

# Emulex® Drivers for Linux

## Revision 12.2.383.0

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### Purpose and Contact Information

These release notes describe the new features, resolved issues, LPFC and NVMe driver known issues, and technical tips associated with this release of the Emulex® drivers for Linux.

For the latest product documentation, go to [www.broadcom.com](http://www.broadcom.com). If you have questions or require additional information, contact an authorized Broadcom® Technical Support representative at [ecd-tech.support@broadcom.com](mailto:ecd-tech.support@broadcom.com).

### New Features

Adds support for the RHEL 8.0 and SLES 15 SP1 operating systems.

### Resolved Issues

1. An issue in which one port of a two-port LPe31000-series and LPe32000-series HBA went to a `link down` state after upgrading firmware is fixed.
2. An issue in which downloading firmware using the OneCommand Manager application CLI failed to complete when NVME was enabled is resolved.
3. A LUN path recovery issue on RHEL 8.0 systems with LPe32000-series HBAs is resolved. The issue is not resolved in the drivers in the associated SLES DUD and KISO kits.
4. A LUN path recovery issue on RHEL 7.6 systems with LPe35002 HBAs is fixed. The issue is not resolved in the drivers in the associated SLES DUD and KISO kits.
5. If a discovered target disappears and then reappears, all attached devices are now rediscovered. The issue is not resolved in the drivers in the associated SLES DUD and KISO kits.
6. An issue that might cause the driver to stop responding has been resolved.

### FC Driver Known Issues

1. Beginning with software release 11.2, FC HBAs and OneConnect® adapters have independent software kits. Before updating earlier drivers and applications to the software in release 12.2.1, refer to the *Emulex Software Kit Migration User Guide* for special instructions and considerations for using the 11.2 and later software kits for FC HBAs and OneConnect adapters.

2. Certain inbox drivers do not support LPe31000-series, LPe32000-series, and LPe35000-series adapters as described in the following table.

**Table 1: Operating System and Support for LPe31000-Series, LPe32000-Series, and LPe35000-Series Adapters**

| Operating System                          | Support for LPe31000-Series and LPe32000-Series Adapters | Support for LPe35000-Series Adapters |
|-------------------------------------------|----------------------------------------------------------|--------------------------------------|
| RHEL 7.4                                  | Yes                                                      | No; use the driver disk              |
| RHEL 7.5                                  | Yes                                                      | No; use the driver disk              |
| RHEL 7.6                                  | Yes                                                      | No                                   |
| RHEL 6.9                                  | Yes                                                      | No; use the driver disk              |
| RHEL 6.10                                 | Yes                                                      | No; use the driver disk              |
| RHEL 8.0                                  | Yes                                                      | Yes                                  |
| SLES 12 SP3                               | Yes                                                      | No; use the driver disk              |
| SLES 12 SP4                               | Yes                                                      | Yes                                  |
| SLES 15                                   | Yes                                                      | Yes                                  |
| SLES 15 SP1                               | Yes                                                      | Yes                                  |
| UEK R4 U6, U7 (OL6.9 and OL 7.5 or later) | Yes                                                      | No                                   |
| UEK R5, R5 U1                             | Yes                                                      | Yes                                  |
| Ubuntu 16.04                              | Yes                                                      | No                                   |
| Ubuntu 18.04                              | Yes                                                      | Yes                                  |
| Ubuntu 19.04                              | Yes                                                      | Yes                                  |
| XenServer 6.5                             | No                                                       | No                                   |
| XenServer 7.0                             | Yes                                                      | No                                   |
| XenServer 7.1                             | Yes                                                      | No                                   |

### Workaround

Follow the guidelines in [Table 1](#).

3. PCI Hot Plug might cause applications, such as the Emulex OneCommand® Manager application or third-party applications that use the Emulex libraries (for example, an HBA API), to malfunction.

