default RC)                                                  |
| -s, --size=<size>                  | The size of message to exchange (default 65536)                                     |
| -a, --all                          | Runs sizes from 2 till 2 <sup>23</sup>                                              |
| -t, --tx-depth=<dep>               | The size of tx queue (default 100)                                                  |
| -n, --iters=<iters>                | The number of exchanges (at least 2, default 1000)                                  |
| -u, --qp-timeout=<timeout>         | QP timeout. The timeout value is 4 usec * 2 <sup>(timeout)</sup> , default 14       |
| -S, --sl=<sl>                      | The service level (default 0)                                                       |
| -x, --gid-index=<index>            | Test uses GID with GID index taken from command line (for RDMAoE index should be 0) |
| -C, --report-cycles                | Reports times in cpu cycle units (default microseconds)                             |
| -H, --report-histogram             | Print out all results (default print summary only)                                  |
| -U, --report-unsorted (implies -H) | Print out unsorted results (default sorted)                                         |
| -V, --version                      | Displays version number                                                             |
| -F, --CPU-freq                     | The CPU frequency test. It is active even if the cpufreq_ondemand module is loaded  |
| -I, --inline_size=<size>           | The maximum size of message to be sent in “inline mode” (default 0)                 |
| -R, --rdma_cm                      | Connects QPs with rdma_cm and run test on those QPs                                 |
| -z, --com_rdma_cm                  | Communicates with rdma_cm module to exchange data - use regular QPs                 |

### 14.4.13 nd\_write\_bw

This test is used for performance measuring of RDMA-Write requests in Microsoft Windows Operating Systems. `nd_write_bw` is performance oriented for RDMA-Write with maximum throughput, and runs over Microsoft's NetworkDirect standard. The level of customizing for the user is relatively high. User may choose to run with a customized message size, customized number of iterations, or alternatively, customized test duration time. `nd_write_bw` runs with all message sizes from 1B to 4MB (powers of 2), message inlining, CQ moderation.

#### 14.4.13.1nd\_write\_bw Synopsis

```
<running on specific single core>
Server side: start /b /affinity 0x1 nd_write_bw -s1048576 -D10 -S 11.137.53.1
Client side: start /b /wait /affinity 0x1 nd_write_bw -s1048576 -D10 -C 11.137.53.1
```

#### 14.4.13.2nd\_write\_bw Options

The table below lists the various flags of the command.

**Table 48 - nd\_write\_bw Flags and Options**

Flag	Description
-h	Shows the Help screen.
-v	Shows the version number.
-p	Connects to the port <port> <default 6830>.
-s <msg size>	Exchanges the message size with <default 65536B>, and it must not be combined with -a flag.
-a	Runs all the messages' sizes from 1B to 8MB, and it must not be combined with -s flag.
-n <num of iterations>	The number of exchanges (at least 2, the default is 100000)
-I <max inline size>	The maximum size of message to send inline. The default number is 128B.
-D <test duration in seconds>	Tests duration in seconds.
-f <margin time in seconds>	The margin time to avoid calculation, and it must be less than half of the duration time.
-Q	CQ-Moderation <value>. The default number is 100.
-S <server interface IP>	<server side only, must be last parameter>
-C <server interface IP>	<client side only, must be last parameter>

### 14.4.14 nd\_write\_lat

This test is used for performance measuring of RDMA-Write requests in Microsoft Windows Operating Systems. `nd_write_lat` is performance oriented for RDMA-Write with minimum

latency, and runs over Microsoft's NetworkDirect standard. The level of customizing for the user is relatively high. User may choose to run with a customized message size, customized number of iterations, or alternatively, customized test duration time. `nd_write_lat` runs with all message sizes from 1B to 4MB (powers of 2), message inlining, CQ moderation.

#### 14.4.14.1 `nd_write_lat` Synopsis

```
<running on specific single core>
Server side: start /b /affinity 0X1 nd_write_lat -s1048576 -D10 -S 11.137.53.1
Client side: start /b /wait /affinity 0X1 nd_write_lat -s1048576 -D10 -C 11.137.53.1
```

#### 14.4.14.2 `nd_write_lat` Options

The table below lists the various flags of the command.

**Table 49 - `nd_write_lat` Options**

Flag	Description
-h	Shows the Help screen.
-v	Shows the version number.
-p	Connects to the port <port> <default 6830>.
-s <msg size>	Exchanges the message size with <default 65536B>, and it must not be combined with -a flag.
-a	Runs all the messages' sizes from 1B to 8MB, and it must not be combined with -s flag.
-n <num of iterations>	The number of exchanges (at least 2, the default is 100000)
-I <max inline size>	The maximum size of message to send inline. The default number is 128B.
-D <test duration in seconds>	Tests duration in seconds.
-f <margin time in seconds>	The margin time to avoid calculation, and it must be less than half of the duration time.
-S <server interface IP>	<server side only, must be last parameter>
-C <server interface IP>	<client side only, must be last parameter>
-h	Shows the Help screen.

#### 14.4.15 `nd_read_bw`

This test is used for performance measuring of RDMA-Read requests in Microsoft Windows Operating Systems. `nd_read_bw` is performance oriented for RDMA-Read with maximum throughput, and runs over Microsoft's NetworkDirect standard. The level of customizing for the user is relatively high. User may choose to run with a customized message size, customized number of iterations, or alternatively, customized test duration time. `nd_read_bw` runs with all message sizes from 1B to 4MB (powers of 2), message inlining, CQ moderation.

### 14.4.15.1nd\_read\_bw Synopsis

```
<running on specific single core>
Server side: start /b /affinity 0X1 nd_read_bw -s1048576 -D10 -S 11.137.53.1
Client side: start /b /wait /affinity 0X1 nd_read_bw -s1048576 -D10 -C 11.137.53.1
```

### 14.4.15.2nd\_read\_bw Options

The table below lists the various flags of the command.

**Table 50 - nd\_read\_bw Options**

Flags	Description
-h	Shows the Help screen.
-v	Shows the version number.
-p	Connects to the port <port> <default 6830>.
-s <msg size>	Exchanges the message size with <default 65536B>, and it must not be combined with -a flag.
-a	Runs all the messages' sizes from 1B to 8MB, and it must not be combined with -s flag.
-n <num of iterations>	The number of exchanges (at least 2, the default is 100000)
-I <max inline size>	The maximum size of message to send inline. The default number is 128B.
-D <test duration in seconds>	Tests duration in seconds.
-f <margin time in seconds>	The margin time to avoid calculation, and it must be less than half of the duration time.
-Q	CQ-Moderation <value>. The default number is 100.
-S <server interface IP>	<server side only, must be last parameter>
-C <server interface IP>	<client side only, must be last parameter>
-h	Shows the Help screen.

### 14.4.16 nd\_read\_lat

This test is used for performance measuring of RDMA-Read requests in Microsoft Windows Operating Systems. nd\_read\_lat is performance oriented for RDMA-Read with minimum latency, and runs over Microsoft's NetworkDirect standard. The level of customizing for the user is relatively high. User may choose to run with a customized message size, customized number of iterations, or alternatively, customized test duration time. nd\_read\_lat runs with all message sizes from 1B to 4MB (powers of 2), message inlining, CQ moderation.

### 14.4.16.1nd\_read\_lat SynopsisSynopsis

```
<running on specific single core>
Server side: start /b /affinity 0X1 nd_read_lat -s1048576 -D10 -S 11.137.53.1
Client side: start /b /wait /affinity 0X1 nd_read_lat -s1048576 -D10 -C 11.137.53.1
```

### 14.4.16.2nd\_read\_lat Options

The table below lists the various flags of the command.

**Table 51 - nd\_read\_lat Options**

Flags	Description
-h	Shows the Help screen.
-v	Shows the version number.
-p	Connects to the port <port> <default 6830>.
-s <msg size>	Exchanges the message size with <default 65536B>, and it must not be combined with -a flag.
-a	Runs all the messages' sizes from 1B to 8MB, and it must not be combined with -s flag.
-n <num of iterations>	The number of exchanges (at least 2, the default is 100000)
-I <max inline size>	The maximum size of message to send inline. The default number is 128B.
-D <test duration in seconds>	Tests duration in seconds.
-f <margin time in seconds>	The margin time to avoid calculation, and it must be less than half of the duration time.
-S <server interface IP>	<server side only, must be last parameter>
-C <server interface IP>	<client side only, must be last parameter>
-h	Shows the Help screen.

### 14.4.17 nd\_send\_bw

This test is used for performance measuring of Send requests in Microsoft Windows Operating Systems. nd\_send\_bw is performance oriented for Send with maximum throughput, and runs over Microsoft's NetworkDirect standard. The level of customizing for the user is relatively high. User may choose to run with a customized message size, customized number of iterations, or alternatively, customized test duration time. nd\_send\_bw runs with all message sizes from 1B to 4MB (powers of 2), message inlining, CQ moderation.

### 14.4.17.1nd\_send\_bw Synopsis

```
<running on specific single core>
Server side: start /b /affinity 0X1 nd_send_bw -s1048576 -D10 -S 11.137.53.1
Client side: start /b /wait /affinity 0X1 nd_send_bw -s1048576 -D10 -C 11.137.53.1
```

### 14.4.17.2nd\_send\_bw Options

The table below lists the various flags of the command.

