Emulex® Drivers for Linux for OneConnect® Adapters

User Guide

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Chapter 1: Introduction

1.1 Overview

This guide provides installation, updating, uninstalling, configuring, and troubleshooting procedures for several types of Emulex®-supported drivers for Linux.

This guide is applicable to several versions of drivers, operating systems, firmware, and adapters.

- For supported firmware versions and their latest release, refer to the Documents and Downloads area of http://www.broadcom.com for the specific adapter.
- This product supports the following Emulex OneConnect® converged network adapters (CNAs):
  - OCe11000-series adapters
  - OCe14000-series adapters

1.2 Abbreviations

AIC	adaptive interrupt coalescing
ANSI	American National Standards Institute
API	application programming interface
ARI	alternative routing-ID interpretation
ASIC	application-specific integrated circuit
BIOS	basic input/output system
CLI	command line interface
CNA	converged network adapter
CPU	central processing unit
CQ	completion queue
CQE	completion queue entry
DAPL	Direct Access Programming Library
DCBX	Data Center Bridging Capabilities Exchange
DHCHAP	Diffie-Hellman Challenge Handshake Authentication Protocol
DIF	Data Integrity Field
DIMM	dual in-line memory module
DMA	direct memory access
EQ	event queue
ETO	extended timeout
FC	Fibre Channel
FCF	Fibre Channel over Ethernet Forwarder
FCFI	Fibre Channel Forwarder Indicator
FCoE	Fibre Channel over Ethernet
FCP	Fibre Channel Protocol
FSB	front side bus

FW	firmware
GbE	gigabit Ethernet
Gb/s	gigabits per second
GID	group identifier
GnuPG	GNU Privacy Guard
GRO	Generic Receive Offload
GUI	Graphical User Interface
HBA	host bus adapter
HII	Human Interface Infrastructure
IB	Infiniband
IEEE	Institute of Electrical and Electronics Engineers
I/O	input/output
IOCB	input/output control block
IOPs	I/O operations per second
IOV	I/O virtualization
IP	Internet Protocol
IPL	initial program load
IQN	iSCSI qualified name
IRQ	interrupt request
iSCSI	internet Small Computer System Interface
iSER	iSCSI Extensions for RDMA
iSNS	Internet Storage Name Service
KVM	kernel-based virtual machine
LACP	Link Aggregation Control Protocol
LAN	local area network
LBA	logical block address
LDTO	link down timeout
LLC	logical link control
LOM	LAN on motherboard
LPVID	logical port VLAN ID
LRO	large receive offload
LUN	logical unit number
MAC	Media Access Control
Mb/s	megabits per second
MPIO	multipath I/O
MR	memory region
MSI	message signaled interrupts
MSI-X	message signaled interrupts - extended
MTU	maximum transmission unit
NAA	Network Address Authority
NCSI	Network Communication Services Interface
NFS RDMA	network file system over RDMA
NIC	network interface card (or controller)

NPar	NIC partitioning
NPIV	N_Port ID Virtualization
NUMA	non-uniform memory access
OFA	Open Fabric Alliance
OFED	OpenFabrics Enterprise Distribution
PCIe	Peripheral Component Interconnect Express
PD	protection domain
PF	physical function
PFC	priority flow control
POST	power-on self-test
QCN	quantized congestion notification
QoS	quality of service
QP	queue pair
RDMA	remote direct memory access
RHEL	Red Hat Enterprise Linux
RoCE	RDMA over converged Ethernet
RPI	remote port indicator
RPM	resource package manager
RQ	receive queue
RSCN	registered state change notification
RSS	receive-side scaling
Rx	receive
SAN	storage area network
SCSI	Small Computer System Interface
SGE	Oracle (formerly Sun) grid engine
SLES	SUSE Linux Enterprise Server
SLI	Service Level Interface
SNAP	Subnetwork Access Protocol
SNMP	Simple Network Management Protocol
SQ	send queue
SR-IOV	single-root I/O virtualization
SRQ	shared receive queue
tar	tape archive
TCP	Transmission Control Protocol
TSO	TCP Segmentation Offload
Tx	transmit
UDP	User Datagram Protocol
UEFI	Unified Extensible Firmware Interface
UMC	Universal multichannel
VEB	virtual Ethernet bridging
VEPA	virtual Ethernet port aggregator
VF	virtual function
VGT	virtual guest tagging

VLAN	virtual local area network
VM	virtual machine
VPD	vital product data
VPort	virtual port
VXLAN	Virtual eXtensible LAN
WWPN	World Wide Port Name
XRI	extensible resource indicator

Chapter 2: Installing and Uninstalling

Emulex releases Linux binary RPMs that are digitally signed using the GNU Privacy Guard (GnuPG) standard. This signature will allow certification of the contents of the RPMs and verification that the contents have not been modified since they were created by Emulex. The RPMs have been digitally signed by Emulex with a GnuPG private key that is only held by Emulex. Instructions for creating the GnuPG public key file are located at:

http://www.broadcom.com/docs/elx-rpm-public-key

2.1 General Installation Requirements

NOTE You must install the driver before updating the firmware.

Prior to driver installation, follow these general requirements:

- Install a supported Emulex adapter in the system. Refer to the adapter installation guide for specific hardware installation instructions.
- Use a supported operating system. Refer to the Documents and Downloads area of http://www.broadcom.com for supported operating systems.

2.2 Binary RPM FCoE Driver Kit

The binary resource package manager (RPM) Fibre Channel over Ethernet (FCoE) driver kit contains the following:

- A zipped tape archive (tar) file that includes the driver binary RPMs for a specific driver version and Linux distribution

  NOTE Use only officially released Linux distribution kernels. The binary RPM packages only support officially released Linux distribution kernels and do not support pre-release distribution kernels.
- An installation script, `brcmfcoe_install.sh`, that installs by default the FCoE driver binary RPM that corresponds to the target system's architecture and kernel memory variant
- A README file that provides a description of the kit structure, its contents, and distribution support scope

2.2.1 Installing the Binary RPM FCoE Driver Kit

NOTE You must uninstall any driver kits that are not part of this distribution. For example, you must uninstall any previous FCoE driver kits before installing this driver kit. This installation fails if a previous version of the FCoE driver kit is detected. For more information, see Section 2.2.2, Uninstalling the Binary RPM FCoE Driver Kit.

To install the binary RPM FCoE driver:

1. Download the appropriate driver kit from the Documents and Downloads area of http://www.broadcom.com.
2. Log in as *root* to a terminal, and unpack the tarball:

   ```
   tar xzf brcm-lpfc-dd-<Linux distribution version>-<driver version>.tar.gz
   ```
3. Change to the directory into which the tarball was extracted:

   ```
   cd brcm-lpfc-dd-<Linux distribution version>-<driver version>/
   ```

4. Run the `brcmfcoe_install.sh` script without options to install the driver kit:

   ```
   ./brcmfcoe_install.sh
   ```

   After the `brcmfcoe_install.sh` script has finished running successfully, the Emulex Fibre Channel (FC) and FCoE driver is loaded, and devices that are connected to the system are accessible.
5. Reboot the system to enable the newly added driver options in the ramdisk. You can also reboot the system later.

2.2.2 Uninstalling the Binary RPM FCoE Driver Kit

NOTE You must run the uninstall script that shipped with the version of the driver kit you want to remove.

To uninstall the binary RPM FCoE driver:

1. Log in as *root*.
2. If possible, exit all applications that use FCoE-attached drives, then unmount the drives. If you cannot exit all applications that use FCoE-attached drives, the uninstall script works properly, but you must reboot after the uninstall is complete.
3. Run the `brcmfcoe_install.sh` script with the `--uninstall` option:

   ```
   ./brcmfcoe_install.sh --uninstall
   ```

2.3 Ethernet Driver Kit

The Ethernet driver kit includes the driver that supports the network interface card (NIC) protocol. The Ethernet driver kit contains the following:

- A zipped tar file that includes the driver binary RPMs for a specific driver version, and for all of the supported Linux distribution kernels

  NOTE Use only officially released Linux distribution kernels. The binary RPM packages only support officially released Linux distribution kernels and do not support pre-release distribution kernels.
- An installation script, `elx_net_install.sh`, which installs (by default) the Ethernet driver binary RPM that corresponds to the target system's architecture and kernel memory variant
- A README file that provides a description of the kit structure, its contents, and distribution support scope

2.3.1 Installing the Ethernet Driver Kit

NOTE Remove any previously installed Ethernet driver kits (that is, those that were not part of a distribution's kernel), before proceeding. For more information on uninstalling the driver, see Section 2.3.2, Uninstalling the Ethernet Driver Kit.

To install the Ethernet driver:

1. Download the appropriate driver kit from the Documents and Downloads area of http://www.broadcom.com.
2. Log in as *root* to a terminal, and unpack the tarball:

   ```
   tar xzf elx-be2net-dd-<driver version>.tar.gz
   ```
3. Change to the directory that is extracted:

   ```
   cd elx-be2net-dd-<driver version>/
   ```

4. Run the `elx_net_install.sh` script without options to install the driver kit:

   ```
   ./elx_net_install.sh
   ```

   After the `elx_net_install.sh` script has finished running successfully, the Emulex Ethernet driver is loaded, and devices that are connected to the system are accessible.
5. Reboot the system to enable the newly added driver options in the ramdisk. You can also reboot the system later.

2.3.2 Uninstalling the Ethernet Driver Kit

NOTE You must run the uninstall script that shipped with the version of the driver kit you want to remove.

To uninstall the Ethernet driver:

1. Log in as *root*.
2. If possible, exit all applications that use Ethernet-attached drives, then unmount the drives. If you cannot exit all applications that use Ethernet-attached drives, the uninstallation works properly, but you must reboot after the uninstallation is complete.
3. Run the `elx_net_install.sh` script with the `--uninstall` option:

   ```
   ./elx_net_install.sh --uninstall
   ```

2.4 RoCE Driver for the OCe14000-Series Adapters

NOTE RDMA over converged Ethernet (RoCE) is available as Technical Preview only. Do not use RoCE in a production environment.

RoCE is a network protocol that allows remote direct memory access over an Ethernet network. RoCE is a link layer protocol that allows communication between any two hosts in the same Ethernet broadcast domain.

Network-intensive applications, such as networked storage or cluster computing require, a network infrastructure with high bandwidth and low latency. The advantages of remote direct memory access (RDMA) over other network application programming interfaces are lower latency, lower central processing unit (CPU) load, and higher bandwidth.

For a list of operating systems supported for RoCE, refer to the latest *Emulex Driver for Linux for OneConnect Adapters Release Notes*.

2.4.1 Installing the Infiniband Stack

Before installing the OpenFabrics Enterprise Distribution (OFED) package/Infiniband stack (IB stack) and RoCE driver/libraries, ensure that the OCe14000 adapter uses the NIC+RoCE profile. You can verify this by pressing **Ctrl+P** during system booting, or by checking the profile using the Emulex OneCommand® CNA Manager application, or by inspecting the Ethernet driver load messages in `/var/log/messages` as detailed in Section 3.3.1.2, Confirming that the RoCE Profile Is Enabled.

Before you proceed with installation, ensure that the installed operating system supports the driver. Check the latest *Emulex for Linux Driver for OneConnect Adapters Release Notes* for the list of supported operating systems.

2.4.1.1 Installing the IB Stack from the OFA Distribution

The Open Fabric Alliance (OFA) distributes the IB stack in the form of a OFED tarball. For a list of available OFED versions that are compatible with the supported operating systems, refer to the latest Emulex *Driver for Linux for OneConnect Adapters Release Notes*.

Supported OFED packages can be downloaded from the following website:

`https://www.openfabrics.org/downloads/OFED/`

To install the OFED package:

1. Download the appropriate tarball file to the `/tmp` directory.
2. Extract the downloaded `OFED-x.tgz` tarball.

```
# cd /tmp
# tar -xvzf OFED-x.tgz
```

3. Install the OFED package by typing:

```
#cd /tmp/<OFED-version>
```

— To install the OFED package in SUSE Linux Enterprise Server (SLES) 12 platforms, type:

```
# ./install.pl --without-ocrdma --without-be2net
--without-infiniband-diags
```

NOTE If the `infiniband-diags` package is removed, the ibstat and ibxxx tools are not available.

— To install the OFED package in any other platform, type:

```
# ./install.pl --without-ocrdma --without-be2net
```

4. When installation of the OFED stack is complete, reboot the system.

NOTE The OFED installation process might list a few missing dependency packages that you can install from the operating system CD.

2.4.1.2 Installing the IB Stack from the Operating System Distribution

To install the IB stack during the operating system installation process:

1. Select **Infiniband Support** in the customization menu. The Infiniband Support option will install all IB stack kernel components, user space libraries, and utilities.

   The following list of RPM packages are typically present in a fully configured IB system:

   Binary packages

   — `librdmacm-utils`
   — `libibverbs-utils`
   — `libibverbs`
   — `libibmad`
   — `librdmacm`
   — `libibumad`
   — `perftest`
   — `qperf`

   Development packages

   — `libibumad-devel`
   — `libibverbs-devel`
   — `librdmacm-devel`

   To verify whether the RPM packages are present in your system, type:

```
# rpm -qa | grep <rpm name>
```

2.4.1.3 Installing the IB stack using the yum groupinstall Command

If the operating system has already been installed or you did not choose the **Infiniband Support** option while installing the operating system, you can use the `yum groupinstall` command to install the IB stack. Before you

run the `yum groupinstall` command, a yum repository must be set up. For information on setting up the yum repository, refer to the Red Hat Enterprise Linux (RHEL) documentation.

To install the IB stack using the `yum groupinstall` command, type:

```
# yum groupinstall "Infiniband Support"
```

NOTE This command resolves any RPM package dependencies that might exist.

2.4.1.4 Installing the RoCE Driver Using the elx_roce_install.sh Script

NOTE Always use the `elx_roce_install.sh` script to install the RoCE driver.

To install the ROCE driver using the `elx_roce_install.sh` script:

1. Download the Emulex RoCE driver package from the Documents and Downloads area of http://www.broadcom.com.
2. Use the following package to install the driver:
   `elx-ocrdma-dd-<release>-<version>.tar.gz`
3. Copy the package to `/tmp` and run:
   `tar -xvzf elx-ocrdma-dd-<release>-<version>.tar.gz`
4. Change directory to the RoCE packages directory:
   `cd /tmp/elx-<release>-ocrdma-dd-<version>`
5. Select the required package based on the host on which the driver is being installed. The current Linux distribution on the host might be determined as follows:
   On an RHEL host, type:
   `# cat /etc/redhat-release`
   On an SLES host, type:
   `# cat /etc/SuSE-release`
6. Select the appropriate package based on the output of step 5.
7. Change the directory to the resulting directory from the tar extraction command to find the installer script.
   `./elx_roce_install.sh`
8. Run the installer script to install the required RoCE driver and user library RPMs.
   `#./elx_roce_install.sh`

NOTE SLES 11 platforms can prevent loading of unsupported modules by default. In such cases, it is possible that the installer can fail to load the modules even though the RPMs are installed. If this situation occurs, try manually loading the ocrdma module after doing one of the following:

- Set `allow_unsupported_modules` to `1` in `/etc/modprobe.d/unsupported-modules`.
- Specify `--allow-unsupported` on the command line.

2.4.1.5 Manually Installing the Out-of-Box Driver rpms (OFED-3.12 or Later)

In situations where the `elx_roce_install.sh` script cannot be used, use the manual procedure to install the RoCE driver.

Use the `elx_roce_install.sh` script to install the out-of-box driver rpms. If the `elx_roce_install.sh` script is not used to update the drivers and the inbox OFED drivers (be2net and ocrdma) are also present, use the

following script to update and load the drivers. The following script prevents the situation where fresh OOB rpms are installed, but the `modinfo be2net/ocrdma` command displays the older driver versions.

```
Goto /lib/modules/<kernel
version>/updates/drivers/net/ethernet/emulex/benet
If be2net.ko exists /bin/rm be2net.ko
Goto /lib/modules/<kernel version>/updates/drivers/infiniband/hw/ocrdma/
If ocrdma.ko exists /bin/rm ocrdma.ko
rpm –ivh kmod-be2net-11.0.xx.x.rpm
rpm -ivh --nodeps kmod-ocrdma-11.0.xxx.ofed-xxx.x.rpm
rpm -ivh libocrdma-11.0.xx.ofed-xx.rpm
rmmod be2net
modprobe be2net
modprobe ocrdma
```

2.4.2 Uninstalling the RoCE Driver

Before you attempt to uninstall the RoCE driver, you must perform these steps:

1. Stop all active network file system over RDMA (NFS RDMA) mounts and internet Small Computer System Interface (iSCSI) Extensions for RDMA (iSCSI Extensions for RDMA [iSER]) sessions.
2. Stop the ibacm service on systems where OFED is installed using the command:

   ```
   # service ibacm stop
   ```
3. Stop all user space RoCE applications.