### Workaround

- Stop all applications that are accessing the Light Pulse Fibre Channel (LPFC) HBA API interface (Emulex OneCommand Manager application or third-party applications) before performing PCI Hot Plug of an LPFC adapter.
- Use the following command to stop the Emulex OneCommand Manager application:

```
#/usr/sbin/ocmanager/stop_ocmanager
```

- After performing PCI Hot Plug of the adapter, restart the applications.

4. SCSI errors might occur on deletion of vPorts or PCI Hot Unplug.

On occasion, the kernel might report SCSI errors when deleting vPorts through the `sysfs` interface or performing a PCI Hot Unplug of an Emulex adapter:

```
kernel: Synchronizing SCSI cache for disk
kernel: FAILED
```

Or:

```
SCSI error: return code = 0x00010000
```

### Workaround

None. Ignore these messages; they do not indicate a functional failure.

5. An issue exists while deleting vPorts when devices are in use.

Emulex provides management utilities that allow you to delete vPorts. However, no mechanism exists for the LPFC driver to detect whether devices accessed through that vPort are in use. This situation means you can delete a vPort when devices accessible through the vPort are mounted or when I/O is outstanding to the device. When file systems are mounted on vPorts and vPorts are deleted, the file systems still appear to be mounted; however, they are inaccessible.

#### Workaround

Before deleting vPorts, you must prepare the system affected by the vPort deletion accordingly, by unmounting all the devices accessible through the vPorts and ensuring there is no outstanding I/O.

6. Devloss timeout occurs after swapping ports.

The driver might not finish discovery when two initiator ports are swapped. This situation causes all devices accessible through one or both of these initiator ports to time out and all I/O to fail.

#### Workaround

Do one of the following:

- When swapping cables, replace each cable, one at a time, and allow discovery to finish before replacing the next cable. To determine if discovery is finished, read the `state sysfs` parameter.
- When swapping cables, allow the devloss timeout to occur before replacing the cables (this action fails all outstanding I/O).

7. The Linux Loader (LILO) boot loader is not supported on i386 and x86\_64 architectures.

The LILO boot loader on i386 and x86\_64 architectures is not supported for this driver. If the LILO boot loader is used, after the LPFC driver package is installed and upon reboot, an incorrect initial ramdisk is used, and the system might not boot correctly.

#### Workaround

The boot loader supported with this driver is Grand Unified Bootloader (GRUB), which is the default boot loader for most of the Linux distributions. LILO is an older boot loader used on i386 and x86\_64 architectures only. GRUB works correctly with the driver package installation script.

8. Enabling the ExpressLane™ feature on a LUN, when maximum LUNs are already enabled for ExpressLane, might result in an error.

#### Workaround

Use the `/usr/sbin/lpfc/lpfc_clean_xlane_conf.sh` script to clear any unwanted entries and retry enabling ExpressLane.

9. An error message `Failed to issue SLI_CONFIG ext-buffer` might be displayed when multiple queue operations are performed.

#### Workaround

During firmware update operations, do not perform queue operations, such as resetting the adapter, the bus, the target, or the host.

10. Revision A of the FOIT AFCT-57F3TMZ-ELX (16GFC longwave optic transceiver) does not support D\_Port for MDS Diagnostic for Cisco switches.

#### Workaround

None.

11. Neither Revision A nor Revision B of the FOIT AFCT-57F3TMZ-ELX (16GFC longwave optic transceiver) supports D\_Port for Brocade® switches.

**Workaround**

None.

12. The SLES 12 SP3 driver fails to install on the SLES 12 SP3 GA driver.

**Workaround**

The minimum kernel on which the SLES 12 SP3 driver can be installed is maintenance kernel 718 (4.4.126-94.22.1) from SUSE, dated April 23, 2018.

13. Invalid link fault code messages might be generated, followed by mailbox command failures .

**Workaround**

For example:

```
kernel:
lpfc 0000:05:00.2: 2:0398 Invalid link fault code: x3
```

This is the result of improper handling of a new firmware link fault code by inbox Linux drivers.