**Table 52 - nd\_send\_bw Flags and Options**

Flag	Description
-h	Shows the Help screen.
-v	Shows the version number.
-p	Connects to the port <port> <default 6830>.
-s <msg size>	Exchanges the message size with <default 65536B>, and it must not be combined with -a flag.
-a	Runs all the messages' sizes from 1B to 8MB, and it must not be combined with -s flag.
-n <num of iterations>	The number of exchanges (at least 2, the default is 100000)
-I <max inline size>	The maximum size of message to send inline. The default number is 128B.
-D <test duration in seconds>	Tests duration in seconds.
-f <margin time in seconds>	The margin time to avoid calculation, and it must be less than half of the duration time.
-Q	CQ-Moderation <value>. The default number is 100.
-S <server interface IP>	<server side only, must be last parameter>
-C <server interface IP>	<client side only, must be last parameter>

### 14.4.18 nd\_send\_lat

This test is used for performance measuring of Send requests in Microsoft Windows Operating Systems. nd\_send\_lat is performance oriented for Send with minimum latency, and runs over Microsoft's NetworkDirect standard. The level of customizing for the user is relatively high. User may choose to run with a customized message size, customized number of iterations, or alternatively, customized test duration time. nd\_send\_lat runs with all message sizes from 1B to 4MB (powers of 2), message inlining, CQ moderation.

### 14.4.18.1nd\_send\_lat Synopsis

```
<running on specific single core>
Server side: start /b /affinity 0X1 nd_send_lat -s1048576 -D10 -S 11.137.53.1
Client side: start /b /wait /affinity 0X1 nd_send_lat -s1048576 -D10 -C 11.137.53.1
```

### 14.4.18.2nd\_send\_lat Options

The table below lists the various flags of the command.

**Table 53 - nd\_send\_lat Options**

Flag	Description
-h	Shows the Help screen.
-v	Shows the version number.
-p	Connects to the port <port> <default 6830>.
-s <msg size>	Exchanges the message size with <default 65536B>, and it must not be combined with -a flag.
-a	Runs all the messages' sizes from 1B to 8MB, and it must not be combined with -s flag.
-n <num of iterations>	The number of exchanges (at least 2, the default is 100000)
-I <max inline size>	The maximum size of message to send inline. The default number is 128B.
-D <test duration in seconds>	Tests duration in seconds.
-f <margin time in seconds>	The margin time to avoid calculation, and it must be less than half of the duration time.
-S <server interface IP>	<server side only, must be last parameter>
-C <server interface IP>	<client side only, must be last parameter>
-h	Shows the Help screen.

### 14.4.19 NTttcp

NTttcp is a Windows base testing application that sends and receives TCP data between two or more endpoints. It is a Winsock-based port of the ttcp tool that measures networking performance bytes/second.

To download the latest version of NTttcp (5.28), please refer to Microsoft website following the link below:

<http://gallery.technet.microsoft.com/NTttcp-Version-528-Now-f8b12769>



This tool should be run from cmd only.



### 14.4.19.1NTttcp Synopsis

```
Server: ntttcp_x64.exe -r -t 15 -m 16,*,<interface IP>
Client: ntttcp_x64.exe -s -t 15 -m 16,*,<same address as above>
```

### 14.4.19.2NTttcp Options

The table below lists the various flags of the command.

**Table 54 - NTttcp Options**

Flags	Description
-s	Works as a sender
-r	Works as a receiver
-l	<Length of buffer> [default TCP: 64K, UDP: 128]
-n	<Number of buffers> [default: 20K]
-p	<port base> [default: 5001]
-sp	Synchronizes data ports, if used -p should be same on every instance
-a	<outstanding I/O> [default: 2]
-x	<PacketArray size> [default: 1]
-rb	<Receive buffer size> [default: 64K]
-sb	<Send buffer size> [default: 8K]
-u	UDP send/recv
-w	WSARecv/WSASend
-d	Verifies Flag
-t	<Runtime> in seconds.
-cd	<Cool-down> in seconds
-wu	<Warm-up> in seconds
-nic	<NIC IP> Use NIC with for sending data (sender only).
-m	<mapping> [mapping]

## 15 Troubleshooting

### 15.1 InfiniBand Troubleshooting

**Issue 1.** The InfiniBand interfaces are not up after the first reboot after the installation process is completed.

**Suggestion:** To troubleshoot this issue, follow the steps below:

1. Check that the InfiniBand driver is running on all nodes by using “vstat”. The vstat utility located at <installation\_directory>\tools, displays the status and capabilities of the network adaptor card(s).
2. On the command line, enter “vstat” (use -h for options) to retrieve information about one or more adapter ports. The field port\_state will be equal to:
  - PORT\_DOWN - when there is no InfiniBand cable ("no link");
  - PORT\_INITIALIZED - when the port is connected to some other port ("physical link");
  - PORT\_ACTIVE - when the port is connected and OpenSM is running ("logical link")
  - PORT\_ARMED - when the port is connected to some other port ("physical link");
3. Run “sminfo” and verify that OpenSM is running.  
In case OpenSM is not running, please see OpenSM operation instructions in [Section 12, “OpenSM - Subnet Manager”, on page 98](#) above.
4. Verify the status of ports by using vstat: All connected ports should report "PORT\_ACTIVE" state.

### 15.2 Ethernet Troubleshooting

**Issue 1.** The installation of Win OFED VPI for Windows fails with the following error message:

This installation package is not supported by this processor type. Contact your product vendor."

**Suggestion:** This message is printed if you have downloaded and attempted to install an incorrect driver version-- for example, if you are trying to install a 64-bit driver on a 32-bit machine (or vice versa).

**Issue 2.** The performance is low.

**Suggestion:** This can be due to non-optimal system configuration. See the section "Performance Tuning" to take advantage of Mellanox 40/10 GBit NIC performance.

**Issue 3.** The driver does not start.

**Suggestion 1:** This can happen due to an RSS configuration mismatch between the TCP stack and the Mellanox adapter. To confirm this scenario, open the event log and look under "System" for the "mlx4ethX" source. If found, enable RSS as follows:

1. Run the following command: "netsh int tcp set global rss = enabled".

**Suggestion 2:** This is a less recommended suggestion, and will cause low performance. To disable RSS on the adapter, run the following command: "netsh int tcp set global rss = no dynamic balancing".

**Issue 4.** The Ethernet driver fails to start. In the Event log, under the mlx4\_bus source, the following error message appears: RUN\_FW command failed with error -22

**Suggestion:** The error message indicates that the wrong firmware image has been programmed on the adapter card.

See [Section 2, "Downloading Mellanox WinOF Driver,"](#) on page 17.

**Issue 5.** The Ethernet driver fails to start. A yellow sign appears near the "Mellanox ConnectX 10Gb Ethernet Adapter" in the Device Manager display.

**Suggestion:** This can happen due to a hardware error. Try to disable and re-enable "Mellanox ConnectX Adapter" from the Device Manager display.

**Issue 6.** No connectivity to a Fault Tolerance bundle while using network capture tools (e.g., Wireshark).

**Suggestion:** This can happen if the network capture tool captures the network traffic of the non-active adapter in the bundle. This is not allowed since the tool sets the packet filter to "promiscuous", thus causing traffic to be transferred on multiple interfaces. Close the network capture tool on the physical adapter card, and set it on the LBFO interface instead.

**Issue 7.** No Ethernet connectivity on 10Gb adapters after activating Performance Tuning (part of the installation).

**Suggestion:** This can happen due to adding a TcpWindowSize registry value. To resolve this issue, remove the value key under HKEY\_LOCAL\_MACHINE\SYSTEM\CurrentControlSet\Services\Tcpip\Parameters\TcpWindowSize or set its value to 0xFFFF.

**Issue 8.** Packets are being lost.

**Suggestion:** This may occur if the port MTU has been set to a value higher than the maximum MTU supported by the switch.

**Issue 9.** Issue(s) not listed above.

The MLNX\_EN for Windows driver records events in the system log of the Windows event system. Using the event log you'll be able to identify, diagnose, and predict sources of system problems.

**Suggestion:** To see the log of events, open System Event Viewer as follows:

1. Right click on My Computer, click Manage, and then click Event Viewer.

OR

1. Click start-->Run and enter "eventvwr.exe".

2. In Event Viewer, select the system log.

The following events are recorded:

- Mellanox ConnectX EN 10Gbit Ethernet Adapter <X> has been successfully initialized and enabled.
- Failed to initialize Mellanox ConnectX EN 10Gbit Ethernet Adapter.
- Mellanox ConnectX EN 10Gbit Ethernet Adapter <X> has been successfully initialized and enabled. The port's network address is <MAC Address>
- The Mellanox ConnectX EN 10Gbit Ethernet was reset.
- Failed to reset the Mellanox ConnectX EN 10Gbit Ethernet NIC. Try disabling then re-enabling the "Mellanox Ethernet Bus Driver" device via the Windows device manager.
- Mellanox ConnectX EN 10Gbit Ethernet Adapter <X> has been successfully stopped.
- Failed to initialize the Mellanox ConnectX EN 10Gbit Ethernet Adapter <X> because it uses old firmware version (<old firmware version>). You need to burn firmware version <new firmware version> or higher, and to restart your computer.

- Mellanox ConnectX EN 10Gbit Ethernet Adapter <X> device detected that the link connected to port <Y> is up, and has initiated normal operation.
- Mellanox ConnectX EN 10Gbit Ethernet Adapter <X> device detected that the link connected to port <Y> is down. This can occur if the physical link is disconnected or damaged, or if the other end-port is down.
- Mismatch in the configurations between the two ports may affect the performance. When Using MSI-X, both ports should use the same RSS mode. To fix the problem, configure the RSS mode of both ports to be the same in the driver GUI.
- Mellanox ConnectX EN 10Gbit Ethernet Adapter <X> device failed to create enough MSI-X vectors. The Network interface will not use MSI-X interrupts. This may affect the performance. To fix the problem, configure the number of MSI-X vectors in the registry to be at least <Y>.