To uninstall the RoCE driver, type:

```
./elx_roce_install.sh --uninstall
```

2.5 iSCSI Driver Kit

The iSCSI driver kit includes the driver that supports the iSCSI protocol. The iSCSI driver kit contains the following:

- A zipped tar file that includes the binary RPMs for a specific driver version, and for all of the supported Linux distribution kernels

  NOTE Use only officially released Linux distribution kernels. The binary RPM packages only support officially released Linux distribution kernels and do not support pre-release distribution kernels.
- An installation script, `elx_iscsi_install.sh`, that installs by default the iSCSI driver binary RPM that corresponds to the target system's architecture and kernel memory variant
- A README file that provides a description of the kit structure, its contents, and distribution support

2.5.1 Compiling the iSCSI Driver

To compile the iSCSI driver from source, you must run the following `make` command from the driver `src` directory:

```
make -C /usr/src/<kernel dir> M=`pwd` CONFIG_BE2ISCSI=m
```

Where the <*kernel dir*> is:

For RHEL 6.5 SS#:

```
/usr/src/kernels/2.6.32-431.el6/
```

For SLES 11 SP# default variant:

```
/usr/src/linux-obj/x86_64/default
```

To compile and install the iSCSI driver, use following instructions:

```
make -C /lib/modules/`uname –r` M=`pwd` CONFIG_BE2ISCSI=m modules
make -C /lib/modules/`uname –r` M=`pwd` CONFIG_BE2ISCSI=m modules_install
```

2.5.2 Installing the iSCSI Driver Kit

Remove any previously installed iSCSI driver kits, Application Helper Modules (that is, those that were not part of a distribution's kernel), or both before proceeding. For more information on uninstalling the driver, see Section 2.5.3, Uninstalling the iSCSI Driver Kit.

When using this driver for storage area network (SAN)-boot applications, the following dependencies must be installed:

- iscsi-initiator-utils
- dracut-network
- For SAN boot with an SLES operating system, kernel parameter `withiscsi=1` should be passed during installation.

Because this driver is based on Open-iSCSI, attempting to perform a SAN-boot without these dependencies will fail.

To install the iSCSI driver:

1. Download the appropriate driver kit from the Documents and Downloads area of http://www.broadcom.com.
2. Log in as *root* to a terminal, and unpack the tarball:

   ```
   tar xzf elx-be2iscsi-dd-<driver version>.tar.gz
   ```
3. Change to the directory that is extracted:

   ```
   cd elx-be2iscsi-dd-<driver version>/
   ```
4. Run the `elx_iscsi_install.sh` script with no options to install the driver kit:

   ```
   ./elx_iscsi_install.sh
   ```
5. After the `elx_iscsi_install.sh` script has finished running successfully:
   - For an iSCSI boot case, you must reboot the system now to load the driver.
   - For all other iSCSI cases, the Emulex iSCSI driver is loaded, and devices that are connected to the system are accessible. Reboot the system now to enable the newly added driver options in the ramdisk. You can also reboot the system later.

2.5.3 Uninstalling the iSCSI Driver Kit

NOTE You must run the uninstall script that shipped with the version of the driver kit you want to remove.

To uninstall the iSCSI driver:

1. Log in as *root*.
2. If possible, exit all applications that use iSCSI-attached drives, then unmount the drives. If you cannot exit all applications that use iSCSI-attached drives, the uninstallation works properly, but you must reboot after the uninstallation is complete.
3. Run the `elx_iscsi_install.sh` script with the `--uninstall` option:

   ```
   ./elx_iscsi_install.sh --uninstall
   ```

2.6 Booting from a Nonzero LUN Attached to a Emulex FCoE Adapter

To configure SLES 11 SPx to boot from an FCoE-attached disk device other than `/dev/sda`, refer to the *Boot for NIC, iSCSI, and FCoE Protocols User Guide* which is available at the Documents and Downloads area of http://www.broadcom.com.

2.7 Emulex OneCommand CNA Manager Application

The Emulex OneCommand CNA Manager application is a powerful and centralized adapter management suite. It provides discovery, reporting, and management of local and remote adapters from a single console anywhere in the SAN and across platforms. Both a Graphical User Interface (GUI) and command line interface (CLI) are provided. For instructions on installing and using the Emulex OneCommand CNA Manager application, refer to the *OneCommand CNA Manager Application for OneConnect Adapters User Guide*, which is available at the Documents and Downloads area of http://www.broadcom.com.

2.8 Updating the Adapter Firmware

NOTE This section can be ignored if the adapter already has the required firmware version and RoCE profile.

2.8.1 Determining the Firmware Version

The adapter firmware should be updated to version 11.2. You can update the firmware manually or by using the Emulex OneCommand CNA Manager application.

1. Determine if the firmware must be updated. List the ocrdma interfaces by typing:

   ```
   #ibdev2netdev
   ```

   NOTE The `ibdev2netdev` command is supported only in an RoCE set up. In a NIC, an FCoE, or an iSCSI set up, you must use the `ifconfig` command to find the Emulex NIC interfaces.

2. Each ocrdma interface maps to an Ethernet interface ethX. Use `ethtool -i ethX` to determine the firmware version on the adapter.

   If the reported firmware version does not match the version listed previously, the firmware for that adapter must be updated.

   The latest firmware can be downloaded from the Documents and Downloads area of http://www.broadcom.com. The name of the firmware file has a format of:

   `oc14-x.x.x.x.ufi`

   `oc14` in the filename refers to the OCe14000-series NIC adapter, and *x.x.x.x* refers to the version.

2.8.2 Updating the Firmware Manually

NOTE These steps must be performed only once for each adapter.

To update the firmware:

1. The firmware download command must be invoked once for each adapter by specifying any Ethernet interface (ethX) configured on the adapter.
2. List the ocrdma interfaces:

   ```
   #ibdev2netdev
   ```

3. Update the firmware for ethX:

   ```
   cp oc14-x.x.x.x.ufi /lib/firmware
   ```

   to

   ```
   /lib/firmware
   # ethtool –f ethX  oc14***.ufi
   ```

   NOTE Multiple ocrdma interfaces can be present on an adapter, so by using the mapping of ocrdma interfaces to Ethernet interfaces (through `ibdev2netdev`) and `ethtool -i ethX`, only one Ethernet interface per adapter can be selected.

Chapter 3: Configuration

3.1 FCoE Driver Configuration

The following section describes how to configure parameters for the FCoE driver.

3.1.1 FCoE Driver Parameters

The FCoE driver parameters determine some aspects of the driver's behavior. There are two main types, static and dynamic. Changes to the static parameters require a driver reload for the change to take effect. Changes to most dynamic parameters take effect immediately; some do not take effect until there is a link-down/link-up sequence.

For more information on driver parameters, see Section 3.1.1.1, Static FCoE Driver Parameters, and Section 3.1.1.2, Dynamic FCoE Driver Parameters.

3.1.1.1 Static FCoE Driver Parameters

Changes to static parameters require a driver reload for the change to take effect. The following table lists the static FCoE driver parameters.

Table 1 Static FCoE Driver Parameters

Parameter	Description	sysfs Visible
`lpfc_ack0`	When enabled, ACK0 is used for Class 2. The enabled value is 1. The disabled value is 0 (default).	Yes
`lpfc_discovery_threads`	Specifies the maximum number of ELS commands that can be outstanding for a discovery. **NOTE** The `lpfc_discovery_threads` parameter defaults to a value of 64 for private loop topologies regardless of the configured value. If multiple ports are configured on the host, the value of 64 is used only for those ports that are connected in a private loop topology. The configured value is used for all other ports. The minimum value is 1. The maximum value is 64. The default value is 32.	No
`lpfc_enable_bg`	Enables the BlockGuard (T10-Data Integrity Field [DIF]) feature. The minimum value is 0 (default). The maximum value is 1.	Yes
`lpfc_enable_da_id`	When enabled, the FCoE driver issues a `DA_ID CT` command to the fabric when VPorts log out of the fabric. The enabled value is 1. The disabled value is 0 (default).	No
`lpfc_enable_hba_heartbeat`	When enabled, the heartbeat logic in the FCoE driver detects whether the adapter is functional. If the heartbeat logic detects the adapter is not functional, the driver will shut down the adapter. The disabled value is 0 (default). The enabled value is 1.	Yes
`lpfc_enable_hba_reset`	When enabled, the FCoE driver passes resets to the adapter. This parameter is typically used for debugging purposes. The enabled value is 1 (default). The disabled value is 0.	Yes
`lpfc_enable_npiv`	When enabled, the FCoE driver uses N_Port ID Virtualization (NPIV) to create VPorts (if supported by the fabric). The enabled value is 1 (default). The disabled value is 0.	Yes
`lpfc_fcp_class`	Specifies either FC Class 2 or 3 for Fibre Channel Protocol (FCP) data transmission. For Class 2, the value is 2. For Class 3, the value is 3 (default).	Yes

Table 1 Static FCoE Driver Parameters (Continued)

Parameter	Description	sysfs Visible
lpfc_fdmi_on	Specifies if FDMI support is enabled or disabled. ■ 0 = Disabled (default) ■ 5 = Enable FDMI without a 60-second delay, use all adapter and port attributes. ■ 7 = Enable FDMI with a 60-second delay, use all adapter and port attributes. Use this value to introduce a delay if FDMI is not operational. The delays begins after a linkup.	Yes
lpfc_lun_queue_depth	Specifies the default maximum number of commands sent to a single logical unit (disk drive). The minimum value is 1. The maximum value is 128. The default value is 30.	Yes
lpfc_max_luns	Specifies the highest available logical unit number (LUN) ID that is valid, per target. For example, a value of 19 means that LUN IDs from 0 to 19 are valid for the target. The Small Computer System Interface (SCSI) layer scans each target until it reaches this specified LUN ID. The minimum value is 0. The maximum value is 65535. The default value is 255.	Yes
lpfc_max_scsicmpl_time	Uses command completion time to control queue depth. The units are in milliseconds. The minimum value is 0 (default). The maximum value is 6000.	Yes
lpfc_multi_ring_rctl	When lpfc_multi_ring_support is enabled, identifies the routing control (R_CTL) for the additional ring configuration. The minimum value is 1. The maximum value is 255. The default value is 4.	Yes
lpfc_multi_ring_support	Determines the number of primary Service Level Interface (SLI) rings over which to spread input/output control block (IOCB) entries. The minimum value is 1 (default). The maximum value is 2.	Yes
lpfc_multi_ring_type	When lpfc_multi_ring_support is enabled, identifies the TYPE of the additional ring configuration. The minimum value is 1. The maximum value is 255. The default value is 5 (logical link control [LLC]/ Subnetwork Access Protocol [SNAP]).	Yes
lpfc_restrict_login	When enabled, restricts VPorts login to remote initiators. The enabled value is 1 (default). The disabled value is 0.	No
lpfc_scan_down	When enabled, selects the *scan down* method (scanning the AL_PA from high to low) to assign a SCSI ID. The enabled value is 1 (default). The disabled value is 0.	Yes
lpfc_sg_seg_cnt	Controls the scatter/gather maximum segment count passed to the FCoE driver. This variable is applicable per SCSI command. The minimum value is 64 (default), and the maximum value is 510.	Yes (sg_tablesize)
lpfc_use_msi	When enabled, determines whether the driver uses message signaled interrupts (MSI) or message signaled interrupts - extended (MSI-X). ■ 0 = MSI disabled; INTx mode is used ■ 1 = MSI; allows a maximum of 32 interrupts. ■ 2 = MSI-X; allows a maximum of 2048 interrupts (default). **NOTE** The default is 2. This value reverts to 1 if the system does not support MSI-X. This value reverts to 0 if the system does not support MSI.	Yes

3.1.1.2 Dynamic FCoE Driver Parameters

Changes to the dynamic parameters take effect immediately. All lpfc dynamic parameters are read/write using sysfs. The following table lists the dynamic FCoE driver parameters.

Table 2 Dynamic FCoE Driver Parameters

Parameter	Description
`lpfc_devloss_tmo`	Specifies the number of seconds to hold an input/output (I/O) error when a device disappears. The minimum value is 0. The maximum value is 255. The default value is 30.
`lpfc_fcp_imax`	Specifies the maximum number of fast-path FCP interrupts per second. The minimum value is 636. The maximum value is 651042. The default value is 5000.
`lpfc_log_verbose`	Specifies the log verbosity level of the messages posted by the driver. Extra activity logging (bit mask). The minimum value is 0x0 (default). The maximum value is 0xFFFFFFFF.
`lpfc_nodev_tmo (deprecated)`	**NOTE** This is a deprecated parameter and the `lpfc_devloss_tmo` parameter should be used instead. This parameter will not work if you altered `lpfc_devloss_tmo`. Specifies the number of seconds to hold an I/O error when a device disappears. The minimum value is 1. The maximum value is 255. The default value is 30.
`lpfc_pci_max_read`	Specifies the maximum direct memory access (DMA) read byte count. The possible values are 512, 1024, 2048 (default), and 4096.
`lpfc_poll`	Sets the FCP ring polling mode control. The possible values are: ■ 0 = No polling (default) ■ 1 = Poll with interrupts enabled ■ 3 = Poll and disable FCP ring interrupts
`lpfc_poll_tmo`	Specifies the number of milliseconds that the driver waits between polling FCP ring interrupts. The minimum value is 1. The maximum value is 255. The default value is 10.
`lpfc_throttle_log_cnt`	Specifies the number of messages logged within `throttle_log_time`. The minimum value is 1. The maximum value is 1000. The default value is 10.
`lpfc_throttle_log_time`	Specifies the time limit for `throttle_log_cnt`. The minimum value is 1. The maximum value is 60. The default value is 1.
`lpfc_use_adisc`	When enabled, an ADISC is sent instead of a PLOGI for device discovery or registered state change notification (RSCN). The enabled value is 1. The disabled value is 0.

3.1.2 Configuring FCoE Driver Parameters

You can configure the FCoE driver parameters using any of the following methods:

- The `modprobe` Linux program for temporary configuration
- The `lpfc.conf` file for persistent configuration
- The sysfs interface (to view and modify parameters after loading the FCoE driver)

  NOTE Not all parameters visible in the sysfs directory can be modified; some are read-only.
- The Emulex OneCommand CNA Manager application (refer to the *Emulex OneCommand CNA Manager Application for OneConnect Adapters User Guide* for more information)

  NOTE The FCoE driver parameter changes made using the Emulex OneCommand CNA Manager application remain after the FCoE driver

is uninstalled. To return to the default settings, you must reset them using the OneCommand CNA Manager application.

3.1.2.1 Temporary Configuration with modprobe

When you manually load the FCoE driver as a module using the `modprobe` command, and you change one or more driver parameter values in the command line, the configuration is temporary. These changes are considered temporary because they are valid only for the current session or until the FCoE driver is unloaded.

The `modprobe` program uses the `lpfc.conf` file, but parameters passed to it using the command line override the parameters in the `lpfc.conf` file. Values can be expressed in hexadecimal or decimal notation.

If you want to temporarily set `lun_queue_depth` to 20 (the default is 30) for all HBAs in your system, load the FCoE driver with the following command:

```
modprobe lpfc lpfc_lun_queue_depth=20
```

3.1.2.2 Persistent Configuration with the lpfc.conf File

To make the FCoE driver parameters persist across module loads and reboots, perform these steps:

1. In the `/etc/modprobe.d` directory, create a file with the driver name `lpfc.conf`.
2. In `/etc/modprobe.d/lpfc.conf`, use the `options` command to add the appropriate FCoE driver parameters and their desired values. For example, adding the following command to the `lpfc.conf` file sets the verbose flag:

   ```
   options lpfc lpfc_log_verbose=0x3ffff
   ```

If driver parameters are added to the `lpfc.conf` file, the FCoE driver must be reloaded for the parameters to take effect. Also, a new ramdisk image is required if you want the changes to take effect in the next boot. For information on creating a new ramdisk, See Section 3.1.3, Creating a New Ramdisk Image.

If the same parameter is specified on the `modprobe` command line and in the `lpfc.conf` file, then the value specified in the modprobe command line takes precedence.

3.1.2.3 Configure Parameters with a Read/Write to sysfs

Sysfs is a virtual file system that exposes the structure of the system. It also includes interfaces to driver parameters through which the FCoE driver parameters can be viewed and modified. Because these interfaces are available only after driver load, only dynamic FCoE driver parameters can be changed. However, both static and dynamic FCoE driver parameters can be read through sysfs.

NOTES

- Sysfs changes exist only during driver load and are lost when the FCoE driver is unloaded or the system is rebooted.
- Driver parameters that are set through module parameters are global; setting them through sysfs is on a SCSI host (adapter port) basis.