The issue is fixed in inbox Linux drivers version 12.0.0.3 and later, such as the following Linux operating systems versions:

- SLES12 SP3 maintenance update 4.4.140-94.42.1 and later
- SLES15 maintenance update 4.12.14-25.3.1 and later

The issue is also fixed in out-of-box Linux driver version 12.0.193.22 and later.

14. On SLES 12 and SLES 15, the driver might not unload due to BTRFS.

If a discovered SCSI device has a BTRFS partition on it, the upper layers maintain a reference count on the driver which will cause it to not be unloaded. After the SCSI layer discovers an FC device and you see the following BTRFS message:

```
[ 5.502273] sd 0:0:0:1: [sdd] Attached SCSI disk
[ 5.552774] BTRFS: device fsid 69ca50b4-c061-4f66-9ada-0287d76269a0 devid 1 transid 274 /dev/sdd2
```

The BTRFS subsystem takes a reference count on the lpfc driver when this happens. This extra reference count might stop the administrator from unloading the lpfc driver. In order to unload the driver the reference count for it must be 0:

```
# cat /sys/module/lpfc/refcnt
0
#
```

15. Boot from SAN is not supported if FC-SP-2 authentication (DHCHAP) is enabled.

**Workaround**

None.

16. Due to limitations in the FC-LS-3 RDP ELS definition, FC switches do not issue RDP commands on trunked links.

**Workaround**

None.

17. The remote switched diagnostic test will fail with Latency Err-Drop error, if you run diagnostics on multiple HBAs simultaneously.

**Workaround**

Run diagnostics on only one port at a time.

18. On certain SLES 15 servers, after completion of an internal loopback test on LPe31000-series and LPe32000-series adapters, it might take around one minute for the link-up event. No functionality is impacted once the link comes back online.

**Workaround**

None.

19. Brocade switches using Fabric Operating System (FOS) version 8.2.1B and earlier might encounter the following issues with DHCHAP authentication:

- You might not be able to configure the secret pair between the switch and the HBA.
- When authentication is enabled on the switch, and authentication is disabled on the HBA, the switch disables the port, but it does not issue the expected status messages.
- The Brocade switch authenticates the HBA port when authentication is disabled on the switch, or when a frame is dropped.

**Workaround**

None.

20. Firmware dump is unavailable for LPe35000-series adapters using standard Emulex applications, such as the OneCommand Manager application and the OneCapture™ utility, on the following Linux inbox drivers:

- SLES 12 SP4
- SLES 15
- RHEL 7.6 (except the RHEL7.6 errata kernel-3.10.0-990.el7)
- Oracle UEK 5.0
- Ubuntu 18.04

To perform a firmware dump on these inbox drivers, see [LPFC Driver Technical Tips, item 6](#) in these release notes.

21. The SLES 12 SP4 driver with MultiQueue enabled does not resume I/Os after a link toggle or link reset.

**Workaround**

No workaround is available for the currently released driver version. This issue is to be fixed by SuSE in the operating system.

22. Loading a Broadcom ECD-signed driver on a system using legacy BIOS might result in an error message similar to the following:

```
Request for unknown module key 'Broadcom Inc.: Emulex Connectivity Division:
dl7ecabc92cd490989959b37f05f0eda48c53895' err -11
```

or

```
PKCS#7 signature not signed with a trusted key
```

**Workaround**

None. This is a benign error message and it can be ignored.

23. On LPe35000-series adapters with trunking enabled, if I/O is running on NVMe and FCP drivers and a LIP (Loop Initialization Protocol) is issued, a call trace is generated and the ports are reset.

**Workaround**

None.

24. On RHEL 8.0 inbox systems, the GUI displays incorrect trunking information.

**Workaround**

Use the RHEL 8.0 out-of-box driver.

25. The Cisco MDS driver parameter should be enabled only when Cisco MDS diagnostics are running. Enabling the parameter when the system is connected to a Brocade switch is not supported.

**Workaround**

Disable the MDS driver parameter when the system is not connected to a Cisco Switch.