#### Issue 10. SR-IOV Environment

In SR-IOV environment, Mellanox driver fails to load a host machine.

Symptom: In SR-IOV environment, Mellanox bus driver fails to load and appears with yellow bang in Device Manager. Clicking on the properties will show the reason:

"This device cannot find enough free resources that it can use. (Code 12) If you want to use this device, you will need to disable one of the other devices on this system."

**Suggestion:** This happens because the BAR space required by device cannot be satisfied by the system. To resolve this issue, please follow the following steps:

**Step 1.** Boot to BIOS and disable SR-IOV

**Step 2.** Burn Firmware with lower number of VFs.

**Step 3.** Re-enable SR-IOV in BIOS.

For more information, please contact Mellanox support.

#### Issue 11. NVGRE configuration

Due to an OS issue, NVGRE changes done on a running VM, are not propagated and do not take effect until OS is restarted.

**Suggestion:** Change of NVGRE configuration on VM connected to the SR-IOV-enabled virtual switch can be done only when VM is stopped.

## 15.3 Performance Troubleshooting

#### Issue 1. Windows Settings

**Suggestion 1:** In Windows 2012 and above, when a kernel debugger is configured (not necessarily physically connected), flow control is disabled unless the following registry key is set (reboot required after setting):

Registry Path: HKLM\SYSTEM\CurrentControlSet\Services\NDIS\Parameters

Type: REG\_DWORD

Key name: AllowFlowControlUnderDebugger

Value: 1

**Suggestion 2:** Go to "Power Options" in the "Control Panel". Make sure "Maximum Performance" is set as the power scheme, reboot is needed.

#### Issue 2. General Diagnostic

**Suggestion 1:** Go to "Device Manager", locate the Mellanox adapter that you are debugging, right-click and go to "Information":

- PCI Gen 2: should appear as "PCI-E 5.0 GT/s"
- PCI Gen 3: should appear as "PCI-E 8.0 GT/s"
- Link Speed: 40.0Gbps/10.0Gbps

**Suggestion 2:** To determine if the Mellanox NIC and PCI bus can achieve their maximum speed, it's best to run `ib_send_bw` in a loopback. On the same machine:

1. Run `start /b /affinity 0x1 ibv_write_bw`
2. Run `start /b /affinity 0x2 ibv_write_bw 127.0.0.1`
3. Repeat for port 2 with additional `-p2`, and for other cards if necessary.
4. On PCI Gen3 the expected result is around 5700MB/s

On PCI Gen2 the expected result is around 3300MB/s

Any number lower than that points to bad configuration or installation on the wrong PCI slot. Malfunctioning QoS settings and Flow Control can be the cause as well.

**Suggestion 3:** To determine the maximum speed between the two sides with the most basic test:

1. Run `ib_send_bw` on machine 1
2. Run `ib_send_bw <host1>` on machine 2 where `<host1>` is the hostname for machine 1.
3. Results appear in MB/s (Mega Bytes 2<sup>20</sup>), and reflect the actual data that was transferred, excluding headers.
4. If these results are not as expected, the problem is most probably with one or more of the following:
  - Old Firmware version.
  - Misconfigured Flow-control: Global pause or PFC is configured wrong on the hosts, routers and switches. See [Section 8.7, "RDMA over Converged Ethernet \(RoCE\),"](#) on page 48
  - CPU/power options are not set to "Maximum Performance".

### Issue 3. QoS and Flow-control

Flow control settings can greatly affect results. In order to see configured settings for all of the QoS options, open a PowerShell prompt and use `Get-NetAdapterQos`

To achieve maximum performance all of the following must exist:

1. All of the hosts, switches and routers should use the same matching flow control settings. If Global-pause is used, all devices must be configured for it. If PFC (Priority Flow-control) is used all devices must have matching settings for all priorities.
2. ETS settings that limit speed of some priorities will greatly affect the output results.
3. Make sure Flow-Control is enabled on the Mellanox Interfaces (enabled by default). Go to the device manager, right click the Mellanox interface go to "Advanced" and make sure Flow-control is enabled for both TX and RX.
4. To eliminate QoS and Flow-control as the performance degrading factor, set all devices to run with Global Pause and rerun the tests:
  - Set Global pause on the switches, routers.
  - Run `Disable-NetAdapterQos *` on all of the hosts in a PowerShell window.

## 15.4 General Troubleshooting

### Issue 1. Running Windows as VM over ESX with Mellanox HCAs

Virtual machines with Windows 2008 and later guest OS fail to power on ConnectX adapter network cards are connected as Direct I/O PCI devices.

To solve this issue, perform the following steps:

1. Right-click the virtual machine and select Edit Settings.
2. Click the Options tab and expand Advanced.
3. Click Edit Configuration.
4. Click Add Row.
5. Add the parameter to the new row:
  - a. In the Name column, add pciPassthru0.maxMSIXvectors.
  - b. In the Value column, add 31.
6. Click OK and click OK again.

For further details, please refer to:

[http://kb.vmware.com/selfservice/microsites/search.do?language=en\\_US&cmd=displayKC&externalId=2032981](http://kb.vmware.com/selfservice/microsites/search.do?language=en_US&cmd=displayKC&externalId=2032981)

### Issue 2. Hyper-V environment

In Hyper-V environment, Enable-NetAdapterVmq powershell command can enable VMQ on a network adapter only if the virtual switch which does not have SR-IOV enabled is defined over corresponding network adapter.

**Suggestion:** This is because the result of the powershell command depends on 2 registry fields: \*VMQ and \*RssOrVmqPreference, when the former is controlled by powershell and the latter is controlled by the virtual switch.

For further information on these registry keys, please refer to:

[http://msdn.microsoft.com/en-us/library/windows/hardware/hh451362\(v=vs.85\).aspx](http://msdn.microsoft.com/en-us/library/windows/hardware/hh451362(v=vs.85).aspx)

### Issue 3. Installation

Setup fails when the remote desktop host service is installed due to a known issue in windows when using the chain MSI feature.

**Suggestion:** Disable the service before the installation and enable it at the end.

## 15.5 Installation Error Codes and Troubleshooting

### 15.5.1 Setup Return Codes

**Table 55 - Setup Return Codes**

Error Code	Description	Troubleshooting
1603	Fatal error during installation	Contact support
1633	The installation package is not supported on this platform.	Make sure you are installing the right package for your platform

For additional details on Windows installer return codes, please refer to:  
<http://support.microsoft.com/kb/229683>

### 15.5.2 Firmware Burning Warning Codes

**Table 56 - Firmware Burning Warning Codes**

Error Code	Description	Troubleshooting
1004	Failed to open the device	Contact support
1005	Could not find an image for at least one device	The firmware for your device was not found. Please try to manually burn the firmware.
1006	Found one device that has multiple images	Burn the firmware manually and select the image you want to burn.
1007	Found one device for which force update is required	Burn the firmware manually with the force flag.
1008	Found one device that has mixed versions	The firmware version or the expansion rom version does not match.

For additional details, please refer to the MFT User Manual:  
<http://www.mellanox.com> > Products > Firmware Tools

### 15.5.3 Restore Configuration Warnings

**Table 57 - Restore Configuration Warnings**

Error	Description	Troubleshooting
3	Failed to restore the configuration	Please see log for more details and contact the support team

## Appendix A: Windows MPI (MS-MPI)

### A.1 Overview

Message Passing Interface (MPI) is meant to provide virtual topology, synchronization, and communication functionality between a set of processes.

With MPI you can run one process on several hosts.

- Windows MPI run over the following protocols:
  - Sockets (Ethernet)
  - Network Direct (ND)

#### A.1.1 Prerequisites

- Install HPC (Build: 4.0.3906.0).
- Validate traffic (ping) between the whole MPI Hosts.
- Every MPI client need to run smpd process which open the mpi channel.
- MPI Initiator Server need to run: mpiexec. If the initiator is also client it should also run smpd.

### A.2 Running MPI

**Step 1.** Run the following command on each mpi client.

```
start smpd -d -p <port>
```

**Step 2.** Install ND provider on each MPI client in MPI ND.

**Step 3.** Run the following command on MPI server.

```
mpiexec.exe -p <smpd_port> -hosts <num_of_hosts> <hosts_ip_list>
-env MPICH_NETMASK <network_ip/subnet> -env
MPICH_ND_ZCOPY_THRESHOLD -1 -env MPICH_DISABLE_ND <0/1> -env
MPICH_DISABLE SOCK <0/1> -affinity <process>
```

### A.3 Directing MSMPI Traffic

Directing MPI traffic to a specific QoS priority may be delayed due to:

- Except for NetDirectPortMatchCondition, the QoS powershell CmdLet for NetworkDirect traffic does not support port range. Therefore, NetworkDirect traffic cannot be directed to ports 1-65536.
- The MSMPI directive to control the port range (namely: MPICH\_PORT\_RANGE 3000,3030) is not working for ND, and MSMPI chose a random port.

### A.4 Running MSMPI on the Desired Priority

**Step 1.** Set the default QoS policy to be the desired priority (Note: this prio should be lossless all the way in the switches\*)

**Step 2.** Set SMB policy to a desired priority only if SMD Traffic running.



**Step 3.** **[Recommended]** Direct ALL TCP/UDP traffic to a lossy priority by using the “IPProtocol-MatchCondition”.



TCP is being used for MPI control channel (smpd), while UDP is being used for other services such as remote-desktop.

