

Red Hat Enterprise Linux (RHEL) 7.3 Driver User Manual

RHEL 7.3

NOTE:

THIS HARDWARE, SOFTWARE OR TEST SUITE PRODUCT (“PRODUCT(S)”) AND ITS RELATED DOCUMENTATION ARE PROVIDED BY MELLANOX TECHNOLOGIES “AS-IS” WITH ALL FAULTS OF ANY KIND AND SOLELY FOR THE PURPOSE OF AIDING THE CUSTOMER IN TESTING APPLICATIONS THAT USE THE PRODUCTS IN DESIGNATED SOLUTIONS. THE CUSTOMER’S MANUFACTURING TEST ENVIRONMENT HAS NOT MET THE STANDARDS SET BY MELLANOX TECHNOLOGIES TO FULLY QUALIFY THE PRODUCT(S) AND/OR THE SYSTEM USING IT. THEREFORE, MELLANOX TECHNOLOGIES CANNOT AND DOES NOT GUARANTEE OR WARRANT THAT THE PRODUCTS WILL OPERATE WITH THE HIGHEST QUALITY. ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT ARE DISCLAIMED. IN NO EVENT SHALL MELLANOX BE LIABLE TO CUSTOMER OR ANY THIRD PARTIES FOR ANY DIRECT, INDIRECT, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES OF ANY KIND (INCLUDING, BUT NOT LIMITED TO, PAYMENT FOR PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY FROM THE USE OF THE PRODUCT(S) AND RELATED DOCUMENTATION EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.



Mellanox Technologies
350 Oakmead Parkway Suite 100
Sunnyvale, CA 94085
U.S.A.
www.mellanox.com
Tel: (408) 970-3400
Fax: (408) 970-3403

© Copyright 2016. Mellanox Technologies Ltd. All Rights Reserved.

Mellanox®, Mellanox logo, Accelio®, BridgeX®, CloudX logo, CompustorX®, Connect-IB®, ConnectX®, CoolBox®, CORE-Direct®, EZchip®, EZchip logo, EZappliance®, EZdesign®, EZdriver®, EZsystem®, GPUDirect®, InfiniHost®, InfiniBridge®, InfiniScale®, Kotura®, Kotura logo, Mellanox CloudRack®, Mellanox CloudXMellanox®, Mellanox Federal Systems®, Mellanox HostDirect®, Mellanox Multi-Host®, Mellanox Open Ethernet®, Mellanox OpenCloud®, Mellanox OpenCloud Logo®, Mellanox PeerDirect®, Mellanox ScalableHPC®, Mellanox StorageX®, Mellanox TuneX®, Mellanox Connect Accelerate Outperform logo, Mellanox Virtual Modular Switch®, MetroDX®, MetroX®, MLNX-OS®, NP-1c®, NP-2®, NP-3®, Open Ethernet logo, PhyX®, PlatformX®, PSIPHY®, SiPhy®, StoreX®, SwitchX®, Tiler®, Tiler logo, TestX®, TuneX®, The Generation of Open Ethernet logo, UFM®, Unbreakable Link®, Virtual Protocol Interconnect®, Voltaire® and Voltaire logo are registered trademarks of Mellanox Technologies, Ltd.

All other trademarks are property of their respective owners.

For the most updated list of Mellanox trademarks, visit <http://www.mellanox.com/page/trademarks>

Table of Contents

Document Revision History	5
1 Firmware Burning	6
2 Port Type Management	7
3 Modules Loading and Unloading	9
4 Important Packages and Their Installation	10
5 SR-IOV Configuration	12
5.1 Setting up SR-IOV in ConnectX-3/ConnectX-3 Pro	12
6 Default RoCE Mode Setting	14

List of Tables

Table 1: Document Revision History	5
--	---

Document Revision History

Table 1: Document Revision History

Revision	Date	Description
RHEL 7.3	November 14, 2016	Initial version of this document.