  For example:

  `echo 0x7f >> /sys/class/scsi_host/host7/lpfc_log_verbose` only affects host 7.

  `modprobe lpfc lpfc_log_verbose=0x7f` applies to all SCSI host (ports) managed by the brcmlpfc driver.

Viewing Parameters with sysfs

The sysfs file system is mounted and available as `/sys`. You must first identify the scsi_host that represents the adapter for which you want to modify the FCoE driver parameters. All scsi_hosts bound to the FCoE driver can be viewed with the following command:

```
ls -d /sys/bus/pci/drivers/lpfc/*/host*
```

Assuming you are interested in adapter scsi_host 7, you can list the FCoE driver parameters for this particular adapter with the following command:

```
ls -l /sys/class/scsi_host/host7/lpfc*
```

An example output follows:

```
-r--r--r--  1 root root 4096 Feb 28 17:03
/sys/class/scsi_host/host7/lpfc_ack0
-r--r--r--  1 root root 4096 Feb 28 17:03
/sys/class/scsi_host/host7/lpfc_fcp_class
-rw-r--r--  1 root root 4096 Feb 28 17:03 /sys/class/scsi_host/host7/
lpfc_fdmi_on
-r--r--r--  1 root root 4096 Feb 28 17:03
/sys/class/scsi_host/host7/lpfc_link_speed
-rw-r--r--  1 root root 4096 Feb 28 15:34
/sys/class/scsi_host/host7/lpfc_log_verbose
-r--r--r--  1 root root 4096 Feb 28 17:03
/sys/class/scsi_host/host7/lpfc_lun_queue_depth
-rw-r--r--  1 root root 4096 Feb 28 17:03
/sys/class/scsi_host/host7/lpfc_max_luns
-rw-r--r--  1 root root 4096 Feb 28 17:03
/sys/class/scsi_host/host7/lpfc_nodev_tmo
-rw-r--r--  1 root root 4096 Feb 28 17:03
/sys/class/scsi_host/host7/lpfc_scan_down
-r--r--r--  1 root root 4096 Feb 28 17:03
/sys/class/scsi_host/host7/lpfc_topology
-rw-r--r--  1 root root 4096 Feb 28 17:03
/sys/class/scsi_host/host7/lpfc_use_adisc
```

Temporary Configuration Parameters with sysfs

In the previous example, notice that the FCoE driver parameters are available as files. Reading a file displays the current value of a driver parameter. If the permissions allow it, you can write a value to the file, and it will take effect immediately.

Reading the `lpfc_log_verbose` file may show that its value is `0`:

```
cat /sys/class/scsi_host/host7/lpfc_log_verbose
0
```

To modify the `lpfc_log_verbose` value to 0xffffffff:

```
echo 0xffffffff > /sys/class/scsi_host/host7/lpfc_log_verbose
```

Reading the lpfc_log_verbose file now shows a value of 0xffffffff:

```
cat /sys/class/scsi_host/host7/lpfc_log_verbose
0xffffffff
```

NOTE Setting the `lpfc_log_verbose` value to 0xffffffff might cause degraded system performance.

3.1.3 Creating a New Ramdisk Image

The `lpfc-install` script creates a ramdisk image containing the FCoE driver for the currently running kernel.

NOTE You must create a new ramdisk image whenever the lpfc options in `/etc/modprobe.conf` are changed and you want the change to take effect on the next reboot.

To create a new initial ramdisk image for inbox FCoE drivers and installed binary RPM FCoE driver kits, type

```
dracut -f /boot/initramfs-<kernel-version>.img <kernel-version>
```

3.1.4 Dynamically Recognizing LUNs and Targets (Using scan)

The FCoE driver enables you to dynamically recognize LUNs and targets without unloading or reloading the FCoE module and without resetting the adapter.

To rescan an adapter's targets with sysfs, given the adapter's host number (in this example, 3), type:

```
echo "- - -" > /sys/class/scsi_host/host3/scan
```

To limit the rescan to a particular target, given the adapter's host number (in this example, 3) and the target number (in this example, 2), type:

```
echo "- 2 -" > /sys/class/scsi_host/host3/scan
```

You can also use the `lun_scan` script in the `/usr/sbin/brcmlpfc` directory.

3.1.5 Persistent Naming

The generic device manager for the Linux kernel is *udev*, which primarily manages device nodes in the `/dev` directory.

3.1.5.1 Using udev to Discover Logical to Physical Mappings for sd Devices

In Linux, the driver for SCSI disk drives is *sd*. A disk device name has an sd prefix. Persistent names for sd devices are provided in the `/dev/disk/by-id` directory. To find the persistent udev name for the disk, which is currently *sdc*, type:

```
cd /dev/disk/by-id
ls -l | grep sdc
```

The sample output is:

```
lrwxrwxrwx 1 root root 9 2006-08-01 19:08 scsi-32000000c5005d6e6 ->
../../sdc
```

In the previous example, the disk has no partitions. If the disk had two partitions, the output would look like the following:

```
lrwxrwxrwx 1 root root 9 2006-08-01 19:08 scsi-32000000c5005d6e6 ->
../../sdc
lrwxrwxrwx 1 root root 10 2006-08-01 19:08 scsi-32000000c5005d6e6-part1 ->
../../sdc1
lrwxrwxrwx 1 root root 10 2006-08-01 19:08 scsi-32000000c5005d6e6-part2 ->
../../sdc2
```

3.1.5.2 Configuring the System to Boot Using Persistent Names

For SLES 11 SPx and SLES 12 SPx:

NOTE SLES 11 SPx and SLES 12 SPx are configured by default with udev to provide persistent names for hard disks, including FCoE-attached disks.

To use a persistent name for a boot device:

1. In `/boot/grub/menu.lst`, find the kernel line for the default boot. For example:
   ```
   kernel /boot/vmlinuz root=/dev/sda2 vga=0x314
   ```
2. Find the persistent name for the root partition (following `root=` on the kernel line) by using the instructions in Section 3.1.5.1, Using udev to Discover Logical to Physical Mappings for sd Devices.
3. In the same file, `/boot/grub/menu.lst`, replace the text after `root=` with the partition's persistent name. For example:
   ```
   kernel /boot/vmlinuz root=/dev/disk/by-id/scsi-32000000c5005d6e6-part2
   vga=0x314
   ```
4. Change any mounts listed in `/etc/fstab` that refer to this root partition by either its `/dev/sd` name or a file system label to use the persistent name as well.

For RHEL 6.x and RHEL 7.x:

To use a persistent name for a boot device:

1. In `/boot/grub/grub.conf`, find the kernel line for the default boot. For example:
   ```
   kernel /boot/vmlinuz -<kernel version> ro root=/dev/sda2
   ```
2. Find the persistent name for the root partition (following `root=` on the kernel line) by using the instructions in Section 3.1.5.1, Using udev to Discover Logical to Physical Mappings for sd Devices.
3. In the same file, `/boot/grub/menu.lst`, replace the text after `root=` with the partition's persistent name. For example:
   ```
   kernel /boot/vmlinuz -<kernel version> ro
   root=/dev/disk/by-id/scsi-32000000c5005d6e6-part2
   ```
4. Change any mounts listed in `/etc/fstab` that refer to this root partition by either its `/dev/sd` name or a file system label to use the persistent name as well.

3.1.5.3 Using udev with st Devices

In Linux, the driver for SCSI tape drives is *st*. A tape device name has an *st* prefix. The udev rules for tape devices are the same as for disk devices. There must be a unique ID that persists across initiator reboots and persists regardless of discovery order.

You must consider whether the tape device is an FC tape device or an FC-SCSI tape device (in which there are multiple SCSI tape devices that reside behind an FC controller). If it is an FC tape device, then the World Wide Port Name (WWPN) is unique and can be used to create the persistent name. In this case, the `scsi_id` command should return this as the unique identifier with a single digit prefix. If the FC controller has multiple SCSI tape devices behind it, the WWPN is not unique, and the persistent name must use multiple information elements to build the unique ID. FC Tape Device Examples and FC-SCSI Tape Device Example are examples of each scenario.

FC Tape Device Examples

The following examples use the `scsi_id` command to retrieve and generate a unique SCSI identifier:

```
scsi_id [options]
```

For these examples, the following [options] are used:

- -g Treats the device as white listed. It is required on the command line or in the scsi_id.config file for the scsi_id command to generate any output. In the examples, the -g option is needed on the command line because the vendor and model for this tape device were not in the /etc/scsi_id.config file.
- -s Generates an id for the sysfs-device. Note that -s is an invalid option for scsi_id version 147.

NOTE Because the [options] can vary depending on the version of the scsi_id command, refer to the *scsi_id* man page on your system for the correct and complete list of the [options].

The following example is an FC tape device using the SCSI generic driver (sg) rather than the SCSI tape driver. The value returned has a leading prefix of 3, which is the Network Address Authority (NAA) type. The remaining digits represent the FC controller's WWPN.

```
scsi_id -g -s /sys/class/scsi_generic/sg0
350060b000029b592
```

The following example is an FC tape device using the SCSI tape driver. The value returned is the same as the previous example.

```
scsi_id -g -s /sys/class/scsi_tape/nst0
350060b000029b592
```

The following example uses a different FC tape vendor. Notice that the value returned is similar to the previous examples, with respect to the leading digit and the WWPN.

```
/sbin/scsi_id -g -s sys/class/scsi_tape/nst0
35005076300015101
```

FC-SCSI Tape Device Example

The following is an example of a FC controller with multiple SCSI tape devices behind it (FC-SCSI tape device). When the Emulex driver is loaded, the SCSI mid-level discovers the SCSI tape devices as follows:

```
scsi scan: INQUIRY to host 14 channel 0 id 0 lun 0
scsi: unknown device type 12
Vendor: ADIC      Model: SNC 4000          Rev: 42d4
Type:   RAID                               ANSI SCSI revision: 03
Attached scsi generic sg5 at scsi14, channel 0, id 0, lun 0,  type 12
scsi scan: INQUIRY to host 14 channel 0 id 0 lun 1
Vendor: ADIC      Model: Scalar 24         Rev: 227A
Type:   Medium Changer                     ANSI SCSI revision: 02
Attached scsi generic sg6 at scsi14, channel 0, id 0, lun 1,type 8
scsi scan: INQUIRY to host 14 channel 0 id 0 lun 2
Vendor: IBM       Model: ULTRIUM-TD2       Rev: 38D0
Type:   Sequential-Access                  ANSI SCSI revision: 03
Attached scsi tape st0 at scsi14, channel 0, id 0, lun 2
st0: try direct i/o: yes (alignment 512 B), max page reachable by HBA
4503599627370495
Attached scsi generic sg7 at scsi14, channel 0, id 0, lun 2,  type 1
scsi scan: INQUIRY to host 14 channel 0 id 0 lun 3
Vendor: IBM       Model: ULTRIUM-TD2       Rev: 38D0
Type:   Sequential-Access                  ANSI SCSI revision: 03
Attached scsi tape st1 at scsi14, channel 0, id 0, lun 3
st1: try direct i/o: yes (alignment 512 B), max page reachable by HBA
4503599627370495
Attached scsi generic sg8 at scsi14, channel 0, id 0, lun 3,  type 1
```

This log output shows a controller at LUN 0, the medium changer at LUN 1, and two SCSI tape devices at LUNs 2 and 3.

The following example is the result of a `scsi_id` call:

```
scsi_id -g -s /sys/class/scsi_tape/nst0
1IBM     ULTRIUM-TD2     1110133831
scsi_id -g -s /sys/class/scsi_tape/nst1
1IBM     ULTRIUM-TD2     1110133994
```

Notice that the unique ID contains three values with space delimiters. A udev rule must have a unique ID for the device, so that all three parts of this returned string are required. To do this, use the following command:

```
scsi_id -u -g -s /sys/class/scsi_tape/nst0
1IBM_____ULTRIUM-TD2_____1110133831
scsi_id -u -g -s /sys/class/scsi_tape/nst1
1IBM_____ULTRIUM-TD2_____1110133994
```

Creating the udev Persistent Name for SCSI Tape Device

After you know the SCSI ID call needed to extract a unique ID, use the same process to create a udev persistent name for a SCSI tape device as on a SCSI disk device.

The rule for the FC tape device follows:

```
BUS="scsi", SYSFS{vendor}="HP", SYSFS{model}="ULTRIUM 3-SCSI",
PROGRAM="/sbin/scsi_id -p 0x83 -u -g -s
/sys/class/scsi_tape/nst%n",RESULT="350060b000029b592",
SYMLINK="fc_lun_st%n"
```

The rule for the FC-SCSI tape device follows:

```
BUS="scsi", SYSFS{vendor}="IBM", SYSFS{model}="ULTRIUM-TD2",
PROGRAM="/sbin/scsi_id -p 0x83 -u -g -s
/sys/class/scsi_tape/nst%n",RESULT="1IBM_____ULTRIUM-TD2_____1110133831",
SYMLINK="fc_lun_st%n"
BUS="scsi", RESULT="1IBM_____ULTRIUM-TD2_____1110133994",
SYMLINK="fc_lun_st%n"
```

Create a new file named `/etc/udev/rules.d/45-local.rules`, and put the appropriate rule in it. Then run `udevtrigger` to reload the udev rules, and the output of the rules will follow:

```
udevtrigger
ls -al /dev/fc*
lrwxrwxrwx  1 root root 3 Apr  7 15:03 fc_lun_st0 -> st0
lrwxrwxrwx  1 root root 3 Apr  7 15:03 fc_lun_st1 -> st1
```

3.1.5.4 Persistent Naming References

Refer to the following references for more information on persistent naming:

- http://www.reactivated.net/writing_udev_rules.html by Daniel Drake (dsd)
- https://groups.google.com/forum/#!topic/fa.linux.kernel/20FrKJkUKAA

3.2 Ethernet Driver Configuration

The following section describes how to configure parameters for the Ethernet driver.

3.2.1 Ethernet Driver Configuration Parameters

The Ethernet driver configuration parameters are described in the following table.

Table 3 Ethernet Driver Configuration Parameters

Parameter	Description
num_vfs	In systems supporting single-root I/O virtualization (SR-IOV), when I/O virtualization (IOV) is enabled, this parameter indicates the number of VFs to be enabled per physical function (PF). For configuring SR-IOV, see Section 3.2.7, SR-IOV Configuration. The default value is 0 (SR-IOV is not enabled). The possible values are 0 to 63. **NOTE** This parameter is obsolete. Use the sysfs method to enable or disable VFs.
rss_on_mc	Enables receive-side scaling (RSS) on multichannel functions that have the capability. The default value is 0 (disabled). The enabled value is 1. **NOTE** Currently, this parameter is ignored by the driver. The driver enables RSS on multichannel functions that have the capability by default.
rx_frag_size	The size of fragments used to DMA received data. The possible values are 2048 (default), 4096 and 8192.

You can configure Linux to automatically load the driver with any of these options after each reboot. To do so, add a line to `/etc/modprobe.conf` with the required options. For example, to load the driver with the fragment size of 4096, add the following line:

```
options be2net rx_frag_size=4096
```

3.2.2 VLAN Support on UMC

In the Universal multichannel (UMC) mode, a logical port VLAN ID (LPVID) for each channel configured in the basic input/output system (BIOS) is transparently added in the transmit path and removed in the receive path by the adapter. When a virtual local area network (VLAN) is configured in the host using `vconfig` or `ip link` on any of the functions, the host VLAN ID overrides the corresponding LPVID channel configured in the BIOS. Up to 15 VLAN IDs can be configured in the host for each PF using `vconfig` or `ip link`. The VLAN IDs configured in the host should be different from the channel VLAN IDs configured in the BIOS. For additional information on UMC, refer to the *Emulex Universal Multichannel Reference Manual*.

NOTE

- Link Aggregation Control Protocol (LACP) is not supported when UMC is enabled.
- SR-IOV is not supported when UMC is enabled.

3.2.3 Support for Ethtool set-channels and get-channels Commands

The Ethtool `get-channels` command – `ethtool -l <ethx>` displays the following information:

- The current number of receive (Rx)/ transmit (Tx)/interrupt queue pairs (a *combined channel*) created by the NIC function
- The maximum number of channels supported by the NIC function

The NIC driver supports a combination of Rx/Tx-only channels along with combined channels.

Use the following command to create the combined channels:

```
ethtool -L <ethx> combined N
```

Use the following commands to create N Tx-queues and M Rx-queues:

When N < M use:

```
ethtool -L ethX combined N rx M-N
```

When M < N use:

```
ethtool -L ethX combined M tx N-M
```

NOTE

- You can increase (up to the maximum supported limit) or decrease the number of channels used by the NIC function.
- Setting both Rx-only and Tx-only channels is not supported; it is mandatory to create at-least one combined channel.
- The maximum number of channels supported by an interface is also limited to the number of cpu-cores in the server.