26. On some inbox Linux distributions, the `lpfc_enable_mds_diags` driver parameter cannot be enabled dynamically.

**Workaround**

Enable the `lpfc_enable_mds_diags` parameter temporarily by issuing the following commands:

```
rmmod lpfc
modprobe lpfc lpfc_enable_mds_diags=1
```

After the diagnostics are complete, reload the driver without the `lpfc_enable_mds_diags` parameter.

## NVMe Driver Known Issues

1. NVMe multipath is enabled by default in SLES 15. Native NVMe Multipath was not a testing focus of Emulex. Hence, Emulex cannot make a statement on its support. Please contact the operating system vendor for Native NVMe Multipathing support status.

**Workaround**

If desired to run without NVMe multipath, you can disable NVMe multipath by adding `nvme-core.multipath=N` as a boot parameter in the Grand Unified Bootloader (`grub`) package.

2. In the latest SLES 12, SLES 15, and RHEL 7.x operating system variants, the `nvme list` command might not display all namespaces when maximum namespaces (255) are created on the target.

**Workaround**

Use the `lsblk` command to display all namespaces.

3. Running the `nvmetcli clear` command on an NVMe target when the NVMe initiator port is down might cause the target system to stop responding. Make sure that the NVMe initiator port is UP and all the NVMe devices are disconnected from the initiator before running the `nvmetcli clear` command on the target.

**Workaround**

None.

4. The deliberate faulting of NVMe discovery commands (also called jamming) is not supported. If a discovery command is faulted during initial linkup or during the LIP linkup recovery time, NVMe discovery fails on the affected controller.

**Workaround**

Perform a LIP on the initiator link, and remove the condition that is faulting discovery.

5. If you are adding a subsystem dynamically on a target, you must issue an LIP on the initiator host port bound to the target. If you are adding new namespaces dynamically to existing subsystems, you must perform a manual scan on the initiator. See [NVMe Driver Technical Tips](#) for more information.

6. Configuring Initiator ports as NVMe over FC is not supported on ports configured as Fabric assigned Port World Wide Names (FA-PWWN).

7. This release supports FC-NVMe specification version 1.18.

8. Target port reset using `hbacmd` or the Emulex OneCommand Manager application is not supported in this release.

9. Dynamic NVMe target management (including reconfiguration) and dynamic initiator rescan are not supported. Any reconfiguration requires a target server reboot.

After the target server reboots and the configuration is activated, connected initiators might require a link bounce to rescan the target.

10. Due to an issue on Linux operating systems, NVMe I/O might stop if the initiator server administrator continually resets the NVMe controllers for more than one hour while the system is under I/O load.

**Workaround**

Perform a server reboot.

11. Unloading the `lpfc` driver using the `modprobe -r` command might cause issues on the initiator before NVMe devices are disconnected.

**Workaround**

Unload the driver with `rmmod lpfc`, or if `modprobe -r lpfc` is required, wait for the device loss period of 60 seconds before unloading the driver.

12. If the following files are present on the system after the operating system is installed, the operating system has already installed NVMe over FC autoconnect facilities. Do not install the Emulex autoconnect script file for inbox NVMe over FC drivers.

- `/usr/lib/systemd/system/nvmeofc-boot-connections.service`
- `/usr/lib/systemd/system/nvmeofc-connect@.service`
- `/usr/lib/udev/rules.d/70-nvmeofc-autoconnect.rules`

13. On SLES 12 SP4 and SLES 15 operating systems, an I/O error can occur while resetting an NVMe controller. Error messages similar to the following might be shown and the I/O request could fail.

```
nvme nvme0: NVME-FC{0}: controller reset complete
print_req_error: I/O error, dev nvme0c2n3, sector 11715.
```

**Workaround**

None.

14. On systems with version 1.7 of the `nvme-cli` installed, connection attempts might fail, and you might not see NVMe-FC storage. Console log messages and Systemd log messages indicate the failure to connect.

