Ubuntu 16.10 Linux Inbox Driver
User Manual

Ubuntu 16.10
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Document Revision History

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<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ubuntu 16.10</td>
<td>December 1, 2016</td>
<td>Initial version of this document.</td>
</tr>
</tbody>
</table>
1  

**Firmware Burning**

1. Check the device’s PCI address.
   
   ```bash
   lspci | grep Mellanox
   ```

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

2. Identify the adapter card's PSID.

   ```bash
   # mstflint -d 81:00.0 q
   ```

<table>
<thead>
<tr>
<th>Image type:</th>
<th>FS2</th>
</tr>
</thead>
<tbody>
<tr>
<td>FW Version:</td>
<td>2.36.5000</td>
</tr>
<tr>
<td>FW Release Date:</td>
<td>26.1.2016</td>
</tr>
<tr>
<td>Rom Info:</td>
<td>type=PXE version=3.4.718 devid=4103</td>
</tr>
<tr>
<td>Device ID:</td>
<td>4103</td>
</tr>
<tr>
<td>Description:</td>
<td>Node Port1 Port2</td>
</tr>
<tr>
<td>Sys image GUIDs:</td>
<td>e41d2d0300b3f590 e41d2d0300b3f591 e41d2d0300b3f592</td>
</tr>
<tr>
<td>e41d2d0300b3f593</td>
<td></td>
</tr>
<tr>
<td>MACs:</td>
<td>e41d2db3f591 e41d2db3f592</td>
</tr>
<tr>
<td>VSD:</td>
<td></td>
</tr>
<tr>
<td>PSID:</td>
<td>MT_1090111019</td>
</tr>
</tbody>
</table>

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

   [www.mellanox.com ➔ Support/Education ➔ Support Downloader](http://www.mellanox.com)

4. Burn the firmware.

   ```bash
   # 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:

   ```bash
   # ethtool -i ens3
   ```

<table>
<thead>
<tr>
<th>driver: mlx4_en</th>
</tr>
</thead>
<tbody>
<tr>
<td>version: 2.2-1 (Feb 2014)</td>
</tr>
<tr>
<td>firmware-version: 2.40.5000</td>
</tr>
<tr>
<td>expansion-rom-version:</td>
</tr>
<tr>
<td>bus-info: 0000:0a:00.0</td>
</tr>
<tr>
<td>supports-statistics: yes</td>
</tr>
<tr>
<td>supports-test: yes</td>
</tr>
<tr>
<td>supports-eprom-access: no</td>
</tr>
<tr>
<td>supports-register-dump: no</td>
</tr>
<tr>
<td>supports-priv-flags: yes</td>
</tr>
</tbody>
</table>
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:**
   
<table>
<thead>
<tr>
<th>LINK_TYPE_P1</th>
<th>Current</th>
<th>New</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB(1)</td>
<td>ETH(2)</td>
<td></td>
</tr>
</tbody>
</table>
   
   **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:**
   
<table>
<thead>
<tr>
<th>SRIOV_EN</th>
<th>NUM_OF_VFS</th>
<th>LINK_TYPE_P1</th>
<th>LINK_TYPE_P2</th>
<th>LOG_BAR_SIZE</th>
<th>BOOT_PKEY_P1</th>
<th>BOOT_PKEY_P2</th>
<th>BOOT_OPTION_ROM_EN_P1</th>
<th>BOOT_VLAN_EN_P1</th>
<th>BOOT_RETRY_CNT_P1</th>
<th>LEGACY_BOOT_PROTOCOL_P1</th>
<th>BOOT_VLAN_P1</th>
<th>BOOT_OPTION_ROM_EN_P2</th>
</tr>
</thead>
<tbody>
<tr>
<td>True(1)</td>
<td>8</td>
<td>ETH(2)</td>
<td>IB(1)</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>True(1)</td>
<td>False(0)</td>
<td>0</td>
<td>PXE(1)</td>
<td>1</td>
<td>True(1)</td>
</tr>
<tr>
<td>Variable</td>
<td>Value</td>
<td></td>
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<tr>
<td>BOOT_VLAN_EN_P2</td>
<td>False(0)</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>BOOT_RETRY_CNT_P2</td>
<td>0</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>LEGACY_BOOT_PROTOCOL_P2</td>
<td>PXE(1)</td>
<td></td>
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</tr>
<tr>
<td>BOOT_VLAN_P2</td>
<td>1</td>
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</tr>
<tr>
<td>IP_VER_P1</td>
<td>IPv4(0)</td>
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<td></td>
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</tr>
<tr>
<td>IP_VER_P2</td>
<td>IPv4(0)</td>
<td></td>
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</tbody>
</table>
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
- libibverbs-devel: Development files for the libibverbs library
- libibverbs-utils: Examples for the libibverbs library
- libibverbs: A library for direct userspace use of RDMA (InfiniBand/iWARP)

librdmacm: RDMA cm library
- librdmacm-devel: Development files for the librdmacm library
- librdmacm: Userspace RDMA Connection Manager

libibcm: Userspace InfiniBand Connection Management API
- libibcm: Userspace InfiniBand Connection Manager

libibmad: Low layer InfiniBand diagnostic and management programs
- libibmad: OpenFabrics Alliance InfiniBand MAD library
- libibmad-devel: Development files for the libibmad library
- libibmad: OpenFabrics Alliance InfiniBand umad (user MAD) library

libmlx4: Mellanox ConnectX InfiniBand HCA User space Driver
- libmlx4: Mellanox ConnectX InfiniBand HCA Userspace Driver

libmlx5: Mellanox Connect-IB InfiniBand HCA User space Driver
- libmlx5: Mellanox Connect-IB InfiniBand HCA Userspace Driver

opensm: InfiniBand Subnet Manager
- opensm-libs: Libraries used by OpenSM and included utilities
- opensm: OpenIB InfiniBand Subnet Manager and management utilities

ibutils: OpenIB Mellanox InfiniBand Diagnostic Tools
- ibutils-libs: Shared libraries used by ibutils binaries
- ibutils: OpenIB Mellanox InfiniBand Diagnostic Tools

infiniband-diags: OpenFabrics Alliance InfiniBand Diagnostic Tools
- infiniband-diags: OpenFabrics Alliance InfiniBand Diagnostic Tools

srptools: Tools for SRP/IB
- srptools: Tools for using the InfiniBand SRP protocol devices

perftest: IB Performance tests
- perftest: IB Performance Tests

mstflint: Mellanox Firmware Burning and Diagnostics Tools
- mstflint: Mellanox firmware burning tool

rdmacm-utils
- librdmacm-utils: Examples for the librdmacm library

ibverbs-utils
- libibverbs-utils: Examples for the libibverbs library
To install the packages above run:

```bash
# apt-get install libibverbs1 librdmaclibibcm libibmad5 libibumad3
libmlx4-1 libmlx5-1 opensm ibutils infiniband-diags srptools perf
mstflint rdmacm-utils ibverbs-utils -y
```
5  
SR-IOV Configuration

5.1 Setting up SR-IOV

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]re > /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 configfs file.

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

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

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

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

```bash
# 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

```bash
# 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
```