Arista switches forwards the pcp bits (e.g. 802.1p priority within the vlan tag) from ingress to egress to enable any two End-Nodes in the fabric as to maintain the priority along the route.

In this case the packet from the sender goes out with priority X and reaches the far end-node with the same priority X.



The priority should be lossless in the switches

➤ **To force MSMPI to work over ND and not over sockets, add the following in mpiexec command:**

```
-env MPICH_DISABLE_ND 0 -env MPICH_DISABLE_SOCKET 1
```

## A.5 Configuring MPI

- Step 1.** Configure all the hosts in the cluster with identical PFC (see the PFC example below).
- Step 2.** Run the WHCK ND based traffic tests to Check PFC (ndrping, ndping, ndrpingpong, ndpingpong).
- Step 3.** Validate PFC counters, during the run-time of ND tests, with “Mellanox Adapter QoS Counters” in the perfmon.
- Step 4.** Install the same version of HPC Pack in the entire cluster.  
NOTE: Version mismatch in HPC Pack 2012 can cause MPI to hung.
- Step 5.** Validate the MPI base infrastructure with simple commands, such as “hostname”.

### A.5.1 PFC Example

In the example below, ND and NDK go to priority 3 that configures no-drop in the switches. The TCP/UDP traffic directs ALL traffic to priority 1.

- Install dcbox, and remove any previous settings
- Install-WindowsFeature Data-Center-Bridging
- Remove-NetQoSTrafficClass
- Remove-NetQoSPolicy -Confirm:\$False
- Set-NetQoSDcbxSetting -Willing 0
- New-NetQoSPolicy “SMB” -NetDirectPortMatchCondition 445 - PriorityValue8021Action 3
- New-NetQoSPolicy “DEFAULT” -Default -PriorityValue8021Action 3
- New-NetQoSPolicy “TCP” -IPProtocolMatchCondition TCP - PriorityValue8021Action1

- New-NetQosPolicy "UDP" -IPProtocolMatchCondition UDP - PriorityValue8021Action 1
- Enable-NetQosFlowControl 3
- Disable-NetQosFlowControl 0,1,2,4,5,6,7
- Enable-netadapterqos -Name

## A.5.2 Running MPI Command Examples

- Running MPI pallas test over ND.

```
mpiexec.exe -p 19020 -hosts 4 11.11.146.101 11.21.147.101 11.21.147.51  
11.11.145.101 -env MPICH_NETMASK 11.0.0.0/  
255.0.0.0 -env MPICH_ND_ZCOPY_THRESHOLD -1 -env MPICH_DISABLE_ND 0 -env  
MPICH_DISABLE_SOCKET 1 -affinity c:\\test1.exe
```

- Running MPI pallas test over ETH.

```
exempiexec.exe -p 19020 -hosts 4 11.11.146.101 11.21.147.101 11.21.147.51  
11.11.145.101 -env MPICH_NETMASK 11.0.0.0/  
255.0.0.0 -env MPICH_ND_ZCOPY_THRESHOLD -1 -env MPICH_DISABLE_ND 1 -env  
MPICH_DISABLE_SOCKET 0 -affinity c:\\test1.exe
```

## Appendix B: NVGRE Configuration Scripts Examples

The setup is as follow for both examples below:

```
Hypervisor mtlae14 = "Port1", 192.168.20.114/24
  VM on mtlae14 = mtlae14-005, 172.16.14.5/16, Mac 00155D720100
  VM on mtlae14 = mtlae14-006, 172.16.14.6/16, Mac 00155D720101
Hypervisor mtlae15 = "Port1", 192.168.20.115/24
  VM on mtlae15 = mtlae15-005, 172.16.15.5/16, Mac 00155D730100
  VM on mtlae15 = mtlae15-006, 172.16.15.6/16, Mac 00155D730101
```

### B.1 Adding NVGRE Configuration to Host 14 Example

The following is an example of adding NVGRE to Host 14.

```
# On both sides
# vSwitch create command

# Note, that vSwitch configuration is persistent, no need to configure it after each
reboot

New-VMSwitch "VSwMLNX" -NetAdapterName "Port1" -AllowManagementOS $true

# Shut down VMs
Stop-VM -Name "mtlae14-005" -Force -Confirm
Stop-VM -Name "mtlae14-006" -Force -Confirm

# Connect VM to vSwitch (maybe you have to switch off VM before), doing manual does also
work
# Connect-VMNetworkAdapter -VMName " mtlae14-005" -SwitchName "VSwMLNX"
Add-VMNetworkAdapter -VMName "mtlae14-005" -SwitchName "VSwMLNX" -StaticMacAddress
"00155D720100"
Add-VMNetworkAdapter -VMName "mtlae14-006" -SwitchName "VSwMLNX" -StaticMacAddress
"00155D720101"

# ----- The commands from Step 2 - 4 are not persistent, Its suggested to create
script is running after each OS reboot

# Step 2. Configure a Subnet Locator and Route records on each Hyper-V Host (Host 1 and
Host 2) mtlae14 & mtlae15
New-NetVirtualizationLookupRecord -CustomerAddress 172.16.14.5 -ProviderAddress
192.168.20.114 -VirtualSubnetID 5001 -MACAddress "00155D720100" -Rule "TranslationMetho-
dEncap"
New-NetVirtualizationLookupRecord -CustomerAddress 172.16.14.6 -ProviderAddress
192.168.20.114 -VirtualSubnetID 5001 -MACAddress "00155D720101" -Rule "TranslationMetho-
dEncap"
New-NetVirtualizationLookupRecord -CustomerAddress 172.16.15.5 -ProviderAddress
192.168.20.115 -VirtualSubnetID 5001 -MACAddress "00155D730100" -Rule "TranslationMetho-
dEncap"
New-NetVirtualizationLookupRecord -CustomerAddress 172.16.15.6 -ProviderAddress
192.168.20.115 -VirtualSubnetID 5001 -MACAddress "00155D730101" -Rule "TranslationMetho-
dEncap"
# Add customer route
New-NetVirtualizationCustomerRoute -RoutingDomainID "{11111111-2222-3333-4444-
000000005001}" -VirtualSubnetID "5001" -DestinationPrefix "172.16.0.0/16" -NextHop
"0.0.0.0" -Metric 255
```

```

# Step 3. Configure the Provider Address and Route records on Hyper-V Host 1 (Host 1
Only) mtlae14
$NIC = Get-NetAdapter "Port1"
New-NetVirtualizationProviderAddress -InterfaceIndex $NIC.InterfaceIndex -Pro-
viderAddress 192.168.20.114 -PrefixLength 24
New-NetVirtualizationProviderRoute -InterfaceIndex $NIC.InterfaceIndex -Destination-
Prefix "0.0.0.0/0" -NextHop 192.168.20.1
# Step 5. Configure the Virtual Subnet ID on the Hyper-V Network Switch Ports for each
Virtual Machine on each Hyper-V Host (Host 1 and Host 2)
# Run the command below for each VM on the host the VM is running on it, i.e. the for
mtlae14-005, mtlae14-006 on
# host 192.168.20.114 and for VMs mtlae15-005, mtlae15-006 on host 192.168.20.115
# mtlae14 only
Get-VMNetworkAdapter -VMName mtlae14-005 | where {$_.MacAddress -eq "00155D720100"} |
Set-VMNetworkAdapter -VirtualSubnetID 5001
Get-VMNetworkAdapter -VMName mtlae14-006 | where {$_.MacAddress -eq "00155D720101"} |
Set-VMNetworkAdapter -VirtualSubnetID 5001

```

## B.2 Adding NVGRE Configuration to Host 15 Example

The following is an example of adding NVGRE to Host 15.

```

# On both sides
# vSwitch create command

# Note, that vSwitch configuration is persistent, no need to configure it after each
reboot

New-VMSwitch "VSwMLNX" -NetAdapterName "Port1" -AllowManagementOS $true

# Shut down VMs
Stop-VM -Name "mtlae15-005" -Force -Confirm
Stop-VM -Name "mtlae15-006" -Force -Confirm
# Connect VM to vSwitch (maybe you have to switch off VM before), doing manual does also
work
# Connect-VMNetworkAdapter -VMName " mtlae14-005" -SwitchName "VSwMLNX"
Add-VMNetworkAdapter -VMName "mtlae15-005" -SwitchName "VSwMLNX" -StaticMacAddress
"00155D730100"
Add-VMNetworkAdapter -VMName "mtlae15-006" -SwitchName "VSwMLNX" -StaticMacAddress
"00155D730101"