**Workaround**

Do one of the following:

- Contact the operating system vendor to obtain a newer version of the `nvme-cli` utility.
- Download and use the latest `nvme-cli` utility at <https://github.com/linux-nvme/nvme-cli>.

15. On LPe35000-series adapters with trunking enabled, if I/O is running on NVMe and FCP drivers and a LIP is issued, a call trace is generated and the ports are reset.

**Workaround**

None.

16. On RHEL 8.0, I/O does not resume on NVMe namespaces after a storage node failover.

**Workaround**

None.

17. On RHEL 8.0, call traces are observed while running I/O on 4K block size namespaces.

**Workaround**

None.

18. On SLES 15 SP1, `nvme-cli` auto discovery fails.

**Workaround**

None.

19. On SLES 15 SP1, the out-of-box `lpfc` driver incorrectly defaults to setting the `lpfc_enable_fc4_type` driver parameter to 1 instead of 3. The `lpfc_enable_fc4_type` driver parameter must be set to 3 to enable NVMe support.

**Workaround**

To enable NVMe, add the `lpfc_enable_fc4_type` driver parameter to a `modprobe` configuration file by performing the following steps:

- a. Modify or create the `/etc/modprobe.d/lpfc.conf` file.
- b. Add options `lpfc lpfc_enable_fc4_type=3`.

20. To enable autoconnect on the SLES 15 SP1 operating system, install `nvme-cli` from the operating system distribution media.

## FC Driver Technical Tips

1. Locked optics are supported on Emulex LPe31000-series and LPe32000-series adapters.

The adapters perform the following operations:

- Detect and enable both Broadcom or Emulex certified SFP optics.
- For firmware revision 11.x and later, unqualified optics are disabled, the link is down, and an error message is written to the log file.
- The `lpfc` out-of-box driver revision 11.x and later shows this message, and the link will not come up.  
"3176 Port Name [wwpn] Unqualified optics - Replace with Avago optics for Warranty and Technical support"

When a 32 Gb/s optic is installed in an Emulex LPe31000-series, LPe32000-series, or LPe35000-series adapter, the link supports 32 Gb/s, 16 Gb/s, and 8 Gb/s speeds.

When a 16 Gb/s optic is installed in an Emulex LPe31000-series or LPe32000-series adapter, the link supports 16 Gb/s, 8 Gb/s, and 4 Gb/s speeds.

2. This release supports UEFI secure boot for RHEL 7.x. If secure boot is enabled in the system BIOS, you must download the public key file for RHEL 7.x from [www.broadcom.com](http://www.broadcom.com) and place it in the system's key ring before installing the signed driver for RHEL 7.x. Refer to the Red Hat documentation for instructions on adding a kernel module to the system.
3. `D_Port` and `FA-PWWN` cannot be enabled simultaneously.

**Workaround**

If `D_Port` is enabled and you want to enable `FA-PWWN`, you must first disable `D_Port`. If `FA-PWWN` is enabled and you want to enable `D_Port`, you must first disable `FA-PWWN`.

4. `D_Port` is enabled by default.