NOTE In earlier Linux distributions, use the sysfs interface as follows:

- The maximum number of channels supported by the NIC function:
  `cat /sys/class/net/<ethx>/max_qs`
- The current number of channels configured:
  `cat /sys/class/net/<ethx>/num_qs`
- To configure the 'N' number of channels requested for the NIC function:
  `echo N > /sys/class/net<ethx>/num_qs`

3.2.4 Transmit/Receive Queue Counts

The number of queue counts created by the NIC driver is provided in the following table.

Table 4 serves as an example in some combinations of profile configurations and adapters. This table is not intended to be a comprehensive list of all profile configurations and adapters.

Table 4 Tx and Rx Queue Counts

Profile/Configuration			**Combined IRQs (for example, RSS and Tx queues) (Initial/Max) Initial: number of queues available on load Max: number of queues that can be set by the `set-channels` command**		
	OCe14002 (ASIC REV 0x11)	OCe14401	OCe14002 (ASIC REV 0x10)	OCe14004	OCe11102
NIC only	8/31	8/31	8/31	8/31	8/16
NIC only SR-IOV PF (sriov_numvfs>0)	[1-8]/[1-31]	[1-8]/[1-31]	[1-8]/[1-31]	[1-8]/[1-31]	1/1

Table 4 Tx and Rx Queue Counts (Continued)

Profile/Configuration			Combined IRQs (for example, RSS and Tx queues) (Initial/Max) Initial: number of queues available on load Max: number of queues that can be set by the `set-channels` command		
NIC only SR-IOV virtual function (VF)	[1-3]/[1-3]	[1-3]/[1-3]	[1-3]/[1-3]	[1-3]/[1-3]	1/1
NIC only SR-IOV PF (sriov_numvfs=0)	8/31	8/31	8/31	8/31	8/16
NIC (only with ARI) (UMC andFlex10, NIC partitioning [NPar])	8/8	8/8	4/4	8/8	8/16 (first interface, 1/1 otherwise)

3.2.5 Support for Ethtool set-rxfh/get-rxfh Commands

The Ethtool `get-rxfh` and `set-rxfh` commands are available in kernel versions of RHEL 7.1, 3.16.0 and later.

The Ethool `get-rxfh` command – `ethtool – x <ethx>` shows the following information:

- The current indirection table entries
- The programmed RSS hash key

The Ethtool `set-rxfh` command – `ethtool –X <ethx> [hkey aa:bb:cc...] [equal N | weight W0 W1...]` sets the following parameters:

- Indirection table entries
- RSS hash key

NOTE In earlier Linux distributions, use the sysfs interface as follows:

- To show the currently configured RSS hash key:
  `cat /sys/class/net/<ethx>/rss_hashkey`
- To configure the new RSS hash key
  `echo -e "aa:bb:cc...." > /sys/class/net/<ethx>/rss_hashkey`

3.2.6 Support for Showing Onboard Die Temperature

Onboard die temperature is exported through the sysfs interface. On kernels that support the hardware monitoring framework, the temperature is exported using the hwmon sysfs interface. Temperatures exported using the hwmon interface can also be read using the lm-sensors utility with the `sensors` command.

To show the current board temperature using the sysfs node:

```
cat /sysclass/hwmon/<hwmonx>/device/temp1_input
```

Otherwise, the current board temperature is exported with the regular sysfs interface:

```
cat /sys/class/net/<ethx>/device/temp1_input
```

3.2.7 SR-IOV Configuration

3.2.7.1 Introduction

This section contains requirements and instructions to use SR-IOV with the following host operating systems:

- Red Hat Enterprise Linux 6.6 – 64-bit kernel-based virtual machine (KVM)
- Red Hat Enterprise Linux 6.7– 64-bit KVM
- Red Hat Enterprise Linux 6.8 – 64-bit KVM
- Red Hat Enterprise Linux 7.1 – 64-bit KVM
- Red Hat Enterprise Linux 7.2 – 64-bit KVM
- Red Hat Enterprise Linux 7.3 – 64-bit KVM
- SuSE Linux Enterprise Server 11 SP3 – 64-bit Xen and KVM
- SuSE Linux Enterprise Server 11 SP4 – 64-bit Xen and KVM
- SuSE Linux Enterprise Server 12 SPI – 64-bit Xen and KVM
- SuSE Linux Enterprise Server 12 SP2 – 64-bit Xen and KVM
- SLES and RHEL supported with Xen

These environments support capabilities of the Emulex OneConnect adapter to enable multiple Peripheral Component Interconnect Express (PCIe) virtual functions (VFs) for a PCIe physical function (PF). Each of these VFs can be assigned to virtual machines (VMs). A VF enables the guest operating system direct access to the Emulex OneConnect adapter, such that guest performance is not limited by the overheads of the hypervisor.

With SR-IOV, VMs directly drive I/Os on the NIC. Therefore, SR-IOV has the following advantages over traditional virtualized I/O:

- Improved device performance for virtual guests
- Increased scalability
- Reduced CPU utilization
- Reduced latency

Known issues include:

- The Kdump (kernel dump) feature is not supported when SR-IOV is enabled.

3.2.7.2 Setting Up SR-IOV

NOTE SR-IOV is not supported in multichannel setups (except FLEX10 and Dell NPAR).

Prerequisites

To set up SR-IOV on your system, you need the following:

- A server or blade with an SR-IOV-capable motherboard BIOS

  NOTE Configuration mechanisms for parameters, such as Media Access Control (MAC) address, VLAN, and quality of service (QoS) for VF, are supported in RHEL 6 and later, and SLES 11 and later distributions.
- The Emulex OneConnect OCx11102-xT or later adapter versions.
- If a KVM hypervisor is installed, it must contain the qemu-kvm packages.

Depending on your system, perform one or more of the following tasks to set up your BIOS. For more information, refer to the manufacturer's instructions for your system.

- Enable SR-IOV in the system BIOS, which supports SR-IOV functionality.
- Enable Intel Virtualization Technology support for Direct I/O VT-d.

You can use the PXESelect utility, the Emulex OneCommand CNA Manager application, or the Unified Extensible Firmware Interface (UEFI) Human Interface Infrastructure (HII) utility to set up SR-IOV.

To enable and configure SR-IOV using either the UEFIBoot utility or the PXESelect utility, refer to the *Boot for NIC, iSCSI, and FCoE Protocols User Guide*.

1. Install the required Linux operating system that serves as a hypervisor.
2. Update the `/boot/grub/menu.lst` file to include the following command line load parameter for the Linux kernel:

   ```
   intel_iommu=on
   ```
3. Install the appropriate version of the Emulex Ethernet driver that supports SR-IOV for the operating system version that you are using.
4. Reboot the server for the new changes to become operational.
5. Use the `lspci -vvv` output command to check if SR-IOV is properly enabled.

   The `lspci-vvv` command returns an SR-IOV capability section for each Ethernet PF. The Initial VFs and Total VFs should be nonzero. Make a note of the lspci command output in the hypervisor. This output is needed in step 10. Specifically, make note of the pci-id of the VFs that have been created.

   The following is an example of the SR-IOV capabilities section output of the PF with SR-IOV enabled:

   ```
   Capabilities: [180] Single Root I/O Virtualization (SR-IOV)
   IOVCap: Migration-, Interrupt Message Number: 000
   IOVCtl: Enable- Migration- Interrupt- MSE- ARIHierarchy-
   IOVSta: Migration-
   Initial VFs: 32, Total VFs: 32, Number of VFs: 0, Function Dependency
   Link: 00
   VF offset: 0, stride: 1, Device ID: 0710
   Supported Page Size: 00000557, System Page Size: 00000001
   Region 0: Memory at 0000000000000000 (64-bit, non-prefetchable)
   VF Migration: offset: 00000000, BIR: 0
   ```

   The following is an example of the SR-IOV capabilities section output of the PF with SR-IOV disabled:

   ```
   Capabilities: [180] Single Root I/O Virtualization (SR-IOV)
   IOVCap: Migration-, Interrupt Message Number: 000
   IOVCtl: Enable- Migration- Interrupt- MSE- ARIHierarchy-
   IOVSta: Migration-
   Initial VFs: 0, Total VFs: 0, Number of VFs: 0, Function Dependency
   Link: 00
   VF offset: 0, stride: 1, Device ID: 0710
   Supported Page Size: 00000557, System Page Size: 00000001
   Region 0: Memory at 0000000000000000 (64-bit, non-prefetchable)
   VF Migration: offset: 00000000, BIR: 0
   ```
6. Create a virtual machine (VM) using the Virtual Machine Manager utility, and install any supported operating system on the VM.
7. Shut down the VM.
8. Echo the number of VFs/PF to the `sriov_numvfs` file, where *X* is the number of VFs per PF:

   ```
   echo X > /sys/bus/pci/devices/..../sriov_numvfs
   ```

   The possible values are 0 to 64 per physical port. The default value is 0 (SR-IOV is not enabled).

   With the latest kernels, the sysfs path to enable VFs is:

   ```
   /sys/bus/pci/devices/<device-id>/sriov_numvfs
   ```

   For earlier kernels, the sysfs path to enable VFs is

   ```
   /sys/bus/pci/devices/<device-id>/net/<ifaceName>/sriov_numvfs
   ```

The total number of VFs can be distributed among available ports as required, but each port has a maximum of 64 VFs. Table 5 lists the total number of VF counts that are supported for various adapter configurations.

The maximum number of VFs supported per PF can be read from:

```
cat/sys/bus/pci/devices/..../sriov_totalvfs
```

NOTE

- On 4-port OCx11104 adapters, VFs can be configured only for ports 0 and 1, not for ports 2 or 3.
- VFs are supported only for network functions; they are not supported for storage functions.

Table 5 serves as an example in some adapter configurations. This table is not intended to be a comprehensive list of all adapter configurations.

Table 5 Total VF Counts Supported for Some Adapter Configurations

Adapter Configuration	Number of Ports	PF Count	VF Count per ASIC	Comments
OCe11102 2-port 10Gb NIC, stand-alone adapter	2	2	60	Per-port VF count is 30. P0/P1: 30/30.
OCe11102 2-port 10Gb NIC, stand-alone, Network Communication Services Interface (NCSI)-enabled initial program load (IPL)	2	2	59	Per-port VF count can be P0/P1: 30/29 or P0/P1: 29/30.
OCm11102 2-port 10Gb, HP/Lenovo System X LAN on motherboard (LOM)/Mezzanine	2	2	60	Per-port VF count is 30. P0/P1: 30/30.
OCm11102 2-port 10Gb, HP/Lenovo System X LOM/Mezzanine, NCSI-enabled IPL	2	2	59	Per-port VF count can be P0/P1: 30/29 or P0/P1: 29/30.
OCm11104 2-port 10Gb + 2-port 1Gb (4-port), Lenovo System X LOM/Mezzanine	4	4	55	Per-port VF count can be P0/P1: 28/27 or P0/P1: 27/28. VFs are not supported on 1Gb/s ports.
OCe11102 2-port 10Gb HP, Flex-10 enabled (all IPLs)	2	4/6/8	48	Per-port VF count is 24. VFs will be distributed across the PFs in multiples of 8.
OCe14401 1-port 40Gb NIC	1	1	63	63 VFs for NIC port.
OCe14102 (ASIC REV 0X10) 2-port 10Gb NIC	2	2	62	Per-port VF count is 31.
OCe14102 (ASIC REV 0X11) 2-port 10Gb NIC	2	2	126	Per-port VF count is 63.
OCe14104 4-port 10Gb NIC	4	4	124	Per-port VF count is 31.
OCe14401 1-port 40Gb NIC plus storage (iSCSI/FCoE)	1	2 (one NIC, one storage)	63	63 VFs for NIC port.
OCe14102 (ASIC REV 0x10) 2-port 10Gb NIC plus storage (iSCSI/FCoE)	2	4 (two NIC, two storage)	62	Per-NIC-port VF count is 31.
OCe14102 (ASIC REV 0X11) 2-port 10Gb NIC plus storage (iSCSI/FCoE)	2	4 (two NIC, two storage)	126	Per-NIC-port VF count is 63.

9. Detach VFs from the host before adding them to the guest.

   Example 1 (using only one VF per physical port):

   RHEL 6.x KVM: View Emulex PCI devices with the `lspci` command:

   ```
   # lspci | grep Emulex     16:00.0 Ethernet controller: Emulex Corporation OneConnect 10Gb NIC (be3) (rev 03) <-- LOM Port 0 (Function 0)     16:00.1 Ethernet controller: Emulex Corporation OneConnect 10Gb NIC (be3) (rev 03) <-- LOM Port 1 (Function 1)     16:04.0 Ethernet controller: Emulex Corporation OneConnect 10Gb NIC (be3) (rev 03) <-- VF LOM Port 0 (Function 0)     16:08.0 Ethernet controller: Emulex Corporation OneConnect 10Gb NIC (be3) (rev 03) <-- VF LOM Port 1 (Function 1)
   ```

   Detach desired VFs:

   ```
   # virsh nodedev-dettach pci_0000_16_04_0     Device pci_0000_16_04_0 detached <-- VF LOM Port 0 (Function 0)     # virsh nodedev-dettach pci_0000_16_08_0     Device pci_0000_16_08_0 detached <-- VF LOM Port 1 (Function 1)
   ```

   Per-port VF count SLES 11.*x* Xen: View Emulex PCI devices with the `lspci` command:

   ```
   # lspci | grep Emulex     16:00.0 Ethernet controller: Emulex Corporation OneConnect 10Gb NIC (be3) (rev 03) <-- LOM Port 0 (Function 0)     16:00.1 Ethernet controller: Emulex Corporation OneConnect 10Gb NIC (be3) (rev 03) <-- LOM Port 1 (Function 1)     16:04.0 Ethernet controller: Emulex Corporation OneConnect 10Gb NIC (be3) (rev 03) <-- VF LOM Port 0 (Function 0)     16:08.0 Ethernet controller: Emulex Corporation OneConnect 10Gb NIC (be3) (rev 03) <-- VF LOM Port 1 (Function 1)     # lspci -nn | grep Emulex     16:00.0  Ethernet controller: [0200]: Emulex Corporation OneConnect 10Gb NIC (be3) [19a2:0710] (rev 03) <-- LOM Port 0 (Function 0)     16:00.1  Ethernet controller: [0200]: Emulex Corporation OneConnect 10Gb NIC (be3) [19a2:0710] (rev 03) <-- LOM Port 1 (Function 1)     16:04.0  Ethernet controller: [0200]: Emulex Corporation OneConnect 10Gb NIC (be3) [19a2:0710] (rev 03) <-- VF LOM Port 0 (Function 0)     16:08.0  Ethernet controller: [0200]: Emulex Corporation OneConnect 10Gb NIC (be3) [19a2:0710] (rev 03) <-- VF LOM Port 1 (Function 1)
   ```

   List Emulex PCI device by device code:

   ```
   # virsh nodedev-list | grep 19a2     pci_19a2_710  <-- LOM Port 0 (Function 0)     pci_19a2_710_0 <-- LOM Port 1 (Function 1)     pci_19a2_710_1 <-- VF LOM Port 0 (Function 0)     pci_19a2_710_2 <-- VF LOM Port 1 (Function 1)     # virsh nodedev-dettach pci_19a2_710_1     Device pci_19a2_710_1 detached <-- VF LOM Port 0 (Function 0)     # virsh nodedev-dettach pci_19a2_710_2     Device pci_19a2_710_2 detached <-- VF LOM Port 1 (Function 1)
   ```

10. Use the Virtual Machine Manager GUI to attach the VF (step 5.) to the guest operating system by using the add physical device option.

    NOTE To reconfigure a system that is already set up, remove the attached VF from the guest operating system by selecting the VF and using the remove option. Refer to the documentation for the host operating system for information on using the Virtual Machine Manager to attach and remove virtual interfaces.

11. Start the RHEL 6.*x* guest operating system. After the guest operating system is booted, use the `lspci` command to confirm the visibility of the NIC function. The output shows a NIC function, for example:

    ```
    03:00.0 Ethernet controller: Emulex Corp. Emulex OneConnect 10Gb NIC (be3)
    ```

12. The Ethernet driver automatically loads with the out-of-box driver and creates the network interfaces. Use the `ifconfig` command to verify that the interface is created.

13. After configuring the network interfaces with proper Internet Protocol (IP) addresses, you can send network traffic to and receive network traffic from the VM. Refer to the documentation for the host and guest operating systems for information on network configuration.

3.2.7.3 Edge Virtual Bridging

The OCe14000-series chip supports both virtual Ethernet bridging (VEB) and tagless virtual Ethernet port aggregator (VEPA) modes. VEB mode is enabled by default in the chip. Switching to VEB/VEPA mode can be done using the bridge utility or the Emulex OneCommand CNA Manager application. The bridge utility is available in RHEL 7 and SLES 12 and later distributions.