```

```

# ----- The commands from Step 2 - 4 are not persistent, Its suggested to create
script is running after each OS reboot

# Step 2. Configure a Subnet Locator and Route records on each Hyper-V Host (Host 1 and
Host 2) mtlae14 & mtlae15
New-NetVirtualizationLookupRecord -CustomerAddress 172.16.14.5 -ProviderAddress
192.168.20.114 -VirtualSubnetID 5001 -MACAddress "00155D720100" -Rule "TranslationMethodEncap"
New-NetVirtualizationLookupRecord -CustomerAddress 172.16.14.6 -ProviderAddress
192.168.20.114 -VirtualSubnetID 5001 -MACAddress "00155D720101" -Rule "TranslationMethodEncap"
New-NetVirtualizationLookupRecord -CustomerAddress 172.16.15.5 -ProviderAddress
192.168.20.115 -VirtualSubnetID 5001 -MACAddress "00155D730100" -Rule "TranslationMethodEncap"
New-NetVirtualizationLookupRecord -CustomerAddress 172.16.15.6 -ProviderAddress
192.168.20.115 -VirtualSubnetID 5001 -MACAddress "00155D730101" -Rule "TranslationMethodEncap"
# Add customer route
New-NetVirtualizationCustomerRoute -RoutingDomainID "{11111111-2222-3333-4444-000000005001}" -VirtualSubnetID "5001" -DestinationPrefix "172.16.0.0/16" -NextHop
"0.0.0.0" -Metric 255
# Step 4. Configure the Provider Address and Route records on Hyper-V Host 2 (Host 2
Only) mtlae15
$NIC = Get-NetAdapter "Port1"
New-NetVirtualizationProviderAddress -InterfaceIndex $NIC.InterfaceIndex -ProviderAddress 192.168.20.115 -PrefixLength 24
New-NetVirtualizationProviderRoute -InterfaceIndex $NIC.InterfaceIndex -DestinationPrefix "0.0.0.0/0" -NextHop 192.168.20.1
# Step 5. Configure the Virtual Subnet ID on the Hyper-V Network Switch Ports for each
Virtual Machine on each Hyper-V Host (Host 1 and Host 2)
# Run the command below for each VM on the host the VM is running on it, i.e. the for
mtlae14-005, mtlae14-006 on
# host 192.168.20.114 and for VMs mtlae15-005, mtlae15-006 on host 192.168.20.115
# mtlae15 only
Get-VMNetworkAdapter -VMName mtlae15-005 | where {$_.MacAddress -eq "00155D730100"} |
Set-VMNetworkAdapter -VirtualSubnetID 5001
Get-VMNetworkAdapter -VMName mtlae15-006 | where {$_.MacAddress -eq "00155D730101"} |
Set-VMNetworkAdapter -VirtualSubnetID 5001

```

## Appendix C: Registry Keys

Mellanox IPoIB and Ethernet drivers use registry keys to control the NIC operations. The registry keys receive default values during the installation of the Mellanox adapters. Most of the parameters are visible in the registry by default, however, certain parameters must be created in order to modify the default behavior of the Mellanox driver.

The adapter can be configured either from the User Interface (Device Manager -> Mellanox Adapter -> Right click -> Properties) or by setting the registry directly.

All Mellanox adapter parameters are located in the registry under the following registry key:

```
HKEY_LOCAL_MACHINE
\SYSTEM
\CurrentControlSet
\ Control
\ Class
\{4D36E972-E325-11CE-BFC1-08002bE10318}
\<Index>
```

The registry key can be divided into 4 different groups:

Group	Description
Basic	Contains the basic configuration.
Offload Options	Controls the offloading operation that the NIC supports.
Performance Options	Controls the NIC operation in different environments and scenarios.
Flow Control Options	Controls the TCP/IP traffic.

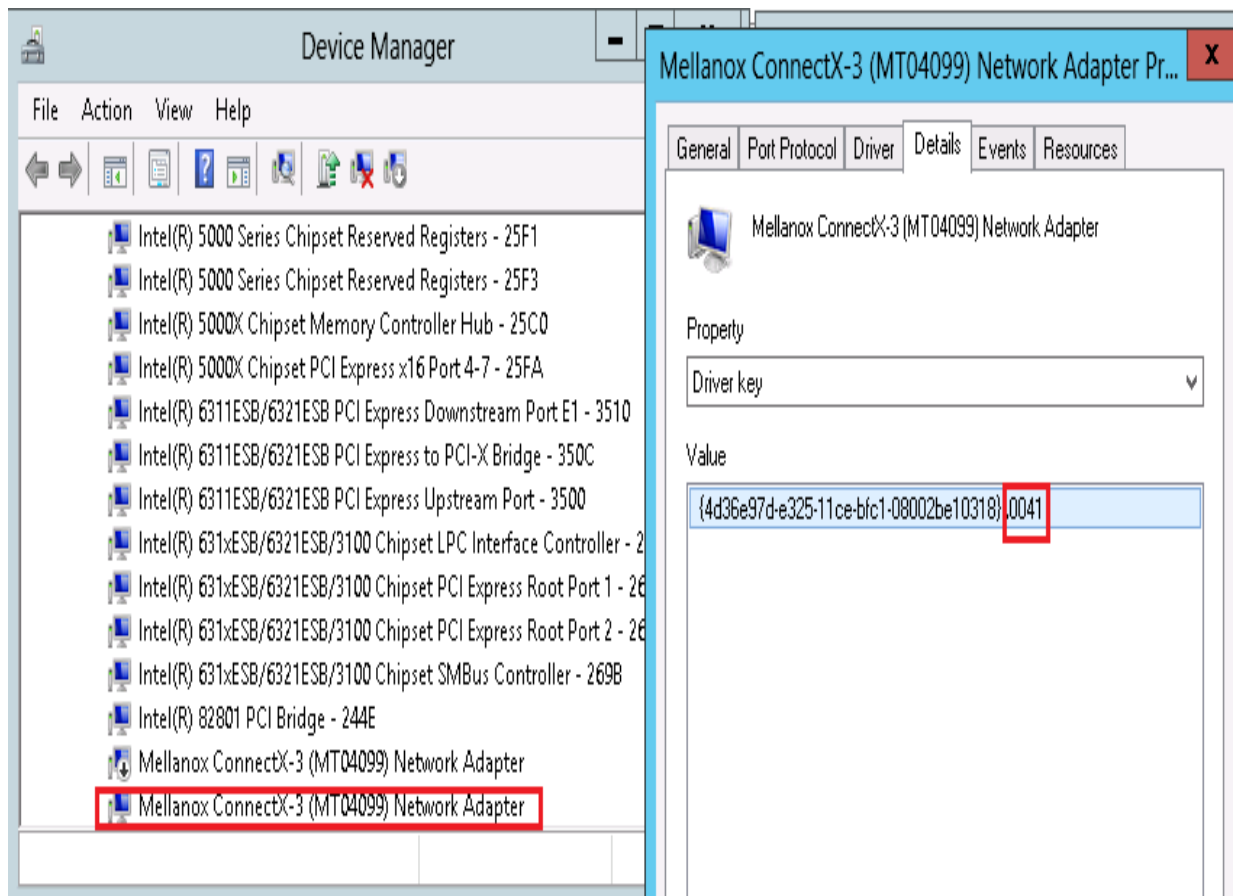
Any registry key that starts with an asterisk ("\*") is a well-known registry key. For more details regarding the registries, please refer to:

[http://msdn.microsoft.com/en-us/library/ff570865\(v=VS.85\).aspx](http://msdn.microsoft.com/en-us/library/ff570865(v=VS.85).aspx)

### C.1 Finding the Index Value of the HCA

➤ *To find the nn value of your HCA from the Device Manager please perform the following steps:*

- Step 1.** Open Device Manager, and go to System devices.
- Step 2.** Right click -> properties on Mellanox -ConnectX® card.
- Step 3.** Go to Details tab.
- Step 4.** Select the Driver key, and obtain the nn number.  
In the below example, the index equals 0041

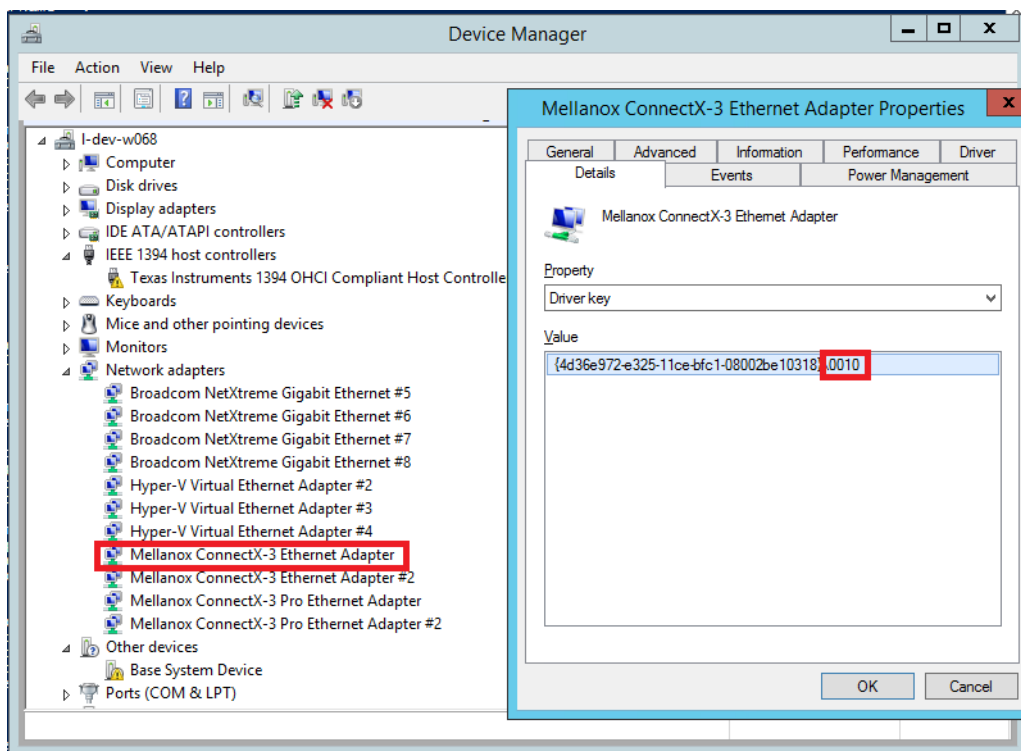


## C.2 Finding the Index Value of the Network Interface

To find the index value of your Network Interface from the Device Manager please perform the following steps:

- Step 1.** Open Device Manager, and go to Network Adapters.
- Step 2.** Right click ->Properties on Mellanox Connect-X® Ethernet Adapter.
- Step 3.** Go to Details tab.
- Step 4.** Select the Driver key, and obtain the nn number.