5. D\_Port and DHCHAP cannot be enabled simultaneously.

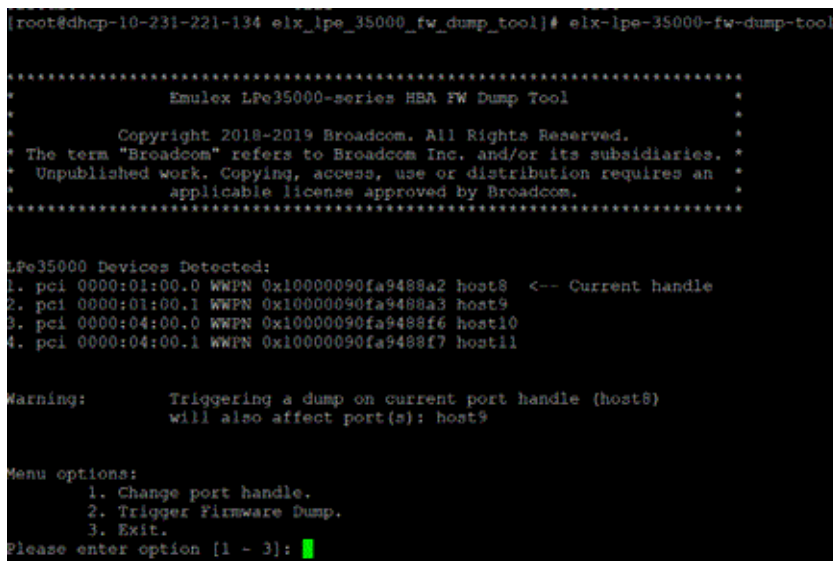
### Workaround

If D\_Port is enabled and you want to enable DHCHAP, you must first disable D\_Port. If DHCHAP is enabled and you want to enable D\_Port, you must first disable DHCHAP.

6. To perform a firmware dump on the inbox drivers listed in [LPFC Driver Known Issues, item 20](#), perform the following steps:
- Ensure that the latest Emulex OneCommand Manager core application kit for Linux is installed on the host.
  - Download the LPe35000-Series HBA Firmware Dump Tool from the Broadcom website, at [www.broadcom.com](http://www.broadcom.com).
  - Type the following commands to extract and install the tool:

```
tar xzf elx-lpe-35000-fw-dump-tool-<version>-ds-1.tar.gz
cd elx-lpe-35000-fw-dump-tool-<version>-ds-1/
rpm -ivh elx-lpe-35000-fw-dump-tool-<version>.<platform>.rpm
```

A window similar to the following is displayed.



```
[root@dhcp-10-231-221-134 elx_lpe_35000_fw_dump_tool]# elx-lpe-35000-fw-dump-tool

*****
Emulex LPe35000-series HBA FW Dump Tool
*****
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*****

LPe35000 Devices Detected:
1. pci 0000:01:00.0 WWPN 0x10000090fa9488a2 host8 <-- Current handle
2. pci 0000:01:00.1 WWPN 0x10000090fa9488a3 host9
3. pci 0000:04:00.0 WWPN 0x10000090fa9488f6 host10
4. pci 0000:04:00.1 WWPN 0x10000090fa9488f7 host11

Warning:      Triggering a dump on current port handle (host8)
              will also affect port(s): host9

Menu options:
1. Change port handle.
2. Trigger Firmware Dump.
3. Exit.
Please enter option [1 - 3]: █
```

- Type **1** and press **Enter** to select the port for which you want to perform the firmware dump.

A window similar to the following is displayed.

```
[root@dhcp-10-231-221-134 elx_lpe_35000_fw_dump_tool]# elx-lpe-35000-fw-dump-tool

*****
*                               *
*      Emulex LPe35000-series HBA FW Dump Tool      *
*                               *
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*                               *
*****

LPe35000 Devices Detected:
1. pci 0000:01:00.0 WWPN 0x10000090fa9488a2 host8 <-- Current handle
2. pci 0000:01:00.1 WWPN 0x10000090fa9488a3 host9
3. pci 0000:04:00.0 WWPN 0x10000090fa9488f6 host10
4. pci 0000:04:00.1 WWPN 0x10000090fa9488f7 host11

Warning:      Triggering a dump on current port handle (host8)
              will also affect port(s): host9

Menu options:
  1. Change port handle.
  2. Trigger Firmware Dump.
  3. Exit.
Please enter option [1 - 3]: 1
```

**NOTE:** If initiating a firmware dump on a specific port will also affect another port on the same adapter ASIC, a warning message notifies you of this fact.

- e. Type the number of the port for which you want to perform the firmware dump, and press **Enter**.