1 Firmware Burning

1. Check the device's PCI address.

```
lspci | grep Mellanox
```

Example:

```
00:06.0 Infiniband controller: Mellanox Technologies MT27520 Family  
[ConnectX-3 Pro]
```

2. Identify the adapter card's PSID.

```
# mstflint -d 81:00.0 q  
Image type:          FS2  
FW Version:          2.36.5000  
FW Release Date:    26.1.2016  
Rom Info:            type=PXE version=3.4.718 devid=4103  
Device ID:          4103  
Description:        Node          Port1          Port2  
Sys image  
GUIDs:              e41d2d0300b3f590 e41d2d0300b3f591 e41d2d0300b3f592  
e41d2d0300b3f593  
MACs:                e41d2db3f591      e41d2db3f592  
VSD:  
PSID:                MT_1090111019
```

3. Download the firmware BIN file from the Mellanox website that matches your card's PSID:

www.mellanox.com → [Support/Education](#) → [Support Downloader](#)

4. Burn the firmware.

```
# mstflint -d <lspci-device-id> -i <image-file> b
```

5. Reboot your machine after the firmware burning is completed.

6. Validate new firmware burned successfully:

```
# ethtool -i ens3  
driver: mlx4_en  
version: 2.2-1 (Feb 2014)  
firmware-version: 2.40.5000  
expansion-rom-version:  
bus-info: 0000:0a:00.0  
supports-statistics: yes  
supports-test: yes  
supports-eprom-access: no  
supports-register-dump: no  
supports-priv-flags: yes
```

2 Port Type Management

ConnectX®-3/ConnectX®-3 Pro/ConnectX®-4 ports can be individually configured to work as InfiniBand or Ethernet ports. By default both ConnectX®-4 VPI ports are initialized as InfiniBand ports. If you wish to change the port type use the `mstconfig` after the driver is loaded.

1. Install `mstflint` tools.

```
yum install mstflint
```

2. Check the device's PCI address.

```
lspci | grep Mellanox
```

Example:

```
00:06.0 Infiniband controller: Mellanox Technologies MT27520 Family
[ConnectX-3 Pro]
```

3. Use `mstconfig` to change the link type as desired IB – for InfiniBand, ETH – for Ethernet.

```
mstconfig -d <device pci> s LINK_TYPE_P1/2=<ETH|IB|VPI>
```

Example:

```
# mstconfig -d 00:06.0 s LINK_TYPE_P1=ETH

Device #1:
-----

Device type:      ConnectX3Pro
PCI device:       00:06.0

Configurations:
                  Current          New
LINK_TYPE_P1     IB (1)           ETH (2)

Apply new Configuration? ? (y/n) [n] : y
Applying... Done!
-I- Please reboot machine to load new configurations.
```

4. Reboot your machine.
5. Query the device's parameters to validate the new configuration.

```
# mstconfig -d 00:06.0 q

Device #1:
-----

Device type:      ConnectX3Pro
PCI device:       0a:00.0

Configurations:
                  Current
SRIOV_EN          True (1)
NUM_OF_VFS        8
LINK_TYPE_P1      ETH (2)
LINK_TYPE_P2      IB (1)
LOG_BAR_SIZE      3
BOOT_PKEY_P1      0
BOOT_PKEY_P2      0
BOOT_OPTION_ROM_EN_P1 True (1)
BOOT_VLAN_EN_P1   False (0)
BOOT_RETRY_CNT_P1 0
LEGACY_BOOT_PROTOCOL_P1 PXE (1)
BOOT_VLAN_P1      1
BOOT_OPTION_ROM_EN_P2 True (1)
```

```
BOOT_VLAN_EN_P2           False (0)
BOOT_RETRY_CNT_P2         0
LEGACY_BOOT_PROTOCOL_P2   PXE (1)
BOOT_VLAN_P2              1
IP_VER_P1                  IPv4 (0)
IP_VER_P2                  IPv4 (0)
```


3 Modules Loading and Unloading

Mellanox modules for ConnectX®-2/ConnectX®-3/ConnectX®-3 Pro are:

- mlx4_en, mlx4_core, mlx4_ib

Mellanox modules for ConnectX®-4/ConnectX®-4 Lx are:

- mlx5_core, mlx5_ib

In order to unload the driver, you need to first unload `mlx*_en/` `mlx*_ib` and then the `mlx*_core` module.

➤ *To load and unload the modules, use the commands below:*

- Loading the driver: `modprobe <module name>`

```
# modprobe mlx5_ib
```

- Unloading the driver: `modprobe -r <module name>`

```
# modprobe -r mlx5_ib
```