In the below example, the index equals 0010



### C.3 Basic Registry Keys

This group contains the registry keys that control the basic operations of the NIC

Value Name	Default Value	Description
*JumboPacket	1500	<p>The maximum size of a frame (or a packet) that can be sent over the wire. This is also known as the maximum transmission unit (MTU). The MTU may have a significant impact on the network's performance as a large packet can cause high latency. However, it can also reduce the CPU utilization and improve the wire efficiency. The standard Ethernet frame size is 1514 bytes, but Mellanox drivers support wide range of packet sizes.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>Ethernet: 600 up to 9600</li> <li>IPoIB: 1500 up to 4092</li> </ul> <p><b>Note:</b> All the devices across the network (switches and routers) should support the same frame size. Be aware that different network devices calculate the frame size differently. Some devices include the header, i.e. information in the frame size, while others do not.</p> <p>Mellanox adapters do not include Ethernet header information in the frame size. (i.e when setting *JumboPacket to 1500, the actual frame size is 1514).</p>



Value Name	Default Value	Description
*ReceiveBuffers	1024	<p>The number of packets each ring receives. This parameter affects the memory consumption and the performance. Increasing this value can enhance receive performance, but also consumes more system memory.</p> <p>In case of lack of received buffers (dropped packets or out of order received packets), you can increase the number of received buffers. The valid values are 256 up to 4096.</p> <p><b>Note:</b> On 32-bit systems, the non-pageable memory is limited. As a result, when the MTU is higher than 5000 and the ring size is 2048 or more, the initialization can fail due to a lack of memory. If the MTU is more than 5000, the driver limits the ring size on 32-bit system to be 1024.</p>
*TransmitBuffers	2048	<p>The number of packets each ring sends. Increasing this value can enhance transmission performance, but also consumes system memory.</p> <p>The valid values are 256 up to 4096.</p>
*SpeedDuplex	7 (default)	<p>The Speed and Duplex settings that a device supports. This registry key should not be changed and it can be used to query the device capability. Mellanox ConnectX device is set to 7 meaning 10Gbps and Full Duplex.</p> <p><b>Note:</b> Default value should not be modified.</p>
MaxNumOfMCList	128	<p>The number of multicast addresses that are filtered by the NIC. If the OS uses more multicast addresses than were defined, it sets the port to multicast promiscuous and the multicast addresses are filtered by OS at protocol level.</p> <p>The valid values are 64 up to 1024.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
*QOS	1	<p>Enables the NDIS Quality of Service (QoS)</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 1: enable</li> <li>• 0: disable</li> </ul> <p><b>Note:</b> This keyword is only valid for ConnectX-3 when using Windows Server 2012 and above.</p>

Value Name	Default Value	Description
RxIntModerationProfile	1	<p>Enables the assignment of different interrupt moderation profiles for receive completions. Interrupt moderation can have a great effect on optimizing network throughput and CPU utilization.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0: Low Latency Implies higher rate of interrupts to achieve better latency, or to handle scenarios where only a small number of streams are used.</li> <li>• 1: Moderate Interrupt moderation is set to midrange defaults to allow maximum throughput at minimum CPU utilization for common scenarios.</li> <li>• 2: Aggressive Interrupt moderation is set to maximal values to allow maximum throughput at minimum CPU utilization, for more intensive, multi-stream scenarios.</li> </ul>
TxIntModerationProfile	1	<p>Enables the assignment of different interrupt moderation profiles for send completions. Interrupt moderation can have great effect on optimizing network throughput and CPU utilization.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0: Low Latency Implies higher rate of interrupts to achieve better latency, or to handle scenarios where only a small number of streams are used.</li> <li>• 1: Moderate Interrupt moderation is set to midrange defaults to allow maximum throughput at minimum CPU utilization for common scenarios.</li> <li>• 2: Aggressive Interrupt moderation is set to maximal values to allow maximum throughput at minimum CPU utilization for more intensive, multi-stream scenarios.</li> </ul>

## C.4 Off-load Registry Keys

This group of registry keys allows the administrator to specify which TCP/IP offload settings are handled by the adapter rather than by the operating system.

Enabling offloading services increases transmission performance. Due to offload tasks (such as checksum calculations) performed by adapter hardware rather than by the operating system (and, therefore, with lower latency). In addition, CPU resources become more available for other tasks.

Value Name	Default Value	Description
*LsoV1IPv4	1	<p>Large Send Offload Version 1 (IPv4).</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul>

Value Name	Default Value	Description
*LsoV1IPv4	1	Large Send Offload Version 2 (IPv4). The valid values are: <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul>
*LsoV1IPv6	1	Large Send Offload Version 2 (IPv6). The valid values are: <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul>
LSOSize	32000	The maximum number of bytes that the TCP/IP stack can pass to an adapter in a single packet. This value affects the memory consumption and the NIC performance. The valid values are MTU+1024 up to 64000.  <b>Note:</b> This registry key is not exposed to the user via the UI. If LSOSize is smaller than MTU+1024, LSO will be disabled.
LSOMinSegment	2	The minimum number of segments that a large TCP packet must be divisible by, before the transport can offload it to a NIC for segmentation. The valid values are 2 up to 32.  <b>Note:</b> This registry key is not exposed to the user via the UI.
LSOTcpOptions	1	Enables that the miniport driver to segment a large TCP packet whose TCP header contains TCP options. The valid values are: <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul> <b>Note:</b> This registry key is not exposed to the user via the UI.
LSOIpOptions	1	Enables its NIC to segment a large TCP packet whose IP header contains IP options. The valid values are: <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul> <b>Note:</b> This registry key is not exposed to the user via the UI.
*IPChecksumOffloadIPv4	3	Specifies whether the device performs the calculation of IPv4 checksums. The valid values are: <ul style="list-style-type: none"> <li>• 0: (disable)</li> <li>• 1: (Tx Enable)</li> <li>• 2: (Rx Enable)</li> <li>• 3: (Tx and Rx enable)</li> </ul>

Value Name	Default Value	Description
*TCPUDPChecksumOffloadIPv4	3	Specifies whether the device performs the calculation of TCP or UDP checksum over IPv4. The valid values are: <ul style="list-style-type: none"> <li>• 0: (disable)</li> <li>• 1: (Tx Enable)</li> <li>• 2: (Rx Enable)</li> <li>• 3: (Tx and Rx enable)</li> </ul>
*TCPUDPChecksumOffloadIPv6	3	Specifies whether the device performs the calculation of TCP or UDP checksum over IPv6. The valid values are: <ul style="list-style-type: none"> <li>• 0: (disable)</li> <li>• 1: (Tx Enable)</li> <li>• 2: (Rx Enable)</li> <li>• 3: (Tx and Rx enable)</li> </ul>
ParentBusRegPath	HKLM\SYSTEM\CurrentControlSet\Control\Class\{4d36e97d-e325-11ce-bfc1-08002be10318}\0073	TCP checksum off-load IP-IP.

## C.5 Performance Registry Keys

This group of registry keys configures parameters that can improve adapter performance.

Value Name	Default Value	Description
RecvCompletionMethod	1	Sets the completion methods of the receive packets, and it affects network throughput and CPU utilization. The supported methods are: <ul style="list-style-type: none"> <li>• Polling - increases the CPU utilization, because the system polls the received rings for incoming packets; however, it may increase the network bandwidth since the incoming packet is handled faster.</li> <li>• Adaptive - combines the interrupt and polling methods dynamically, depending on traffic type and network usage.</li> </ul> The valid values are: <ul style="list-style-type: none"> <li>• 0: polling</li> <li>• 1: adaptive</li> </ul>

Value Name	Default Value	Description
*InterruptModeration	1	<p>Sets the rate at which the controller moderates or delays the generation of interrupts, making it possible to optimize network throughput and CPU utilization. When disabled, the interrupt moderation of the system generates an interrupt when the packet is received. In this mode, the CPU utilization is increased at higher data rates, because the system must handle a larger number of interrupts. However, the latency is decreased, since that packet is processed more quickly.</p> <p>When interrupt moderation is enabled, the system accumulates interrupts and sends a single interrupt rather than a series of interrupts. An interrupt is generated after receiving 5 packets or after the passing of 10 micro seconds from receiving the first packet.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul>
RxIntModeration	2	<p>Sets the rate at which the controller moderates or delays the generation of interrupts, making it possible to optimize network throughput and CPU utilization. The default setting (Adaptive) adjusts the interrupt rates dynamically, depending on traffic type and network usage. Choosing a different setting may improve network and system performance in certain configurations.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 1: static</li> <li>• 2: adaptive</li> </ul> <p>The interrupt moderation count and time are configured dynamically, based on traffic types and rate.</p>
pkt_rate_low	150000	<p>Sets the packet rate below which the traffic is considered as latency traffic when using adaptive interrupt moderation. The valid values are 100 up to 1000000.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
pkt_rate_high	170000	<p>Sets the packet rate above which the traffic is considered as bandwidth traffic. when using adaptive interrupt moderation. The valid values are 100 up to 1000000.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>