3.2.7.4 Assigning VFs to a VM on the SLES Operating System

To assign VFs to the VM in the SLES Xen kernel, the VF must be unbound from the NIC module and then bound to the pciback module.

NOTE In the following steps, *0000:07:0b.5* is used as an example. To match those instances to the port that you want to use, you need to select the entry that matches the PCI bus, device, or function that corresponds to the port that you want to assign. Use the `ethtool` utility to determine this information, such as `ethtool -i eth0` (where `eth0` is the interface you want to assign).

1. Load the pciback driver `modprobe pciback`.
2. Navigate to the `/sys/bus/pci/drivers/pciback` directory, and ensure that the following is displayed:

```
Panama-Sles11sp2:/sys/bus/pci/drivers/pciback # ls -lrt
total 0
--w------- 1 root root 4096 Sep 5 15:29 unbind
--w------- 1 root root 4096 Sep 5 15:29 uevent
-r-------- 1 root root 4096 Sep 5 15:29 slots
--w------- 1 root root 4096 Sep 5 15:29 remove_slot
--w------- 1 root root 4096 Sep 5 15:29 remove_id
-rw------- 1 root root 4096 Sep 5 15:29 quirks
-rw------- 1 root root 4096 Sep 5 15:29 permissive
--w------- 1 root root 4096 Sep 5 15:29 new_id
lrwxrwxrwx 1 root root 0 Sep 5 15:29 module ->
../../../../module/pciback
--w------- 1 root root 4096 Sep 5 15:34 new_slot
--w------- 1 root root 4096 Sep 5 15:34 bind
```

3. Navigate to the `/sys/bus/pci/drivers/be2net` directory, and ensure that the following is displayed:

```
--w------- 1 root root 4096 Sep 5 15:32 uevent
--w------- 1 root root 4096 Sep 5 15:32 remove_id
--w------- 1 root root 4096 Sep 5 15:32 new_id
lrwxrwxrwx 1 root root 0 Sep 5 15:32 module ->
../../../../module/be2net
--w------- 1 root root 4096 Sep 5 15:32 bind
--w------- 1 root root 4096 Sep 5 15:33 unbind
lrwxrwxrwx 1 root root 0 Sep 5 15:32 0000:07:0b.5 ->
../../../../devices/pci0000:00/0000:00:09.0/0000:07:0b.5
lrwxrwxrwx 1 root root 0 Sep 5 15:32 0000:07:0b.4 ->
../../../../devices/pci0000:00/0000:00:09.0/0000:07:0b.4
lrwxrwxrwx 1 root root 0 Sep 5 15:32 0000:07:0b.3 ->
../../../../devices/pci0000:00/0000:00:09.0/0000:07:0b.3
lrwxrwxrwx 1 root root 0 Sep 5 15:32 0000:07:0b.2 ->
../../../../devices/pci0000:00/0000:00:09.0/0000:07:0b.2
lrwxrwxrwx 1 root root 0 Sep 5 15:32 0000:07:0b.1 ->
../../../../devices/pci0000:00/0000:00:09.0/0000:07:0b.1
lrwxrwxrwx 1 root root 0 Sep 5 15:32 0000:07:0b.0 ->
../../../../devices/pci0000:00/0000:00:09.0/0000:07:0b.0
```

4. Unbind the VF from the be2net driver.

```
echo –n “0000:07:0b.5” > /sys/bus/pci/drivers/be2net/unbind
```

5. Bind the driver to the pciback module.

```
echo –n “0000:07:0b.5” > /sys/bus/pci/drivers/pciback/new_slot
echo –n “0000:07:0b.5” > /sys/bus/pci/drivers/pciback/bind
```

6. Navigate to the `/sys/bus/pci/drivers/pciback` directory and ensure that the device *0000:07:0b.5* is listed under it. In addition, check that dmesg logs report the same device.

   You can now launch `qemu-kvm` and attach VF *0000:07:0b.5* to any desired VM.

3.2.7.5 Link State Reporting with SR-IOV

When VEB is used for switching traffic between the functions of an SR-IOV-enabled port, the link status reported to the operating system stack when the physical port is not connected varies with the adapter type. In OCe11000-series adapters, the VFs continue to indicate the link to be up even when the physical port is not linked up. In OCe14000-series and OCe11100 series adapters, by default, the VFs indicate the link as down when the physical port is not linked up. This behavior enables two or more VFs to be configured in a bond.

The following table summarizes the default link status of the PFs and VFs when SR-IOV is enabled in the BIOS and in the driver.

Table 6 Default Link Status of the PFs and VFs

Function	Physical Link is Not Connected	
	OCe14000	OCe11100
Physical function (PF)	Down	Down
Virtual function (VF)	Down	Down

The default behavior of VFs in OCe14000-series and OCe11100 series adapters can be changed using the `ip link` command in distributions of Linux that support iproute version 3.11.0 or later. For details on configuring the link state for VFs, see Section 3.2.7.7, Link State Configuration.

When VEPA is configured to switch traffic between the functions instead of VEB, the VF link state always reflects the physical state of the associated port, and this behavior cannot be changed.

3.2.7.6 Configuring VFs

In operating system distributions with newer IP commands that support VF configuration options, the host administrator can perform the following by using the `ip link set` command:

- Change the default MAC address
- Configure VLAN
- Configure the transmission rate
- Configure the link state
- Set the QoS parameter on VFs

MAC Address Configuration

The Emulex OneConnect adapter is shipped with factory-configured MAC addresses for the network interfaces corresponding to the PFs. The driver generates random MAC addresses for the network interfaces corresponding to the VFs based on the factory-configured MAC address. Other MAC addresses can be assigned for the interfaces corresponding to the VF using IP utility commands in the hypervisor.

To configure the MAC address for the virtual function, run the following command in the hypervisor:

```
# ip link set eth<X> vf <VFN> mac <MAC-ADDR>
```

where:

- `eth<X>` is the interface corresponding to the physical function.
- <*VFN*> is the VF number (0-based) corresponding to the interface for which you are configuring the MAC address.
- <*MAC-ADDR*> is the MAC address you are configuring.

For example, to configure the MAC address for VF number 0 on eth0 (PF), run the following command in the hypervisor:

```
# ip link set eth0 vf 0 mac 00:16:88:AA:BB:AA
```

If the VM is already running and the VF driver is loaded, the VF MAC address can be updated using one of the following two methods in the VM:

- If the VF interface is configured using `ifcfg` script:
  a. Update the `ifcfg` script for the VF, with the MAC address configured in the hypervisor in the earlier step. For example, update the HWADDR line in the VF `ifcfg-eth`<X> script.
     `HWADDR=00:16:88:AA:BB:AA`
  b. Restart the network service.
     `# service network restart`

Or

- If the VF interface is not configured using `ifcfg` script:
  Update the VF MAC address using the `ifconfig` or `ip link` command.
  `# ifconfig eth0 hw ether 00:16:88:AA:BB:AA`

VLAN Configuration

This section includes examples for transparent tagging and virtual guest tagging (VGT).

When transparent tagging is configured for a VF, the NIC transparently tags all non-VLAN traffic from the VF with the configured transparent VLAN ID. The VM is not aware of the VLAN tag.

To assign a transparent VLAN ID to the VF, run the following IP command in the hypervisor:

```
# ip link set eth<X> vf <VFN> vlan <VLAN>
```

where:

- `eth<X>` is the interface corresponding to the physical function
- <*VFN*> is the VF number corresponding to the interface for which you are configuring the VLAN
- <*VLAN*> is the VLAN ID you are configuring

Example:

```
# ip link set eth0 vf 0 vlan 5
```

NOTE Guest VLAN tagging is not allowed on the VF in the guest operating system when transparent VLAN tagging is enabled on the VF.

Transmission Rate Configuration

Configure the transmission rate limit (TX-RATE) on a VF interface from the hypervisor using the following IP command syntax:

```
# ip link set eth<X> vf <VFN> rate <TX-RATE>
```

where:

- `eth<X>` is the interface corresponding to the physical function
- <*VFN*> is the VF number corresponding to the interface that you are configuring the TX-RATE

- <*TX-RATE*> is the transmission rate limit, in Mb/s

For example, to set a TX-RATE of 5000 Mb/s for the VF 0, run the following command:

```
# ip link set eth0 vf 0 rate 5000
```

NOTE For OCe14000-series adapters, the TX-RATE must be multiples of 400 Mb/s on a 40Gb port, and multiples of 100 Mb/s on a 10Gb port.

3.2.7.7 Link State Configuration

NOTE The link state configuration feature is supported on RHEL 7.*x* and SLES 12 onwards and is not supported in earlier kernels.

This section provides link state configuration for a VF in OCe14000-series adapters.

Configure the link state on a VF interface from the hypervisor using the following IP command syntax:

```
#ip link set eth<X> vf <VFN> state < auto | enable | disable >
```

where:

- `eth`<*X*> is the interface corresponding to the physical function
- <*VFN*> is the VF number corresponding to the interface for which the link state is being configured
- `auto` – VF link state will reflect the PF link state
- `enable` – VF link state will be always up
- `disable` – VF link state will be always down

3.2.7.8 Spoof Check Configuration

Configure the HW packet source MAC spoof check on a VF interface from the hypervisor using the following IP command syntax:

```
# ip link set eth<X> vf <VFN> spoofchk [on|off]
```

where:

- `eth`<*X*> is the interface corresponding to the physical function
- <*VFN*> is the VF number corresponding to the interface for which you are configuring the spoof check

For example, to turn on spoof checking for the VF 0, run the following command:

```
# ip link set eth0 vf 0 spoofchk on
```

3.2.7.9 Viewing VF Properties

To view the properties configured to VFs attached to a PF, use the following IP command syntax:

```
# ip link show eth<X>
```

where `eth`<*X*> is the interface corresponding to the physical function.

For example, to view the properties of a PF at eth0 (which has VFs 0, 1 associated with it), run the following command in the hypervisor:

```
# ip link show eth0
```

Expected example output:

```
eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc mq state UP qlen
1000
link/ether 00:00:c9:bb:16:ee brd ff:ff:ff:ff:ff:ff
vf 0 MAC 00:00:c9:9d:90:80, tx rate 10000 (Mbps)
vf 1 MAC 00:00:c9:9d:90:81, tx rate 10000 (Mbps)
```

3.2.8 Bonding Considerations

VFs can be added to a bonding configuration. But because VFs are typically assigned to a VM, it might not be possible to identify two VFs from the same PF or physical port. This situation could lead to incorrect configurations. To avoid this issue, the driver exports a physical port identifier corresponding to a given network interface. VFs from the same physical port will have the same identifier.

For example, to obtain the physical port identifier of a VF `eth0` in a VM, read the corresponding sysfs file `phys_port_id` in the VM as follows. The number in the output shown is the physical port identifier of eth0.

```
# cat /sys/class/net/eth0/phys_port_id
0100000000000000000000383838314643
```

The NetworkManager reports incorrect bonding configuration with a message like this:

```
"NetworkManager: <warn> (bond0): slave eth1 shares a physical port with
existing slave eth0"
```

3.2.9 ARI Considerations for OCe14000-Series Adapters

Alternative routing-ID interpretation (ARI) is supported on the OCe14000-series adapters. The maximum number of functions allowed on an adapter is controlled by the adapter's IPL file and the system's support for ARI.

When UMC is enabled on an OCe14000-series network adapter, each port can be partitioned into isolated PFs (channels). You can configure the following number of functions:

- Up to 16 functions on a one-port OCe14400-series adapter
- Up to eight functions per port on a one or two-port OCe14100-series adapter
- Up to four functions per port on a four-port OCe14100-series adapter

NOTE Refer to the *Emulex Universal Multichannel Reference Manual* for additional information on UMC.

ARI must be available to support up to 16 functions on an adapter. OCe14000-series adapters automatically support ARI. However, the following requirements must be met to support more than eight functions on an adapter:

- The system hardware (the motherboard and BIOS) must support ARI.
- ARI must be enabled in the system BIOS.
- The host or guest operating system must support ARI:
  - RHEL 6.4 and later versions
  - RHEL 7
  - SLES 11 SP2 and later versions
- The application management tools, including the Emulex OneCommand CNA Manager application, must support ARI.

If these conditions are not met, you may be able to configure more than eight functions, but only up to eight functions will be running and discovered after a reboot.

3.2.10 NIC Partitioning (NPar) Configuration (Dell Only)

NOTE

- NPar support is only available on OCe14000-series adapters running in 10Gb mode.
- NPar is tested and supported on Dell 12G servers.
- NPar + ARI = NParEP is tested and supported on Dell 13G servers.

NPar mode enables the capability to divide a 10Gb NIC port into multiple PCI functions, with flexible bandwidth capacity allocation that appear to the operating system and network as separate NIC ports. A single 10-gigabit Ethernet (GbE) port appears as multiple physical devices showing in PCI configuration space as multiple functions.

3.2.10.1 Adapter Configuration

NPar can be configured on OCe14000-series adapters by using the BIOS or the Emulex OneCommand CNA Manager application.

- To configure NPar using the BIOS, refer to the *Boot for NIC, iSCSI, and FCoE Protocols User Guide*.
- To configure NPar using the Emulex OneCommand CNA Manager, refer to the latest *Emulex OneCommand CNA Manager Application for OneConnect Adapters User Guide* or the *Emulex OneCommand CNA Manager CLI for OneConnect Adapters User Guide*.

On the host operating system side, NPar provides up to eight PCI functions per device using standard PCI configuration space. Four PCI functions can be mapped to a physical port. Each function or partition will be assigned a unique MAC address.

Partitions will be available for virtual function assignment and for application segmentation through VLAN or IP subnets.

3.2.10.2 NPar Features

- The partitions can be on separate subnets or VLANs.
- Bandwidth allocation is flexible.
- No operating system or BIOS changes are required.
- No external switch changes are required.
- Each partition should have standard NIC properties for stateless offload.
- NIC teaming on the same port should be avoided.

The following items are supported on a per-partition basis:

- Per-partition statistics
- LSO, large receive offload (LRO), RSS, and TCP Segmentation Offload (TSO) needed per partition
- Maximum transmission unit (MTU) per partition
- Support for NetQueues

3.2.10.3 Using NParEP

NOTE

- NParEP is available only on OCe14000-series adapters.
- On a four-port adapter, ARI functionality must be enabled in the PCIe subsystem on a particular system to support NParEP on all four ports.
- NParEP support is available only on Dell 13G or newer systems.

- SR-IOV must be enabled in the system BIOS for NParEP to work properly on Linux systems.

NParEP can be configured on the OCe14000 family of adapters by using the adapter BIOS utility or the Emulex OneCommand CNA Manager application.

- To configure NParEP using the adapter BIOS utility, refer to the *Boot for NIC, iSCSI, and FCoE Protocols User Guide*.
- To configure NParEP using the Emulex OneCommand CNA Manager application, refer to the *Emulex OneCommand CNA Manager Application for OneConnect Adapters User Guide* or the *Emulex OneCommand CNA Manager CLI for OneConnect Adapters User Guide*.

3.3 RoCE Configuration for OCe14000-Series Adapters

NOTE

- RoCE is not supported with multichannel.
- RoCE configurations are not supported with SR-IOV.
- Enable priority flow control (PFC) as the default mode whenever possible while using RoCE. See Section 3.4, iSCSI Driver Configuration, to enable QoS for RoCE. In addition, VLAN interfaces must be configured and used for RoCE trafficr for PFC to work correctly (see Section 3.3.2, Pinning Interrupts to a CPU Core). Use VLANs greater than 1 for best interoperability.

3.3.1 Basic Configuration

3.3.1.1 Setting the Profile

Specify and enable RoCE profiles can be specified and enabled using the OneCommand CNA Manager GUI application, the OneCommand CNA Manager CLI application, and the PXESelect BIOS utility.

For specific information on selecting RoCE profiles, refer to the applicable guide:

- *Boot for NIC, iSCSI, and FCoE Protocols User Guide* for details on the PXESelect BIOS utility.
- *Emulex OneCommand CNA Manager Application for OneConnect Adapters User Guide* for information about setting the RoCE profiles using the OneCommand CNA Manager application GUI.
- *Emulex OneCommand CNA Manager CLI for OneConnect Adapters User Guide* for information on setting the RoCE profiles using the OneCommand CNA Manager CLI.

3.3.1.2 Confirming that the RoCE Profile Is Enabled

The profile can be confirmed from the Ethernet driver load messages in `/var/log/messages`.

For example: Using profile 0x15.

NOTE If the correct profile is not reported, update the profile ID using the Emulex OneCommand CNA Manager application or the PXESelect BIOS utility.