4 Important Packages and Their Installation

libibverbs: InfiniBand verbs library

<code>libibverbs-devel.i686</code>	Development files for the libibverbs library
<code>libibverbs-devel.x86_64</code>	Development files for the libibverbs library
<code>libibverbs-utils.x86_64</code>	Examples for the libibverbs library
<code>libibverbs.i686</code>	A library for direct userspace use of RDMA (InfiniBand/iWARP)
<code>libibverbs.x86_64</code>	A library for direct userspace use of RDMA

librdmacm: RDMA cm library

<code>librdmacm-devel.i686</code>	Development files for the librdmacm library
<code>librdmacm-devel.x86_64</code>	Development files for the librdmacm library
<code>librdmacm-utils.x86_64</code>	Examples for the librdmacm library
<code>librdmacm.i686</code>	Userspace RDMA Connection Manager
<code>librdmacm.x86_64</code>	Userspace RDMA Connection Manager

libibcm: Userspace InfiniBand Connection Management API

<code>libibcm.i686</code>	Userspace InfiniBand Connection Manager
<code>libibcm.x86_64</code>	Userspace InfiniBand Connection Manager

libibmad: Low layer InfiniBand diagnostic and management programs

<code>libibmad.i686</code>	OpenFabrics Alliance InfiniBand MAD library
<code>libibmad.x86_64</code>	OpenFabrics Alliance InfiniBand MAD library

libibumad: Low layer InfiniBand diagnostic and management programs

<code>libibumad-devel.i686</code>	Development files for the libibumad library
<code>libibumad-devel.x86_64</code>	Development files for the libibumad library
<code>libibumad.i686</code>	OpenFabrics Alliance InfiniBand umad (user MAD) library
<code>libibumad.x86_64</code>	OpenFabrics Alliance InfiniBand umad (user MAD) library

libmlx4: Mellanox ConnectX InfiniBand HCA User space Driver

<code>libmlx4.i686</code>	Mellanox ConnectX InfiniBand HCA Userspace Driver
<code>libmlx4.x86_64</code>	Mellanox ConnectX InfiniBand HCA Userspace Driver

libmlx5: Mellanox Connect-IB InfiniBand HCA User space Driver

<code>libmlx5.i686</code>	Mellanox Connect-IB InfiniBand HCA Userspace Driver
<code>libmlx5.x86_64</code>	Mellanox Connect-IB InfiniBand HCA Userspace Driver

opensm: InfiniBand Subnet Manager

<code>opensm-libs.i686</code>	Libraries used by OpenSM and included utilities
<code>opensm-libs.x86_64</code>	Libraries used by OpenSM and included utilities
<code>opensm.x86_64</code>	OpenIB InfiniBand Subnet Manager and management utilities

ibutils: OpenIB Mellanox InfiniBand Diagnostic Tools

<code>ibutils-libs.i686</code>	Shared libraries used by ibutils binaries
<code>ibutils-libs.x86_64</code>	Shared libraries used by ibutils binaries

`ibutils.x86_64` OpenIB Mellanox InfiniBand Diagnostic Tools

infiniband-diags: OpenFabrics Alliance InfiniBand Diagnostic Tools

`infiniband-diags.i686` OpenFabrics Alliance InfiniBand Diagnostic Tools

`infiniband-diags.x86_64` OpenFabrics Alliance InfiniBand Diagnostic Tools

srptools: Tools for SRP/IB

`srptools.x86_64` Tools for using the InfiniBand SRP protocol devices

perftest: IB Performance tests

`perftest.x86_64` IB Performance Tests

mstflint: Mellanox Firmware Burning and Diagnostics Tools

`mstflint.x86_64` Mellanox firmware burning tool

rdmacm-utils

`librdmacm-utils.x86_64` Examples for the librdmacm library

ibverbs-utils

`libibverbs-utils.x86_64` Examples for the libibverbs library

➤ ***To install the packages above run:***

```
# yum install libibverbs librdmacm libibcm libibmad libibumad libmlx4
libmlx5 opensm ibutils infiniband-diags srptools perftest mstflint rdmacm-
utils ibverbs-utils librdmacm-utils -y
```

5 SR-IOV Configuration

5.1 Setting up SR-IOV in ConnectX-3/ConnectX-3 Pro

1. Install the mstflint tools.

```
# yum install mstflint
```

2. Check the device's PCI.

```
# lspci | grep Mellanox
```

Example:

```
00:06.0 Infiniband controller: Mellanox Technologies MT27520 Family
[ConnectX-3 Pro]
```