Value Name	Default Value	Description
*RSS	1	<p>Sets the driver to use Receive Side Scaling (RSS) mode to improve the performance of handling incoming packets. This mode allows the adapter port to utilize the multiple CPUs in a multi-core system for receiving incoming packets and steering them to their destination. RSS can significantly improve the number of transactions per second, the number of connections per second, and the network throughput. This parameter can be set to one of two values:</p> <ul style="list-style-type: none"> <li>• 1: enable (default) Sets RSS Mode.</li> <li>• 0: disable The hardware is configured once to use the Toeplitz hash function and the indirection table is never changed.</li> </ul> <p><b>Note:</b> the I/O Acceleration Technology (IOAT) is not functional in this mode.</p>
TxHashDisrtibution	3	<p>Sets the algorithm which is used to distribute the send-packets on different send rings. The adapter uses 3 methods:</p> <ul style="list-style-type: none"> <li>• 1: Size In this method only 2 Tx rings are used. The send-packets are distributed, based on the packet size. Packets that are smaller than 128 bytes use one ring, while the larger packets use the other ring.</li> <li>• 2: Hash In this method the adapter calculates a hash value based on the destination IP, the TCP source and the destination port. If the packet type is not IP, the packet uses ring number 0.</li> <li>• 3: Hash and size In this method for each hash value, 2 rings are used: one for small packets and another one for larger packets.</li> </ul> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 1: size</li> <li>• 2: hash</li> <li>• 3: hash and size</li> </ul> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
RxSmallPacketBypass	0	<p>Specifies whether received small packets bypass larger packets when indicating received packet to NDIS. This mode is useful in bi-directional applications. Enabling this mode ensures that the ACK packet will bypass the regular packet and TCP/IP stack will issue the next packet more quickly.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul> <p><b>Note:</b> This registry value is not exposed via the UI.</p>

Value Name	Default Value	Description
ReturnPacketThreshold	0	<p>The allowed number of free received packets on the rings. Any number above it will cause the driver to return the packet to the hardware immediately.</p> <p>When the value is set to 0, the adapter uses 2/3 of the received ring size.</p> <p>The valid values are: 0 to 4096.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
NumTcb	16	<p>The number of send buffers that the driver allocates for sending purposes. Each buffer is in LSO size, if LSO is enabled, or in MTU size, otherwise.</p> <p>The valid values are 1 up to 64.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
ThreadPoll	10000	<p>The number of cycles that should be passed without receiving any packet before the polling mechanism stops when using polling completion method for receiving. Afterwards, receiving new packets will generate an interrupt that reschedules the polling mechanism.</p> <p>The valid values are 0 up to 200000.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
AverageFactor	16	<p>The weight of the last polling in the decision whether to continue the polling or give up when using polling completion method for receiving.</p> <p>The valid values are 0 up to 256.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
AveragePollThreshold	10	<p>The average threshold polling number when using polling completion method for receiving. If the average number is higher than this value, the adapter continues to poll.</p> <p>The valid values are 0 up to 1000.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
ThisPollThreshold	100	<p>The threshold number of the last polling cycle when using polling completion method for receiving. If the number of packets received in the last polling cycle is higher than this value, the adapter continues to poll</p> <p>The valid values are 0 up to 1000.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>

Value Name	Default Value	Description
*HeaderDataSplit	0	<p>Enables the driver to use header data split. In this mode, the adapter uses two buffers to receive the packet. The first buffer holds the header, while the second buffer holds the data. This method reduces the cache hits and improves the performance.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
VlanId	0	<p>Enables packets with VlanId. It is used when no LBFO intermediate driver is used.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0: disable No Vlan Id is passed.</li> <li>• 1-4095 Valid Vlan Id that will be passed.</li> </ul> <p><b>Note:</b> This registry value is only valid for Ethernet.</p>
TxForwardingProcessor	Automatically selected based on RSS configuration	<p>The processor that will be used to forward the packets sent by the forwarding thread.</p> <p>Default is based on number of rings and number of cores on the machine.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
DefaultRecvRingProcessor	Automatically selected based on RSS configuration	<p>The type of processor which will be used for the default Receive ring. This variable handles packets that are not handled by RSS. This can be non TCP/UDP packets or even UDP packets, if they are configured to use the default ring.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
TxInterruptProcessor	Automatically selected based on RSS configuration	<p>The type of processor which will be used to handle the TX completions. The default is based on a number of rings and a number of cores on the machine.</p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
*NumRSSQueues	8	<p>The maximum number of the RSS queues that the device should use.</p> <p><b>Note:</b> This registry key is only in Windows Server 2012 and above.</p>



Value Name	Default Value	Description
BlueFlame	1	<p>The latency-critical Send WQEs to the device. When a BlueFlame is used, the WQEs are written directly to the PCI BAR of the device (in addition to memory), so that the device may handle them without having to access memory, thus shortening the execution latency. For best performance, it is recommended to use the BlueFlame when the HCA is lightly loaded. For high-bandwidth scenarios, it is recommended to use regular posting (without BlueFlame).</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
*MaxRSSProcessors	8	<p>The maximum number of RSS processors.</p> <p><b>Note:</b> This registry key is only in Windows Server 2012 and above.</p>

## C.6 Ethernet Registry Keys

The following section describes the registry keys that are only relevant to Ethernet driver.

Value Name	Default Value	Description
RoceMaxFrameSize	1024	<p>The maximum size of a frame (or a packet) that can be sent by the RoCE protocol (a.k.a Maximum Transmission Unit (MTU)). Using larger RoCE MTU will improve the performance; however, one must ensure that the entire system, including switches, supports the defined MTU.</p> <p>Ethernet packet uses the general MTU value, whereas the RoCE packet uses the RoCE MTU</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 256</li> <li>• 512</li> <li>• 1024</li> <li>• 2048</li> </ul> <p><b>Note:</b> This registry key is supported only in Ethernet drivers.</p>
*PriorityVLANTag	3 (Packet Priority & VLAN Enabled)	<p>Enables sending and receiving IEEE 802.3ac tagged frames, which include:</p> <ul style="list-style-type: none"> <li>• 802.1p QoS (Quality of Service) tags for priority-tagged packets.</li> <li>• 802.1Q tags for VLANs.</li> </ul> <p>When this feature is enabled, the Mellanox driver supports sending and receiving a packet with VLAN and QoS tag.</p>

Value Name	Default Value	Description
PromiscuousVlan	0	Specifies whether a promiscuous VLAN is enabled or not. When this parameter is set, all the packets with VLAN tags are passed to an upper level without executing any filtering. The valid values are: <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul> <b>Note:</b> This registry value is not exposed via the UI.
UseRSSForRawIP	1	The execution of RSS on UDP and Raw IP packets. In a forwarding scenario, one can improve the performance by disabling RSS on UDP or a raw packet. In such a case, the entire receive processing of these packets is done on the processor that was defined in DefaultRecvRingProcessor registry key. The valid values are: <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul> This is also relevant for IPoIB. <b>Note:</b> This registry value is not exposed via the UI.
UseRSSForUDP	1	Used to execute RSS on UDP and Raw IP packet. In forwarding scenario you can improve the performance by disable RSS on UDP or raw packet. In such a case all the receive processing of these packets is done on the processor that was defined in DefaultRecvRingProcessor registry key. The valid values are: <ul style="list-style-type: none"> <li>• 0:disabled</li> <li>• 1: Enabled</li> </ul> <b>NOTE:</b> This registry value is not exposed via UI.
SingleStream	0	It used to get the maximum bandwidth when using single stream traffic. When setting the registry key to enabled the driver will forward the sending packet to another CPU. This decrease the CPU utilization of the sender and allows sending in higher rate The valid values are: <ul style="list-style-type: none"> <li>• 0:disabled</li> <li>• 1: Enabled</li> </ul> <b>NOTE:</b> only relevant for Ethernet and IPoIB

### C.6.1 Flow Control Options

This group of registry keys allows the administrator to control the TCP/IP traffic by pausing frame transmitting and/or receiving operations. By enabling the Flow Control mechanism, the adapters can overcome any TCP/IP issues and eliminate the risk of data loss.

Value Name	Default Value	Description
*FlowControl	3	<p>When Rx Pause is enabled, the receiving adapter generates a flow control frame when its received queue reaches a pre-defined limit. The flow control frame is sent to the sending adapter.</p> <p>When TX Pause is enabled, the sending adapter pauses the transmission if it receives a flow control frame from a link partner.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0: Flow control is disabled</li> <li>• 1: Tx Flow control is Enabled</li> <li>• 2: Rx Flow control is enabled</li> <li>• 3: Rx &amp; Tx Flow control is enabled</li> </ul>
PerPriRxPause	0	<p>When Per Priority Rx Pause is configured, the receiving adapter generates a flow control frame when its priority received queue reaches a pre-defined limit. The flow control frame is sent to the sending adapter.</p> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>• This registry value is not exposed via the UI.</li> <li>• RxPause and PerPriRxPause are mutual exclusive (i.e. at most, only one of them can be set).</li> </ul>
PerPriTxPause	0	<p>When Per Priority TX Pause is configured, the sending adapter pauses the transmission of a specific priority, if it receives a flow control frame from a link partner.</p> <p><b>Notes:</b></p> <ul style="list-style-type: none"> <li>• This registry value is not exposed via the UI.</li> <li>• TxPause and PerPriTxPause are mutual exclusive (i.e. at most, only one of them can be set).</li> </ul>

## C.6.2 VMQ Options

This section describes the registry keys that are used to control the NDIS Virtual Machine Queue (VMQ). The VMQ supports Microsoft Hyper-V network performance, and is supported on Windows Server 2008 R2 and above.