A window similar to the following is displayed.

```
LPe35000 Devices Detected:
1. pci 0000:01:00.0 WWPN 0x10000090fa9488a2 host8 <-- Current handle
2. pci 0000:01:00.1 WWPN 0x10000090fa9488a3 host9
3. pci 0000:04:00.0 WWPN 0x10000090fa9488f6 host10
4. pci 0000:04:00.1 WWPN 0x10000090fa9488f7 host11
Please select new handle: 3

*****
*                               *
*      Emulex LPe35000-series HBA FW Dump Tool      *
*                               *
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*                               *
*****

LPe35000 Devices Detected:
1. pci 0000:01:00.0 WWPN 0x10000090fa9488a2 host8
2. pci 0000:01:00.1 WWPN 0x10000090fa9488a3 host9
3. pci 0000:04:00.0 WWPN 0x10000090fa9488f6 host10 <-- Current handle
4. pci 0000:04:00.1 WWPN 0x10000090fa9488f7 host11

Warning:      Triggering a dump on current port handle (host10)
              will also affect port(s): host11

Menu options:
  1. Change port handle.
  2. Trigger Firmware Dump.
  3. Exit.
Please enter option [1 - 3]:
```

- f. When the desired port is identified as the current port, type **2** and press **Enter** to initiate the firmware dump on the current port.
- g. If the firmware dump is successful, the firmware dump tool closes automatically.

- h. Restart the `elxhbmgrd` service by typing the following command:

```
service elxhbmgrd restart
```

This allows applications such as the Emulex OneCommand Manager application to be refreshed.

By default, the firmware dump file is available on the host in the `/var/opt/Emulex/ocmanager/Dump/` directory after the `elxhbmgrd` service has been restarted.

On SLES 12 SP4 or SLES 15, initiating a firmware dump might result in an error message similar to the following:

```
error: Invalid argument (src/elx_lpe_35000_pci_device.cpp:TriggerFWDump:510)
Consider adding "iomem=relaxed" to grub cfg kernel commandline.
[0x10000090fa9488a2], [host8], [0000:01:00.0] Failed to trigger firmware dump...
```

If this message appears, do the following:

- a. Add the following kernel command line to the host grub configuration file:

```
iomem=relaxed
```

- b. Reboot the host.
- c. Repeat the process to initiate a firmware dump.

**NOTE:** For the Ubuntu x86\_64 architecture operating system, the OneCommand Manager application is unavailable. You must use the Emulex OneCapture utility to read the firmware dump from the Flash. You can download the latest Emulex OneCapture utility for Ubuntu from the Broadcom website, at [www.broadcom.com](http://www.broadcom.com), and use it.

For instructions on reading the firmware dump file, refer to the “Output File” section under “Running OneCapture on Linux, Citrix, and Solaris” in the *Emulex OneCapture Utility User Guide*.

## NVMe Driver Technical Tips

1. Creation of N\_Port ID Virtualization (NPIV) connections on initiator ports that are configured for NVMe over FC is not supported. However, initiator ports can connect to Fibre Channel Protocol (FCP) and NVMe targets simultaneously.
2. NVMe disks might not reconnect after a device timeout greater than 60 seconds has occurred.

### Workaround

You must reboot the initiator, or perform a manual scan, or connect via the `nvme connect-all` CLI command.

3. To manually scan for targets or dynamically added subsystems, type the following command (all on one line):

```
nvme connect-all --transport=fc --host-traddr=nn-<initiator_WWNN>:pn-<initiator_WWPN>
--traddr=nn-<target_WWNN>:pn-<target_WWPN>
```

where:

- `<initiator_WWNN>` is the WWNN of the initiator, in hexadecimal.
- `<initiator_WWPN>` is the WWPN of the initiator, in hexadecimal.
- `<target_WWNN>` is the WWNN of the target, in hexadecimal.
- `<target_WWPN>` is the WWPN of the target, in hexadecimal.

For example:

```
# nvme connect-all --transport=fc --host-traddr=nn-0x20000090fa942779:pn-0x10000090fa942779 --
traddr=nn-0x20000090fae39706:pn-0x10000090fae39706
```

4. To enable autoconnect on the SLES 15 SP1 operating system, install `nvme-cli` from the operating system distribution media.

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