CAUTION You must have a homogeneous set up in terms of firmware version, active profile, and driver version. If not, the applications could fail.

3.3.1.3 Interface Configuration

Identify the RoCE interfaces and their corresponding NIC interfaces by using the following commands.

To list the ocrdma interfaces:

```
ibv_devinfo –l
```

To list the corresponding NIC interfaces:

```
ibdev2netdev
```

Follow the standard procedure to assign a valid IP address to the desired Ethernet interface that corresponds to the RoCE port. You can assign an IP address to eth0 to use `ocrdma0` for RoCE.

Example output:

```
# ibv_devinfo –l
2 HBAs found:
ocrdma1
ocrdma2
# ibdev2netdev
ocrdma0 port 1 ==> eth0 (Up)
ocrdma1 port 1 ==> eth1 (Up)
ocrdma2 port 1 ==> eth2 (Up)
ocrdma3 port 1 ==> eth3 (Up)
```

On some systems, the `ibdev2netdev` command might not be available. On these systems, perform the following steps to find the Ethernet interface names from the RoCE interface name.

```
cat /sys/class/infiniband/ocrdma<X>/nic_interface
```

where `ocrdma`<*X*> is the output of the `ibv_devinfo -l` command.

For example:

```
# cat /sys/class/infiniband/ocrdma0/nic_interface
```

3.3.1.4 VLAN Configuration

If QoS is set to use PFC, the interfaces must be configured with VLANs. RoCE PFC performs best if VLANs other than 0 and 1 are used.

To configure a VLAN interface, perform the following steps:

1. Load the 8021q module (if necessary) by typing:

   ```
   modprobe 8021q
   ```

   NOTE `modprobe 8021q` must be loaded even if VLANs are not configured.

2. Create a VLAN interface by typing:

   ```
   vconfig add eth<x><vlan id>
   ```

   For example:

   ```
   # vconfig add eth4 100
   ```

   On systems where `vconfig` is not available, the `ip` command must be used.

   ```
   ip link add link <base interface name> name <vlan interface name> type vlan
   id <vlan-id>
   ```

   For example:

   ```
   # ip link add link eth4 name eth4.100 type vlan id 100
   ```

3. Configure an IP address on the VLAN interface by typing:

```
ifconfig eth<x>.<vlan id> x.x.x.x up
```

For example:

```
# ifconfig eth4.100 11.192.168.2 netmask 255.255.255.0 up
```

Testing the RoCE Interface Connectivity

You can test the RoCE interface connectivity using the `rping` command.

On a server, type:

```
# rping  -sva <server IP>
```

On a client, type:

```
# rping -C <iteration> -cva <server IP>
```

For example:

On a server, when you type:

```
# rping -sva  3.3.3.2
```

The following sample output appears:

```
server ping data: rdma-ping-0: ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]'_`abcdefghijklmnopqr
server ping data: rdma-ping-1: BCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
server ping data: rdma-ping-2: CDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
server ping data: rdma-ping-3: DEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
server ping data: rdma-ping-4: EFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
server DISCONNECT EVENT...
wait for RDMA_READ_ADV state 10
```

On a client, when you type:

```
# rping -C 5 -cva 3.3.3.2
```

The following sample output appears:

```
ping data: rdma-ping-0: ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqr
ping data: rdma-ping-1: BCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrs
ping data: rdma-ping-2: CDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrst
ping data: rdma-ping-3: DEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstu
ping data: rdma-ping-4: EFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuv
client DISCONNECT EVENT...
```

3.3.1.5 Sample Applications

The following additional in-built tools are available for RoCE testing.

- ib_send_bw
- ib_read_bw
- ib_write_bw

NOTE The use of these commands assumes that the client (ocrdma0) and server (ocrdma0) interfaces are configured with IPs 11.192.168.x and 11.192.168.y, respectively.

For example:

- ib_send_bw

  Server:

  ```
  # ib_send_bw -Rd ocrdma0
  ```

  Client:

  ```
  # ib_send_bw -Rd ocrdma0 11.192.168.x
  ```

- ib_read_bw

  Server:

  ```
  # ib_read_bw –Rd ocrdma0
  ```

  Client:

  ```
  # ib_read_bw –Rd ocrdma0 11.192.168.x
  ```

- ib_write_bw

  Server:

  ```
  # ib_write_bw –Rd ocrdma0
  ```

  Client:

  ```
  # ib_write_bw –Rd ocrdma0 11.192.168.x
  ```

3.3.2 Pinning Interrupts to a CPU Core

On a multicore system, distribute RoCE interrupt request (IRQ) vectors among CPU cores to achieve better system utilization.

RoCE interface IRQs can be pinned to different CPU cores by disabling `irqbalance` and running:

```
ocrdma_irq_affinity.sh script
```

(included with Linux RoCE driver package)

```
# service irqbalance stop
# ./ocrdma_irq_affinity.sh  <RoCE interface name>
```

3.3.3 MTU Configuration

The minimum supported MTU for RoCE is 512. However, if you use the `ifconfig` command to set the MTU value on a corresponding Ethernet interface, 80 bytes must be added to the MTU of the RoCE interface. For example, if 512 is the desired MTU on RoCE interface, 592 is the minimum MTU size to be configured on the corresponding Ethernet interface.

To utilize the maximum RoCE MTU of 4096, the Ethernet interface must be configured with an MTU greater than 4176.

Perform the following procedure when changing the MTU value on a network interface or a switch port:

1. Stop all running RoCE applications.
2. Change the MTU value (on the host interface and the switch).
3. Restart all the RoCE applications.

3.3.4 QoS Configuration

This section describes the configuration and behavior aspects of RoCE QoS on the OCe14000-series adapters.

In addition to QOS settings, the OCe14000-series adapter can support quantized congestion notification (QCN) for RoCE ports. To use QCN, the feature must be enabled on both the RoCE port and the switch port. The RoCE port can be enabled using the Emulex OneCommand CNA Manager application in the Physical Port Info tab. For more

information, refer to the latest *Emulex OneCommand CNA Manager Application for OneConnect Adapters User Guide*. The switch must also be enabled to generate QCN packets.

3.3.4.1 QoS Behavior

Supported QoS behavior follows:

- PFC configuration for back to back
- Limited QoS configuration using the Emulex OneCommand CNA Manager application
- A single traffic class group for RoCE per port
- A single RoCE priority in PFC mode
- Bandwidth allocation for priority groups

OCe14000-Series Adapter Defaults

NOTE If generic pause mode is used, ensure that the switches support this feature. Use PFC with priority 5 if the switch does not support the generic pause mode.

- Adapter boot time
  - PFC is disabled on all the ports at adapter boot time in the NIC + RoCE profile.
  - The generic pause mode is enabled on all the ports at adapter boot time in the NIC + RoCE profile.
- Back-to-back connection (OCe14000-to-OCe14000)
  - PFC is enabled by default.
  - The generic pause mode is disabled on that port.
- Data Center Bridging Capabilities Exchange (DCBX)-enabled switch connection
  - If the OCe14000-series adapter is connected to a DCBX-enabled switch, the mode changes from generic pause to PFC mode.
  - The OCe14000-series adapter configures RoCE traffic for priority 5.
  - Priority 5 is manually enabled on a switch under a priority group other than an FCoE, ISCSI, or NIC priority group.

NOTE In the absence of priority 5 at the switch side, the OCe14000-series adapter maintains its configuration for PFC mode priority 5. This configuration can result in packet losses, unrecoverable errors, or infinite retries for RoCE traffic.

- DCBX-disabled switch connection
  - If the OCe14000-series adapter is connected to a DCBX-disabled switch, the generic pause mode is enabled.

3.3.4.2 QoS Configuration Guidelines

This section details QoS configuration.

Priority Groups

Split the traffic into two or more priority groups:

- One priority group for RoCE
- Other groups for non-RoCE traffic

Many RoCE applications use Transmission Control Protocol (TCP)/IP for out-of-band connection establishment. Therefore, you should allocate sufficient bandwidth to non-RoCE priority groups.

L2 Flow Control

When a port is operating in generic pause mode, RoCE latencies can increase. In this situation, configure RoCE to use PFC for better results.

For switches and adapters that do not support PFC, RoCE can continue to operate in generic pause mode. Bandwidth allocation can still be configured for RoCE versus NIC traffic. However, this allocation cannot be guaranteed, because all of the outgoing traffic can be paused due to network congestion.

DCBX-Enabled Switch Configuration

Currently, switches do not support configuring priority for RoCE specific traffic. Priority 5 must be manually enabled on the switch under a priority group other than the FCoE, iSCSI, or NIC priority group.

NOTE In the absence of priority 5 at the switch side, the OCe14000-series adapter maintains its configuration for PFC mode for priority 5. This can result in packet losses, unrecoverable errors, or infinite retries for RoCE traffic.

To configure the switch:

1. Create a priority group 1 (PG 1) for RoCE traffic.
2. Assign priority 5 to PG 1.
3. Assign the appropriate bandwidth (for example, 90 percent) to PG 1.
4. Create PG 2 (or something different from PG 1).
5. Assign NIC traffic to PG 2.
6. Assign the remaining bandwidth to PG 2 (for example, 10 percent).
7. Enable PFC on the switch ports.
8. Set both switch ports to pass relevant VLAN traffic.

NOTE Some switches have jumbo-frame size support disabled by default on the port or global level. Enable jumbo-frame support, or set the MTU to at least 4200.

To configure the host:

1. Enable PFC using the Emulex OneCommand CNA Manager application (refer to the *Emulex OneCommand CNA Manager Application for OneConnect Adapters User Guide)*.
2. Create a VLAN.
3. Assign an appropriate IP address to the VLAN interface.

Example Switch PFC Configuration

NOTE This example is for a Cisco switch that is connected to the OCe14000-series adapter.

By default, the Cisco switch is configured with two priority groups enabled, which are fixed and cannot be deleted:

- Default group name: default-group
- FCoE group name: fcoe-group

To configure the switch PFC:

1. Use default-group as the non-RoCE priority group (see DCBX-Enabled Switch Configuration, step 4).
2. Create another group for priority 5, such as PG 5 (see DCBX-Enabled Switch Configuration, step 1).
3. Assign 90 percent bandwidth to the PG 5 group and 10 percent to the default-group. No other changes are required to the default-group or fcoe-group.
4. Configure the individual ports in trunk mode, enable PFC-allowed VLANs and disable generic pause mode.

The following are examples of switch PFC configurations:

Cisco Global QoS Configuration

Global QoS configuration on the Cisco switch:

```
class-map type qos roce
      match qos 5
class-map type queuing roce
      match qos-group 5
class-map type network-qos roce
      match qos-group 5
policy-map type qos roce
      class roce
            set qos-group 5
      class class-fcoe
            set qos-group 1
      class class-default
policy-map type queuing roce
      class type queuing roce
            bandwidth percent 90
      class type queuing class-fcoe
            bandwidth percent 0
      class type queuing class-default
            bandwidth percent 10
policy-map type network-qos roce
      class type network-qos roce
      pause no-drop
      mtu 4200
      class type network-qos class-default
      mtu 9216
class type network-qos class-fcoe
      pause no-drop
      mtu 2158
system qos
      service-policy type qos input roce
      service-policy type queuing input roce
      service-policy type queuing output roce
      service-policy type network-qos roce

      #Individual port configuration
      interface ethernet 1/13
            switchport mode trunk
            switchport trunk allowed vlan 4
            priority-flow-control mode auto
            flowcontrol receive off
                  flowcontrol send off
```

DCBX-Disabled Switch Connection (Generic Pause Mode)

1. Host configuration:

   On the host and peer systems, ensure that Tx and Rx pause flow control is enabled using the operating system-standard tools on all of the ports or interfaces that are RoCE enabled.

   a. To verify status:

   ```
   ethtool -a ethX
   ```

b. To configure:

```
ethtool -A ethX [ autoneg on|off ]
[ rx on|off ]
[ tx on|off ]
```

2. Switch configuration:
   a. Enable Tx and Rx generic pause flow control on each port.
   b. Some switches have jumbo-frame size support disabled by default on the port or global level. Enable jumbo-frame support, or set MTU to at least 4200.

3.3.5 Advanced Applications

3.3.5.1 NFS over RDMA

On NFS servers where *fsid* must be specified while exporting file systems, ensure that they are unique for each exported file system.

When trying multiple mounts using NFS RDMA, the following error might be seen when the hardware resources are exhausted.

```
mount.nfs4: Cannot allocate memory
```

In this situation, use smaller `rdma_slot_table_entries` counts until the mount succeeds.

NOTE For the new `rdma_slot_table_entries` counts to take effect across all mounts, you must unmount the existing mounts before retrying all the mounts.

To get the current slot table entries, type:

```
# cat /proc/sys/sunrpc/rdma_slot_table_entries
32
```

To modify the slot table entries, type:

```
echo <X> >/proc/sys/sunrpc/rdma_slot_table_entries
```

where <*X*> is the new count for slot table entries.

For example:

```
# echo 16 >/proc/sys/sunrpc/rdma_slot_table_entries
```

3.3.5.2 Server Configuration

To configure the server:

1. Load and configure the ocrdma driver/library.
2. Load NFS-RDMA server module:

   ```
   #modprobe svcrdma
   ```

3. Start the NFS server:

   `# service nfs start` (for RHEL)

   Or

   `#service nfsserver start` (for SLES)

4. Configure the server Listen port number for RDMA transport:

   ```
   #echo “rdma 20050”>/proc/fs/nfsd/portlist
   ```

5. Configure the `/etc/exports` file by adding the required entries:

```
#echo "<path>*(rw,fsid=0,insecure,no_subtree_check,async,
no_root_squash)">>/etc/exports
```

NOTE Each `fsid` value must be unique.

For example:

```
#echo"/export*(rw,insecure,no_subtree_check,async,
no_root_squash)">>/etc/exports
cat/etc/exports
/export*(rw,insecure,no_subtree_check,async,no_root_squash)
```

6. Export the file system configured in`/etc/exports`:

```
#exportfs -a
```

3.3.5.3 Client Configuration

To configure the client:

1. Load and configure the ocrdma driver/library.
2. Load the RDMA client module:

```
#modprobe xprtrdma
```

3. List the file system exported by the NFS server:

```
#showmount –e <server_roce_ip>
```

NOTE *<server_roce_ip>* is the NIC IP address of the corresponding RoCE interface on the NFS Server.

For example:

```
#showmount -e 11.192.168.1
```

Export list for `11.192.168.1`:

```
/export (everyone)
```

4. Mount the file system:

```
#mount –t nfs4 <server_roce_ip>:<path> -o rdma,port=20050 <mount point>
```

For example:

```
#mount –t nfs4 11.192.168.1:/ -o rdma,port=20050 /mnt
```

5. Verify the NFS mount using RDMA:

```
#cat /proc/mounts | grep <mount point>
```

3.3.5.4 Using Multiple Queue Pairs with NFS-RDMA

In OCe14400-series 40GbE adapters, it is possible to use multiple queue pairs per NFS-RDMA mount for improved performance in terms of I/O operations per second (IOPs) and throughput. If this feature is enabled on the adapter port, the provider creates multiple queue pairs for every individual mount point. This feature is disabled by default and must be enabled manually for every port on both the NFS client and NFS server host. In case multiple queue pairs are enabled only on one of the hosts, the feature is disabled by the Emulex RoCE driver.

3.3.5.5 Enabling Multiple Queue Pairs

To enable multiple queue pairs for a port, type:

```
# echo 1 > /sys/class/infiniband/ocrdma<x>/qp_expansion
```

where `ocrdma`<*x*> is the interface exported for OCe14400-series; for example, `ocrdma0`.

3.3.5.6 Verifying Multiple Queue Pairs

To verify if multiple queue pairs are enabled, type:

```
# tail /var/log/messages
```

A sample output indicating four queue pairs would look like the following:

```
ocrdma(0) 40GBps  Adapter. qp_expansion : Setting the expansion factor to 4
```

3.3.5.7 Disabling Multiple Queue Pairs

To disable multiple queue pairs, type:

```
# echo 0 > /sys/class/infiniband/ocrdma<x>/qp_expansion
```

where `ocrdma<x>` is the interface exported for OCe14400-series; for example, `ocrdma0`.

NOTE You cannot disable mount points that are multiple queue pair enabled after they are mounted.