For more details about VMQ please refer to Microsoft web site,  
[http://msdn.microsoft.com/en-us/library/windows/hardware/ff571034\(v=vs.85\).aspx](http://msdn.microsoft.com/en-us/library/windows/hardware/ff571034(v=vs.85).aspx)

Value Name	Default Value	Description
*VMQ	1	<p>The support for the virtual machine queue (VMQ) features of the network adapter.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 1: enable</li> <li>• 0: disable</li> </ul>

Value Name	Default Value	Description
*RssOrVmqPreference	0	Specifies whether VMQ capabilities should be enabled instead of receive-side scaling (RSS) capabilities. The valid values are: <ul style="list-style-type: none"> <li>• 0: Report RSS capabilities</li> <li>• 1: Report VMQ capabilities</li> </ul> <b>Note:</b> This registry value is not exposed via the UI.
*VMQLookaheadSplit	1	Specifies whether the driver enables or disables the ability to split the receive buffers into lookahead and post-lookahead buffers. The valid values are: <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul>
*VMQVlanFiltering	1	Specifies whether the device enables or disables the ability to filter network packets by using the VLAN identifier in the media access control (MAC) header. The valid values are: <ul style="list-style-type: none"> <li>• 0: disable</li> <li>• 1: enable</li> </ul>
MaxNumVmq	127	The number of VMQs that the device supports in parallel. This parameter can effect memory consumption of the interface, since for each VMQ, the driver creates a separate receive ring and an allocate buffer for it. In order to minimize the memory consumption, one can reduce the number of VMs that use VMQ in parallel. However, this can affect the performance. The valid values are 1 up to 127. <b>Note:</b> This registry value is not exposed via the UI.
MaxNumMacAddrFilters	127	The number of different MAC addresses that the physical port supports. This registry key affects the number of supported MAC addresses that is reported to the OS. The valid values are 1 up to 127. <b>Note:</b> This registry value is not exposed via the UI.
MaxNumVlanFilters	127	The number of VLANs that are supported for each port. The valid values are 1 up to 127. <b>Note:</b> This registry value is not exposed via the UI.

### C.6.3 RoCE Options

This section describes the registry keys that are used to control RoCE mode.

Value Name	Default Value	Description
roce_mode	0 - RoCE	<p>The RoCE mode.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0 - RoCE</li> <li>• 4 - No RoCE</li> </ul> <p><b>Note:</b> The default value depends on the WinOF package used.</p>

## C.7 IPoIB Registry Keys

The following section describes the registry keys that are unique to IPoIB.

Value Name	Default Value	Description
GUIDMask	0	<p>Controls the way the MAC is generated for IPoIB interface. The driver uses the 8 bytes GUID to generate 6 bytes MAC. This value should be either 0 or contain exactly 6 non-zero digits, using binary representation.</p> <p>Zero (0) mask indicates its default value: 0xb' 11100111. That is, to take all, except intermediate bytes of GUID to form the MAC address.</p> <p>In case of an improper mask, the driver uses the default one.</p> <p>For more details, please refer to:  <a href="http://mellanox.com/related-docs/prod_software/guid2mac_checker_user_manual.txt">http://mellanox.com/related-docs/prod_software/guid2mac_checker_user_manual.txt</a></p> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
MediumType802_3	0	<p>Controls the way the interface is exposed to an upper level. By default, the IPoIB is exposed as an InfiniBand interface. The user can change it and cause the interface to be an Ethernet interface by setting this registry key.</p> <p>The valid values are:</p> <ul style="list-style-type: none"> <li>• 0 - the interface is exposed as NdisPhysicalMediumInfiniband</li> <li>• 1 - the interface is exposed as NdisPhysicalMedium802_3.</li> </ul> <p><b>Note:</b> This registry value is not exposed via the UI.</p>
SaTimeout	1000	<p>The time, in milliseconds, before retransmitting an SA query request.</p> <p>The valid values are 250 up to 60000.</p>
SaRetries	10	<p>The number of times to retry an SA query request.</p> <p>The valid values are 1 up to 64.</p>
McastIcmpMldGeneralQueryInterval	3	<p>The number of runs of the multicast monitor before a general query is initiated. This monitor runs every 30 seconds.</p> <p>The valid values are 1 up to 10.</p>

Value Name	Default Value	Description
LocalEndpointMaxAge	5	The maximum number of runs of the local end point DB monitor, before an unused local endpoint is removed. The endpoint age is zeroed when it is used as a source in the send flow or a destination in the receive flow. Each monitor run will increment the age of all non VMQ local endpoints. When LocalEndpointMaxAge is reached - the endpoint will be removed. The valid values are 1 up to 20.  <b>Note:</b> This registry value is not exposed via the UI.
LocalEndpointMonitorInterval	60000	The time interval (in ms) between each 2 runs of the local end point DB monitor, for aging, unused local endpoints. Each run will increment the age of all non VMQ local endpoints. The valid values are 10000 up to 1200000.  <b>Note:</b> This registry value is not exposed via the UI.
EnableQPR	0	Enables query path record. The valid values are: <ul style="list-style-type: none"> <li>• 0 - disable</li> <li>• 1 - enable</li> </ul>
McastQueryResponseInterval	2	The number of runs of the multicast monitor (which runs every 30 seconds) allowed until a response to the IGMP/MLD queries is received. If after this period a response is not received, the driver leaves the multicast group. The valid values are 1 up to 10.  <b>Note:</b> This registry value is not exposed via the UI.

## C.8 General Registry Values

This section provides information on general registry keys that affect Mellanox driver operation.

Value Name	Default Value	Description
MaxNumRssCpus	4	The number of CPUs that participate in the RSS. The Mellanox adapter can open multiple receive rings, each ring can be processed by a different processor. When RSS is disabled, the system opens a single Rx ring. The Rx ring number that is configured should be powered of two and less than the number of processors on the system. Value Type: DWORD The valid values are 1 up to number of processors on the system.

Value Name	Default Value	Description
RssBaseCpu	1	The CPU number of the first CPU that the RSS can use. NDIS uses the default value of 0 for the base CPU number, however this value is configurable and can be changed. The Mellanox adapter reads this value from registry and sets it to NDIS on driver start-up. Value Type: DWORD The valid values are 0 up to the number of processors on the system.
CheckFwVersion	1	Configures the Mellanox driver to skip validation of the FW compatibility to the driver version. Skipping this check-up is not recommended and can cause unexpected behavior. It can be used for testing purposes only. Value Type: DWORD The valid values are: <ul style="list-style-type: none"> <li>• 0: Don't check</li> <li>• 1: Check</li> </ul>
MaximumWorkingThreads	2	The number of working threads which can work simultaneously on receive polling. By default, the Mellanox driver creates a working thread for each Rx rings if polling or adaptive receive completion is set. Value Type: DWORD The valid values are 1 up to number of Rx rings.

## C.9 SR-IOV Registry Keys

SR-IOV feature can be controlled, on a machine level or per device, using the same set of Registry Keys. However, only one level must be used consistently to control SR-IOV feature. If both levels were used, the per-machine level of configuration will be enforced by the driver.

Registry Keys location for machine configuration:

```
HKLM\SYSTEM\CurrentControlSet\Services\mlx4_bus\Parameters
```

Registry Keys location for device configuration:

```
HKLM\SYSTEM\CurrentControlSet\Control\Class\{4d36e97d-e325-11ce-bfc1-08002be10318}\<nn>\Parameters
```

For more information on how to find device index nn, please refer to C.1 “Finding the Index Value of the HCA,” on page 174 .

Key Name	Key Type	Values	Description
SriovEnable	REG_DWORD	<ul style="list-style-type: none"> <li>0 = RoCE (default)</li> <li>1 = SR-IOV</li> </ul>	Configures the RDMA or SR-IOV mode. <b>Note:</b> RDMA is not supported in SR-IOV mode.
SriovPortMode		<ul style="list-style-type: none"> <li>0 = auto_port1 (default)</li> <li>1 = auto_port2</li> <li>2 = manual</li> </ul>	Configures the number of VFs to be enabled by the bus driver to each port. <b>Note:</b> In auto_portX mode, port X will have the number of VFs according to the burnt value in the device and the other port will have no SR-IOV and it will support native Ethernet (i.e. no RoCE). Setting this parameter to "Manual" will configure the number of VFs for each port according to the registry key MaxVFPortX. <b>Note:</b> The number of VFs can be configured both on a Mellanox bus driver level and Network Interface level (i.e using Set-Net-AdapterSriov Powershell cmdlet). The number of VFs actually available to the Network Interface is the minimum value between mellanox bus driver configuration and Network Interface configuration. For example, if 8 VFs support was burnt in firmware, SriovPortMode is auto_port1, and Network Interface was allowed 32 VFs using SetNetAdapterSriov Powershell cmdlet, the actual number of VFs available to Network Interface will be 8.
MaxVFPort1 MaxVFPort2		<ul style="list-style-type: none"> <li>16=(default)</li> </ul>	MaxVFPort<i> The maximum number of VFs that are allowed per port. This is the number of VFs the bus driver will open when working in manual mode. <b>Note:</b> If the total number of VFs requested is larger than the number of VFs burnt in firmware, each port X(1\2) will have the number of VFs according to the following formula: $\frac{\text{MaxVFPortX}}{(\text{MaxVFPort1} + \text{MaxVFPort2}) * \text{number of VFs burnt in firmware}}$