3. Check if SR-IOV is enabled in the firmware.

```
mstconfig -d <device pci> q
```

Example:

```
# mstconfig -d 00:06.0 q

Device #1:
-----

Device type:      ConnectX3Pro
PCI device:      00:06.0

Configurations:                                     Current
SRIOV_EN          True(1)
NUM_OF_VFS        8
LINK_TYPE_P1     ETH(2)
LINK_TYPE_P2     IB(1)
LOG_BAR_SIZE     3
BOOT_PKEY_P1     0
BOOT_PKEY_P2     0
BOOT_OPTION_ROM_EN_P1 True(1)
BOOT_VLAN_EN_P1 False(0)
BOOT_RETRY_CNT_P1 0
LEGACY_BOOT_PROTOCOL_P1 PXE(1)
BOOT_VLAN_P1     1
BOOT_OPTION_ROM_EN_P2 True(1)
BOOT_VLAN_EN_P2 False(0)
BOOT_RETRY_CNT_P2 0
LEGACY_BOOT_PROTOCOL_P2 PXE(1)
BOOT_VLAN_P2     1
IP_VER_P1        IPv4(0)
IP_VER_P2        IPv4(0)
```

4. Enable SR-IOV:

```
mstconfig -d <device pci> s SRIOV_EN=<False|True>
```

5. Configure the needed number of VFs

```
mstconfig -d <device pci> s NUM_OF_VFS=<NUM>
```



NOTE: This file will be generated only if IOMMU is set in the grub.conf file (by adding “intel_iommu=on” to /boot/grub/grub.conf file).

6. **[mlx4 devices only]** Create/Edit the file /etc/modprobe.d/mlx4.conf:

```
options mlx4_core num_vfs=[needed num of VFs] port_type_array=[1/2 for IB/ETH],[ 1/2 for IB/ETH]
```

Example:

```
options mlx4_core num_vfs=8 port_type_array=1,1
```

7. **[mlx5 devices only]** Write to the sysfs file the number of needed VFs.

```
echo [num_vfs] > /sys/class/infiniband/mlx5_0/device/sriov_numvfs
```

Example:

```
# echo 8 > /sys/class/infiniband/mlx5_0/device/sriov_numvfs
```

8. Reboot the driver.

9. Load the driver and verify that the VFs were created.

```
# lspci | grep mellanox
```

Example:

```
00:06.0 Network controller: Mellanox Technologies MT27520 Family [ConnectX-3 Pro]
00:06.1 Network controller: Mellanox Technologies MT27500/MT27520 Family [ConnectX-3/ConnectX-3 Pro Virtual Function]
00:06.2 Network controller: Mellanox Technologies MT27500/MT27520 Family [ConnectX-3/ConnectX-3 Pro Virtual Function]
00:06.3 Network controller: Mellanox Technologies MT27500/MT27520 Family [ConnectX-3/ConnectX-3 Pro Virtual Function]
00:06.4 Network controller: Mellanox Technologies MT27500/MT27520 Family [ConnectX-3/ConnectX-3 Pro Virtual Function]
00:06.5 Network controller: Mellanox Technologies MT27500/MT27520 Family [ConnectX-3/ConnectX-3 Pro Virtual Function]
00:06.6 Network controller: Mellanox Technologies MT27500/MT27520 Family [ConnectX-3/ConnectX-3 Pro Virtual Function]
00:06.7 Network controller: Mellanox Technologies MT27500/MT27520 Family [ConnectX-3/ConnectX-3 Pro Virtual Function]
00:06.0 Network controller: Mellanox Technologies MT27500/MT27520 Family [ConnectX-3/ConnectX-3 Pro Virtual Function]
```

For further information, refer to section [Setting Up SR-IOV MLNX_OFED User Manual](#).

6 Default RoCE Mode Setting

1. Mount the configs file.

```
# mount -t configfs none /sys/kernel/config
```

2. Create a directory for the mlx4/mlx5 device.

```
# mkdir -p /sys/kernel/config/rdma_cm/mlx4_0/
```

3. Validate what is the used RoCE mode in the default_roce_mode configs file.

```
# cat /sys/kernel/config/rdma_cm/mlx4_0/ports/1/default_roce_mode  
IB/RoCE v1
```

4. Change the default RoCE mode,

- For RoCE v1: IB/RoCE v1
- For RoCE v2: RoCE v2

```
# echo "RoCE v2" >  
/sys/kernel/config/rdma_cm/mlx4_0/ports/1/default_roce_mode  
# cat /sys/kernel/config/rdma_cm/mlx4_0/ports/1/default_roce_mode  
RoCE v2
```

```
# echo "IB/RoCE v1" >  
/sys/kernel/config/rdma_cm/mlx4_0/ports/1/default_roce_mode  
# cat /sys/kernel/config/rdma_cm/mlx4_0/ports/1/default_roce_mode  
IB/RoCE v1
```