3.3.6 Installing and Using DAPL

The native RDMA stack may not install the Direct Access Programming Library (DAPL)-related RPMs by default. In this case, you must use the following steps to manually download and install the DAPL and DAPL utilities:

1. Install the following RPMs:

   ```
   libibverbs-devel
   librdmacm-devel
   ```

2. Download the DAPL tar ball. A supported DAPL tar ball can be downloaded from the following website:

   http://downloads.openfabrics.org/downloads/dapl/

3. Type the following for the build steps:

   ```
   # tar -zxvf dapl-x.x.x.tar.gz
   # cd dapl-x.x.x
   # ./configure
   # make
   # make install
   ```

4. Configure DAPL. Edit the `/etc/dat.conf` file to append following lines:

   ```
   ofa-v2-scm-roe-ocrdma0-1 u2.0 nonthreadsafe default libdaploscm.so.2
   dapl.2.0 "ocrdma0 1" ""
   ofa-v2-scm-roe-ocrdma1-1 u2.0 nonthreadsafe default libdaploscm.so.2
   dapl.2.0 "ocrdma1 1" ""
   ofa-v2-scm-roe-ocrdma2-1 u2.0 nonthreadsafe default libdaploscm.so.2
   dapl.2.0 "ocrdma2 1" ""
   ofa-v2-scm-roe-ocrdma3-1 u2.0 nonthreadsafe default libdaploscm.so.2
   dapl.2.0 "ocrdma3 1" ""
   ```

3.4 iSCSI Driver Configuration

3.4.1 Open-iSCSI Support

Open-iSCSI is a high-performance, transport independent, multi-platform implementation of Request for Comments (RFC) 3720.

For the inbox Open-iSCSI driver, use the Open-iSCSI tools to configure and manage Open-iSCSI. For the Emulex out-of-box iSCSI driver, use the Emulex OneCommand CNA Manager application to configure and manage Open-iSCSI. The applications are not interchangeable between the drivers.

The `iscsiadm` utility is a command-line tool allowing discovery of iSCSI targets; logging into iSCSI targets; as well as, access and management of the open-iSCSI database on all Linux installations. This utility presents a set of operations that you can perform on iSCSI nodes, sessions, connections, and discovery records.

3.4.2 Discovering and Adding iSCSI Targets

You can add iSCSI targets using a discovery phase first or add them directly (see Adding iSCSI Targets Directly (without Discovering)).

Follow these steps to discover and add a target. In this example, based on the IPL file flashed, the adapter has two NIC functions and two iSCSI functions.

1. To configure iface, type:

   ```
   iscsiadm -m iface
   ```

   Or, to set the network properties of iface, type:

   ```
   iscsiadm -m iface -I <iface name> --op=update -n iface.bootproto -v
   <static|dhcp>
   ```

2. If you selected static in step 1, you must configure the following manually:

   ```
   iscsiadm -m iface -I <iface name> --op=update -n iface.ipaddress -v <IPv4
   address>
   iscsiadm -m iface -I <iface name> --op=update -n iface.subnet_mask -v
   <netmask>
   iscsiadm -m iface -I <iface name> --op=update -n iface.gateway -v <IPv4
   address>
   To configure VLAN following commands need to be executed:
   iscsiadm -m iface -I <iface name> --op=update -n iface.vlan_id -v <1…4095>
   iscsiadm -m iface -I <iface name> --op=update -n iface.vlan_state -v
   <enable/disable>
   iscsiadm -m iface -I <iface name> --op=update -n iface.vlan_priority -v
   <0…7>
   iscsiadm -m iface -I <iface name> -o apply
   ```

   NOTE The apply operation pushes the configuration to the hardware using the iSCSI driver.

3. Log in to the discovered targets.

   ```
   iscsiadm -m node -p 192.168.65.196:3260 -l
   ```

   Example output:

   ```
   Logging in to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt7, portal:
   192.168.65.196,3260]
   Logging in to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt3, portal:
   192.168.65.196,3260]
   ```

```
Logging in to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt1, portal:
192.168.65.196,3260]
Logging in to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt0, portal:
192.168.65.196,3260]
Logging in to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt6, portal:
192.168.65.196,3260]
Logging in to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt4, portal:
192.168.65.196,3260]
Logging in to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt2, portal:
192.168.65.196,3260]
Logging in to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt5, portal:
192.168.65.196,3260]
Login to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt7, portal:
192.168.65.196,3260] successful.
Login to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt3, portal:
192.168.65.196,3260] successful.
      Login to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt1,
portal: 192.168.65.196,3260] successful.
Login to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt0, portal:
192.168.65.196,3260] successful.
Login to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt6, portal:
192.168.65.196,3260] successful.
Login to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt4, portal:
192.168.65.196,3260] successful.
Login to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt2, portal:
192.168.65.196,3260] successful.
Login to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt5, portal:
192.168.65.196,3260] successful.
```

4. Display the session information after a successful login.

   After the login is successful, the session information can be dumped with the following command:

   ```
   iscsiadm -m session -P 3
   ```

5. Log out from the targets.

   To log out from a single target, use the following command:

   ```
   iscsiadm -m node -T <Target_Name> -u
   ```

   To log out from all targets, use the following command:

   ```
   iscsiadm -m node -u
   ```

Adding iSCSI Targets Directly (without Discovering)

If the target details are known, you can skip the discovery phase and add the targets to the iscsiadm node database directly. Then you can log in to those targets.

1. Add individual target details to the nodes database.

   ```
   iscsiadm -m node -o new -T iqn.tgt1 -p 192.168.65.196:3260 -I
   be2iscsi.00:00:c9:f2:73:91
   ```

   Example output:

   ```
   New iSCSI node
   [be2iscsi:[hw=00:00:c9:f2:73:91,ip=,net_if=,iscsi_if=be2iscsi.00:00:c9:f2:7
   3:91] 192.168.65.196,3260,-1 iqn.tgt1] added
   ```

   The `-I be2iscsi.00:00:c9:f2:73:91` option is passed so that the target is bound with the interface name, and the login occurs through those interfaces.

2. Log in to the specific target.

```
iscsiadm -m node -T iqn.tgt1 -l
```

Example output:

```
Logging in to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt1, portal:
192.168.65.196,3260]
Login to [iface: be2iscsi.00:00:c9:f2:73:91, target: iqn.tgt1, portal:
192.168.65.196,3260] successful.
```

3. To display the session after a successful login or to log out, see step 4 and step 5 in Section 3.4.2, Discovering and Adding iSCSI Targets.

3.4.3 iscsiadm Commands for Configuring the Target

After setting up the target and initiator machines, use the following procedure to configure the iSCSI target through Open-iSCSI.

NOTE The following instructions assume that the initiator machine is a Linux machine with an Emulex OneConnect adapter installed.

1. Create a new interface (iface):

```
iscsiadm -m iface -o new -I <ifacename>
```

In this command, <*ifacename*> is the name you provide for the iface.

2. Add a NIC media access control (MAC) address:

```
iscsiadm -m iface -I <ifacename> --op=update -n iface.hwaddress -v <NIC
mac_address>
```

In this command, <*ifacename*> is the name of the iface created in step 1, and <*NIC mac_address*> is the NIC MAC address you are adding for discovery.

3. Add the transport name:

```
iscsiadm -m iface -I <ifacename> --op=update -n iface.transport_name -v
be2iscsi
```

In this command, <*ifacename*> is the name of the iface created in step 1.

4. Restart the service:

```
service open-iscsi restart
```

5. Perform target discovery using `SendTargets`:

```
iscsiadm -m discovery -t st -p <ip:port> -I <iface> -P 1
```

In this command, <*ip:port*> is the IP address and port number and <*iface*> is the name of the iface created in step 1.

6. Add the iSCSI driver MAC address:

```
iscsiadm -m iface -I <ifacename> --op=update -n iface.hwaddress -v <iSCSI
MAC Address>
```

In this command, <*ifacename*> is the name of the iface created in step 1.

7. Set the initiator's IP address:

```
iscsiadm -m iface -I <ifacename> -o update -n iface.ipaddress -v <IP>
```

In this command, <*ifacename*> is the name of the iface created in step 1 and <*IP*> is the IP address.

8. Log into the target:

```
iscsiadm -m node -T <targetname> -p <ip:port> -I <iface> -l
```

In this command, <*targetname*> is the target name you want to log into; <*ip:port*> is the IP address and port number; and <*iface*> is the name of the iface created in step 1.

9. Verify that the disk shows:

```
fdisk -l
```

10. Log out:

```
iscsiadm -m node -T <targetname> -p <ip:port> -I <iface> -u
```

In this command, <*targetname*> is the target name, <*ip:port*> is the IP address and port number, and <*iface*> is the name of the iface created in step 1.

Example

```
iscsiadm -m iface -o new -I iface0
iscsiadm -m iface -I iface0 --op=update -n iface.hwaddress -v
00:0F:1F:62:2B:BF
iscsiadm -m iface -I iface0 --op=update -n iface.transport_name -v be2iscsi
service open-iscsi restart
iscsiadm -m discovery -t st -p 20.0.0.107:3260 -I iface0 -P 1
iscsiadm -m iface -I iface0 --op=update -n iface.hwaddress -v
00:0F:1F:92:6B:BF
iscsiadm -m iface -I iface0 -o update -n iface.ipaddress -v 20.0.0.107
iscsiadm -m node -T iqn.tgt0 -p 20.0.0.107:3260 -I iface0 -l fdisk -l
iscsiadm -m node -T iqn.tgt0 -p 20.0.0.107:3260 -I iface0 –u
```

3.4.4 iSNS Discovery Using iscsiadm

3.4.4.1 For SLES 11 SP3 and Later

Internet Storage Name Service (iSNS) discovery uses a standard NIC interface, but portals that are found will login using the offload adapter.

To discover targets using iSNS:

1. Ping the iSNS Server IP:

```
ping -I ethX <iSNS Server IP>
```

Ping from the Initiator Host machine to the iSNS server IP from the ethX interface of the operating system. The iSNS server IP address is passed during the discovery command.

2. Run the discovery command:

```
iscsiadm -m discoverydb -t isns -p <iSNS Server IP> -I <be2iscsi interface>
--discover -P 1
```

In this command, `-I <be2iscsi interface>` is the interface to which the discovered target is offloaded when login to the target is complete.

3.4.4.2 For All Other Linux Distributions

iSNS discovery uses a standard NIC interface. The default interface is the TCP_interface.

```
localhost:~ # iscsiadm -m iface
default tcp,<empty>,<empty>,<empty>,<empty>
iser iser,<empty>,<empty>,<empty>,<empty>
```

Perform the following steps to discover targets using iSNS through the NIC interface:

1. Ensure that a ping to the iSNS server IP from the initiator machine is successful through the NIC interface.
2. Run the discovery command:

```
iscsiadm -m discoverydb -t isns -p <iSNS_SERVER_IP> -I default --discover -P
1
```

For example:

```
iscsiadm -m discoverydb -t isns -p 10.192.204.116 -I default --discover -P1
```

Example output:

```
Target: iqn.tgt:TGT1
      Portal: 192.168.65.197:3260,1
            Iface Name: default
Target: iqn.tgt:TGT2
      Portal: 192.168.65.197:3260,1
            Iface Name: default
Target: iqn.tgt:TGT3
      Portal: 192.168.65.197:3260,1
            Iface Name: default
```

3. Display the interfaces that are present:

```
iscsiadm -m iface
```

Example output:

```
default tcp,<empty>,<empty>,<empty>,<empty>
iser iser,<empty>,<empty>,<empty>,<empty>
bnx2i.00:25:b3:df:8d:ad bnx2i,00:25:b3:df:8d:ad,<empty>,<empty>,<empty>
be2iscsi.00:00:c9:f2:73:91
```

4. Add the targets listed in the discovery command to the iSCSI driver interface through which the connection will be offloaded:

```
iscsiadm -m node -T <Target_Name> -p <Target_Portal:Port_Number,Portal Tag>
-I
<be2iscsi Interface> -o new
```

For example:

```
iscsiadm -m node -T <Target_Name> -p <Target_Portal:Port_Number,Portal Tag>
-I
```

New iSCSI node

```
iscsiadm -m node -T <Target_Name> -p <Target_Portal:Port_Number,Portal Tag>
-I
```

3.5 VPort Configuration

This section describes how to create, delete, and display virtual ports VPorts.

3.5.1 VPort Configuration Prerequisites

Before configuring VPorts, consider the following points:

- Ensure that you are using the latest recommended firmware for VPort functionality. For the latest firmware, check the Documents and Downloads area of http://www.broadcom.com.

  NOTE Before performing a firmware update, driver installation is required. For more information on installing the driver, see Chapter 2, Installing and Uninstalling.

- Loop devices and NPIV are not supported on the same port simultaneously. If you are running a loop topology and you create a VPort, the VPorts link state is offline.
- VPorts do not persist across system reboots.

3.5.2 Creating, Deleting, and Displaying VPorts

VPorts are created through sysfs entries that are presented in the physical port's sysfs directory. The `vport_create` and `vport_delete` sysfs entries are described in Section 3.5.3.2, VPort sysfs Entries. There are three scripts create, delete, and display VPorts. The scripts reside in the `/usr/sbin/brcmlpfc` directory and are part of the OneCommand CNA Manager application kit.

When NPIV is enabled and VPorts are configured, it can take longer for the adapter to finish discovery in some cases because each VPort must perform discovery independently. As more VPorts are configured, the amount of time that the driver and adapter take to finish discovery of remote ports on the SAN increases. To compensate for this extended amount of time taken in discovery, set the `lpfc_devloss_tmo` parameter to 60 seconds when NPIV is enabled.

3.5.2.1 Creating VPorts Using the mkvport.sh Script

You can use the mkvport script to create VPorts. To see the usage information, run the script with no parameters specified. The `mkvport.sh` script uses the following syntax:

```
./mkvport.sh <Physical Port's Host number> <Port Name> <Node Name>
```

You must supply the physical port's host number, WWPN, and WWNN when using the `mkvport.sh` script. For example, to create a VPort with port name of 10000000c94ac63a and a node name of 20010000c94ac63a on the physical port with scsi_host name *host7*, type:

```
./mkvport.sh host7 10000000c94ac63a 20010000c94ac63a
```

This script fails if the VPort is not created.

NOTE It is possible for a VPort to be created successfully but to be in a failed state. For example, loop devices and NPIV are not supported on the same port simultaneously. If you are running a loop topology and you create a VPort, the VPorts link state will be offline.

3.5.2.2 Deleting VPorts Using the rmvport.sh Script

NOTE You must unmap, unmount, and flush I/Os to VPort-connected devices before deleting the VPort.

You can use the `rmvport.sh` script to delete VPorts. To see the usage information, run the script with no parameters specified. The `rmvport.sh` script uses the following syntax:

```
./rmvport.sh <VPort's Host number>
```

Or

```
./rmvport.sh <Port Name> <Node Name>
```

To delete the VPort with a port name of 10000000c94ac63a and a node name of 20010000c94ac63a, type:

```
./rmvport.sh 10000000c94ac63a 20010000c94ac63a
```

This script may take up to 30 seconds to finish. The script fails if the VPort is not deleted.

3.5.2.3 Displaying VPorts Using the lsvport.sh Script

You can use the `lsvport.sh` script to display the VPorts and physical ports that are present on the system. Run the script with no parameters to display port information. For example:

```
./lsvport.sh
lpfc0: host6 10000000c93a5b5e:20000000c93a5b5e LP10000 NPIV Not Supported
lpfc1: host7 10000000c93a5b5d:20000000c93a5b5d LP10000 NPIV Not Supported
lpfc2: host8 10000000c93cc8dd:20000000c93cc8dd LPe12000 NPIV Physical
```

```
lpfc3: host9 10000000c93cc8dc:20000000c93cc8dc LPe12000 NPIV Physical
lpfc4: host10 10000000c94ac63a:20010000c94ac63a  NPIV Virtual (VPI 1)
```

In reference to the previous example:

- For LPFC0 and LPFC1, *NPIV Not Supported* indicates that this adapter/firmware combination does not support the creation of VPorts.
- For LPFC2 and LPFC3, *NPIV Physical* refers to a physical port of this adapter.
- For LPFC4, *NPIV Virtual* refers to a VPort of this adapter.

3.5.3 VPort sysfs

This section describes the VPort sysfs structure and VPort sysfs entries.

3.5.3.1 VPort sysfs Tree

When a VPort is created, three new directories are created in the class tree:

```
/sys/class/scsi_host/hostY/
/sys/class/fc_host/hostY/
/sys/class/fc_vports/vport-X:0-Z/-
```

Creating a new VPort also creates a new sysfs directory in the bus and devices tree:

```
/sys/bus/pci/drivers/lpfc/0000:A:B:C/hostX/vport-X:0-Z/hostY
/sys/devices/pci0000:A/0000:A:B:C/hostX/vport-X:0-Z/hostY
```

In both directories, there is a hostY directory that contains the remote ports that this new host can access:

```
/sys/bus/pci/drivers/lpfc/0000:A:B:C/hostX/vport-X:0-Z/hostY
/sys/bus/pci/drivers/lpfc/0000:A:B:C/hostX/vport-X:0-Z/hostY/rport-Y:0-0
/sys/bus/pci/drivers/lpfc/0000:A:B:C/hostX/vport-X:0-Z/hostY/rport-Y:0-1
/sys/bus/pci/drivers/lpfc/0000:A:B:C/hostX/vport-X:0-Z/hostY/rport-Y:0-2
```

In this example:

- X indicates the host value for the parent fc_host from which this VPort was created.
- Y indicates the new host value for the VPort that was created.
- Z indicates the instance of VPort created from the parent fc_host. A, B, and C indicate the PCI hierarchy for each physical FCoE port.

hostY is the new host created for the new VPort. *vport-X:0-Z* uniquely identifies the VPort and indicates the parent host structure (X) that created this VPort.

