Red Hat Enterprise Linux (RHEL) 7.7 Driver User Manual
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Table of Contents

Document Revision History .................................................................................................................. 5
1 Firmware Burning .......................................................................................................................... 6
2 Port Type Management .................................................................................................................. 7
3 Modules Loading and Unloading ................................................................................................. 8
4 Important Packages and Their Installation .................................................................................. 9
5 SR-IOV Configuration ............................................................................................................... 10
  5.1 Setting up SR-IOV .............................................................................................................. 10
6 Default RoCE Mode Setting ....................................................................................................... 12
7 PXE over InfiniBand Installation ............................................................................................... 13
List of Tables

Table 1: Document Revision History ........................................................................................................ 5
Document Revision History

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<table>
<thead>
<tr>
<th>Revision</th>
<th>Date</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RHEL 7.7</td>
<td>October 22, 2019</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:
   
   ```bash
   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>FW Version</th>
<th>FW Release Date</th>
<th>Rom Info</th>
<th>Device ID</th>
<th>Description</th>
<th>Sys image</th>
<th>GUIDs</th>
<th>MACs</th>
<th>VSD</th>
<th>PSID</th>
</tr>
</thead>
<tbody>
<tr>
<td>FS2</td>
<td>2.42.5000</td>
<td>26.7.2017</td>
<td>type=PXE version=3.4.752 devid=4103</td>
<td>4103</td>
<td>Node</td>
<td></td>
<td>e41d2d0300b3f590 e41d2d0300b3f591 e41d2d0300b3f592</td>
<td>e41d2db3f591 e41d2db3f592</td>
<td>MT_1090111019</td>
<td></td>
</tr>
</tbody>
</table>

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

4. Burn the firmware.
   
   ```bash
   # mstflint -d <lspci-device-id> -i <image-file> b
   ```

5. Reboot your machine after the firmware burning is completed.
2 Port Type Management

ConnectX®-3 onwards adapter cards’ ports can be individually configured to work as InfiniBand or Ethernet ports. By default, ConnectX® family adapter cards 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.
   ```bash
   yum install mstflint
   ``

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

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

   Example:
   ```bash
   # 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></td>
<td>ETH(2)</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.
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/ConnectX®-5/ConnectX®-5 Ex/ConnectX®-6 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

- **rdma-core**
  - rdma-core: RDMA core userspace libraries and daemons

- **libibmad**: Low layer InfiniBand diagnostic and management programs
  - libibmad: OpenFabrics Alliance InfiniBand MAD library

- **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

- **perftest**: IB Performance tests
  - perftest: IB Performance Tests

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

➤ 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

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/net/ib2/device/sriov_numvfs
```

Example:
```
# echo 8 > /sys/class/net/ib2/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
   ```
   ```bash
   # 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
   ```
7  **PXE over InfiniBand Installation**

PXE over InfiniBand infrastructure has additional parameter in the Boot Loader file for loading the necessary modules and interfaces and for allowing sufficient time to get the link.

To install RHEL from PXE using the IPoIB interfaces, add the following parameters to the Boot Loader file, located in the `var/lib/tftpboot/pxelinux.cfg` directory, at the PXE server:

```bash
bootdev=ib0 ksdevice=ib0 net.ifnames=0 biosdevname=0 rd.neednet=1
rd.bootif=0 rd.driver.pre=mlx5_ib,mlx4_ib,ib_iipoib ip=ib0:dhcp
rd.net.dhcp.retry=10 rd.net.timeout.iflink=60 rd.net.timeout.ifup=80
rd.net.timeout.carrier=80
```

Example:

```bash
default RH7.5
prompt 1
timeout 600
label RH7.5
kernel
append bootdev=ib0 ksdevice=ib0 net.ifnames=0 biosdevname=0 rd.neednet=1
rd.bootif=0 rd.driver.pre=mlx5_ib,mlx4_ib,ib_iipoib ip=ib0:dhcp
rd.net.dhcp.retry=10 rd.net.timeout.iflink=60 rd.net.timeout.ifup=80
rd.net.timeout.carrier=80
```