For example, if a VPort is created from host5, a new scsi_host, a new fc_host, a new fc_vport, and a new entry under the bus tree are created as well.

```
ls /sys/class/scsi_host/
host0  host1  host4  host5  host6
ls /sys/class/fc_host/
host4  host5  host6
ls /sys/class/fc_vports/
vport-5:0-0
```

3.5.3.2 VPort sysfs Entries

NOTE VPort sysfs entries shown in the following table are only present if the driver was loaded with `lpfc_enable_npiv` enabled.

Table 7 VPort sysfs Entries

VPort sysfs Entries	Type	Range/Input	Location and Description
`lpfc_peer_port_login`	Read/Write	0=Off (default) 1=On	`/sys/class/scsi_host/hostX/lpfc_peer_port_login` This entry sets the port's behavior when discovering targets in the SAN. The default behavior (value=0) will log in only to N_Ports that are physically located on a different port. The port will still attempt to log in to targets on all other ports (including the other port in a dual-port adapter). If this parameter is turned on (value=1), the port attempts to log in to all N_Ports, even if they are physically located on the same port. **NOTE** This parameter was created to reduce the amount of hardware resources (for example, RPIs) that the driver requires. In a configuration where many VPorts are on one physical port, this capability greatly reduces the number of RPIs that the driver uses.
`lpfc_restrict_login`	Read/Write	0=Off 1=On (default)	`/sys/class/scsi_host/hostX/lpfc_restrict_login (VPorts only)` This entry sets the VPort behavior when discovering targets in the SAN. The default behavior (value=1) prevents the VPort from logging into other initiator ports in the SAN. It also rejects logins from other ports in the SAN, because it assumes that all ports that send a PLOGI are initiators. If this sysfs entry is turned off, the driver attempts to log in to every port that it can access in the SAN, and it accepts logins from all ports. **NOTE** This parameter was created to reduce the amount of hardware resources (for example, RPIs) that the driver requires. In a SAN where there are other initiators, this capability greatly reduces the number of RPIs that the driver uses.
`max_npiv_vports`	Read-only	integers	`/sys/class/fc_host/hostX/max_npiv_vports` This entry displays the maximum number of VPorts that are supported by the underlying fc_host hardware. This sysfs entry exists only if the `vport_create` and `vport_delete` sysfs entries exist. If an fc_host does not support NPIV, this sysfs entry may not exist. Use this sysfs entry with the `npiv_vports_inuse` entry to determine whether the maximum number of VPorts have been created on this fc_host.

`node_name`	Read-only	16-byte hexadecimal value	For the FC RHEL 5.*x* driver:
			`/sys/class/fc_host/hostX/node_name`
			For FC RHEL 6.*x*/SLES 11 SPx drivers:
			`/sys/class/fc_host/hostX/node_name/sys/class/fc_vports/vport-X:0-Z/node_name`
			These entries display the physical or VPort node name. You assign this value when the VPort is created, and it is transmitted to the fabric upon fabric login.

`npiv_vports_inuse`	Read-only	integers	`/sys/class/fc_host/hostX/npiv_vports_inuse` This entry displays the number of VPorts that were created on this fc_host. This sysfs entry exists only if the `vport_create` and `vport_delete` sysfs entries exist. If an fc_host does not support NPIV, this sysfs entry might not exist. Use this sysfs entry with `max_npiv_vports` to determine whether the maximum number of VPorts have been created on this fc_host.

Table 7 VPort sysfs Entries (Continued)

VPort sysfs Entries	Type	Range/Input	Location and Description
port_name	Read-only	16-byte hexadecimal value	/sys/class/fc_host/hostX/port_name/sys/class/fc_vports/vport-X:0-Z/port_name This entry displays the physical or VPort's port name. You assign this value when the VPort is created, and it is transmitted to the fabric upon fabric login.
vport_create	Write-only	WWPN; WWNN	/sys/class/fc_host/hostX/vport_create This entry creates a VPort on the physical port on which hostX is located. The new VPort will have a WWPN and WWNN present on the fabric based on the WWPN and WWNN that are entered with this sysfs entry. This entry returns a 0 if the VPort creation was successful. A nonzero value indicates that the VPort was not created. If an fc_host does not support NPIV, this sysfs entry might not exist. **NOTE** It is possible for the VPort creation to succeed, but the VPort will be in a failed or an inoperative state. Use the new sysfs tree created by the new VPort to check the state of the new VPort.
vport_delete	Write-only	WWPN; WWNN	/sys/class/fc_host/hostX/vport_delete This entry deletes a VPort on the physical port on which hostX is located. The VPort matching the WWPN and WWNN is immediately deleted. This entry returns a 0 if the VPort deletion was successful. A nonzero value indicates that the VPort was not deleted. If an fc_host does not support NPIV, this sysfs entry may not exist. **NOTE** This entry deletes the VPort even if there are mounted file systems being accessed through this VPort, or if there are open files on it.

3.5.4 Monitoring VPorts with fc_vport (FCoE Drivers)

The transport creates an fc_vports directory that you can use to monitor VPorts. This directory is populated entirely of VPorts and has links from each to the fc_host associated with that VPort.

```
ls /sys/class/fc_vports/
vport-5:0-0
ls -d /sys/bus/pci/drivers/lpfc/*/host*/*/host*
/sys/bus/pci/drivers/lpfc/0000:03:06.1/host5/vport-5:0-0/host6
ls /sys/devices/pci*/*/host5/vport-5*/host6
power rport-6:0-0 rport-6:0-1 rport-6:0-2 uevent
ls /sys/devices/pci*/*/host5/vport-5*/host6/rport-*
/sys/devices/pci00:03/00:03:06.1/host5/vport-5:0-0/host6/rport-6:0-0:
power uevent

/sys/devices/pci00:03/00:03:06.1/host5/vport-5:0-0/host6/rport-6:0-1:
power uevent

/sys/devices/pci00:03/00:03:06.1/host5/vport-5:0-0/host6/rport-6:0-2:
power target6:0:0 uevent
```

In this example:

- A new entry exists in the fc_vports directory for the VPort (vport-5:0-0). The vport-5:0-0 entry indicates that the VPort was created from host5 and it is the first (0) VPort to be created on that fc_host.
- The new host for the VPort is host6, and it will appear in the usual directories.

- A new directory also exists in the bus tree. This new directory indicates that host6 was created under vport-5:0-0 (which was created from host5).

3.5.5 VPort Configuration Limits

VPort configuration limits are designated as enforced or unenforced. Enforced limits are limits that the driver enforces and prevents you from exceeding. Unenforced limits are limits that the driver cannot enforce, but configurations that exceed them are unsupported.

The following VPort configuration limits have been tested with and are supported by the Emulex driver. Configurations that exceed one or more of these limits are unsupported.

- Before the VPort is deleted or the driver is unloaded, I/O devices accessed through a VPort must be stopped and file systems must be unmounted.
- For enterprise-class adapters, the maximum number of VPorts configurable on a physical port is 64. The hardware allows more than 64 VPorts to be created, but the driver has only been qualified at 64. For mid-range adapters, the maximum number of VPorts configurable on a physical port is 16.
- The maximum number of LUNs supported on each driver port is 256.
- The maximum number of targets supported for each driver port is 255.
- The maximum number of driver ports in one zone is 64. This limit is based on the system's ability to recover from link events within the time constraints of the default timers.

The NPIV use-cases that involve a virtual server environment, include associating a VPort with a virtual machine, and placing the virtual machine in its own zone. This situation results in one VPort per zone. In the case of load-balanced environments, this situation can increase typically to two VPorts per virtual machine, to a practical limit of something far less than 50.

In the NPIV cases not related to virtual server environments, zoning is typically initiator-zoning, again resulting in one VPort, or a low number of VPorts in the case of load-balancing, within a given zone. If too many VPorts are within a single zone, expected behavior includes devices being lost after link events.

- The minimum lifetime of a VPort is 60 seconds. An unenforced limit of 60 seconds exists between the creation of a VPort and the deletion of the same VPort. VPorts exist for a long time in the system, and the creation of VPorts is asynchronous, which means that a VPort might not be finished with FC or SCSI discovery when the command to create a VPort is finished.

3.6 FCoE Driver Performance Tuning

This section describes how to tune the FC/FCoE driver for best performance.

3.6.1 Overview

The following configurable parameters can enhance performance:

- `lpfc_fcp_io_channel`
- `lpfc_fcp_io_sched`
- `lpfc_fcp_imax`

These features are available through module parameters that are defined in the FCoE driver, as well as sysfs entries defined by the Linux kernel.

In addition, you can use the `lpfc_vector_map.sh` script to map a specific I/O channel to a specific CPU. Determination of the mapping of the I/O channel to a specific CPU is also handled by the driver.

This section provides more information about how the tuning parameters and script can improve Emulex adapter performance.

3.6.1.1 lpfc_fcp_io_channel

The `lpfc_fcp_io_channel` module parameter can be configured at driver load time. It defines the number of I/O channels supported by the driver. The driver is capable of supporting parallel I/O paths, and each I/O path is capable of posting and completing FCP commands independent of the other.

Emulex adapters that are running in MSI-X interrupt mode can use more than one I/O path. Each I/O channel is composed of a unique MSI-X vector- event queue (EQ)/ completion queue (CQ)/WQ tuple. This parameter will override the value of the `lpfc_fcp_eq_channel` and the `lpfc_fcp_wq_count` parameters.

By default, the driver is configured for four I/O channels per port. The driver will also limit the number of I/O channels to not exceed the number of online *logical* CPUs (as reported by `/proc/cpuinfo`).

3.6.1.2 lpfc_fcp_io_sched

The `lpfc_fcp_io_sched` module parameter can be configured at driver load time. It can also be set dynamically as an sysfs entry. The driver uses the parameter to determine which algorithm to use when scheduling an FCP I/O to an I/O channel.

When multiple I/O channels are in use, I/Os can be scheduled to an I/O channel in a round-robin fashion, or by determining which CPU is running when the I/O is submitted.

The default value (0) configures the driver for round-robin scheduling. A value of 1 configures scheduling by CPU.

3.6.1.3 lpfc_fcp_imax

The `lpfc_fcp_imax` can be configured at driver load time. It can also be set dynamically as an sysfs entry. This parameter defines the maximum number of interrupts per second that each adapter port will support.

Considerations

- The lower the value set, the more completions are coalesced by the adapter, which causes the driver to handle multiple completions under the context of one interrupt. The higher the value, the faster an interrupt is generated for a completed command. Therefore, a balanced or *tuned* system must be found.
- A lower value equals higher interrupt latency; a higher value equals lower interrupt latency.
- Faster completions consume more system resources and CPU cycles, as the overhead of one interrupt completes fewer commands. The value is divided by the number of I/O channels, and each I/O channel is separately configured for its own interrupt latency.

By default, the module parameter is configured for 50,000 interrupts per second per adapter port. Older driver versions have a default value of 10,000.

3.6.1.4 lpfc_vector_map.sh

The `lpfc_vector_map.sh` script uses kernel sysfs entry points to map a specific I/O channel (MSI-X vector-EQ/CQ/WQ tuple) to a specific CPU. Run the script immediately after the driver is loaded.

This script resides in the `/usr/sbin/lpfc` directory. Run this script by adding the following line to the `/etc/modprobe.d/lpfc.conf` file and through `/etc/rc.d` for the initial boot:

```
install lpfc /sbin/modprobe --ignore-install lpfc;
/usr/sbin/lpfc/lpfc_vector_map.sh
```

The script maps each interrupt vector allocated by the driver to a CPU, thereby spreading the interrupt load of the ports across multiple CPUs. Each vector, with its associated I/O channel, is sequentially mapped to a CPU in a round-robin fashion. The number of vectors assigned to each adapter port is defined by the `lpfc_fcp_io_channel` module parameter.

I/O channels, which correspond to vectors, are typically mapped to unique CPUs to enhance the ability of the driver to run multiple FCP commands in parallel. In addition, running this script forces I/O scheduling to be by CPU (`lpfc_fcp_io_sched = 1`), which increases performance when a specific I/O channel is mapped to a specific CPU.

The script has two modes of operation: Driver mode and host bus adapter (HBA) mode. By default, the script runs in Driver mode.

Driver Mode

Driver mode maps all vectors for all driver ports, starting with CPU0, sequentially assigning a new CPU for each vector belonging to the entire driver. If there are more interrupt vectors than CPUs, the vector assignment wraps back to CPU0 as needed.

HBA Mode

HBA mode maps all vectors for each specific adapter port, starting with CPU0, sequentially assigning a new CPU for each vector belonging to that adapter port.

3.7 Network Performance Tuning

This section describes optimizing network performance.

3.7.1 Memory Bandwidth Considerations

The availability of higher memory bandwidth leads to better network performance. The following sections describe how memory bandwidth can be increased.

3.7.1.1 Enabling Optimal Bandwidth Options

Most computers offer multiple distinct memory channels, or memory interleaves, that might not be enabled by default. Check the manufacturer's documentation and BIOS parameters for details on enabling optimal memory bandwidth options.

3.7.1.2 Populating DIMM Slots

Typically, all the dual in-line memory module (DIMM) slots must be populated to make use of all the memory channels. As a general rule, using more DIMMs provides better performance by allowing a higher degree of memory-access interleaving to occur.

3.7.1.3 Disabling Memory Mirroring

Some servers may allow memory mirroring, where the total memory is divided in half and each location is stored twice. Memory mirroring allows fault recovery if one memory location detects an error, but it greatly reduces the perceived memory bandwidth of the system. Consider disabling memory mirroring if it is not needed.

3.7.1.4 Using a Fast Clock Speed for the FSB

Nearly any desktop or low-end server has enough memory bandwidth for Emulex adapters to support DMA at 20Gb/s of data (10Gb/s read, 10Gb/s write). However, most of the memory demands come from the processor accessing the data for either packet copies in the nonoffloaded networking stack or application accesses. All processor memory accesses use the front side bus (FSB). The clock speed of this bus is critical for allowing efficient memory bandwidth. A system with a faster processor FSB clock speed performs better than a system with a slower FSB clock speed.

3.7.2 Network Memory Limits

The default values of tunable parameters in the Linux network stack are optimal for most network applications involving several TCP/User Datagram Protocol (UDP) streams. The optimal size for the network queues and buffers depends on several factors, such as protocol, number of streams (connections), request size, and application behavior.

The following network configuration settings are a good combination to get the best unidirectional transmit and receive performance with six or more TCP connections/UDP streams:

```
echo 4096 87380 4194304 > /proc/sys/net/ipv4/tcp_rmem
echo 4096 16384 4194304 > /proc/sys/net/ipv4/tcp_wmem
echo 64000000 > /proc/sys/net/core/rmem_default
echo 64000000 > /proc/sys/net/core/rmem_max
echo 32000000 > /proc/sys/net/core/wmem_default
echo 32000000 > /proc/sys/net/core/wmem_max
```

These settings assume ideal conditions, such as low latency, zero (or close-to-zero) packet loss in the network, enough free memory, and 10Gb/s path-to-peer system.

These `tcp_rmem` and `tcp_wmem` values are also the default values in recent RHEL 5 distributions. If your application requires best throughput with very small number of connections (less than four), it may help to increase the `tcp_rmem` and `tcp_wmem` to much larger values:

```
echo 4096 87380 16777216 > /proc/sys/net/ipv4/tcp_rmem
echo 4096 65536 16777216 > /proc/sys/net/ipv4/tcp_wmem
```

3.7.3 TCP Segmentation Offload (TSO)

In low-loss networks, TSO considerably improves performance and, therefore, must be enabled. TSO is enabled by default in the OneConnect network driver.

The `/proc/sys/net/ipv4/tcp_tso_win_divisor` process variable controls how aggressive the network stack can be in making TSO requests. For low-loss networks, the TSO divisor values must be in the range of 2 to 16. In most distributions, the default value of 3 may be the optimal choice for a no-loss network.

Smaller divisor values result in larger TSO chunks and better throughput, as well as better CPU utilization. However, if the receiver or the network is dropping frames (too many retransmits on the transmit side as indicated by `netstat -st`), it might help to make TSO chunks smaller (by increasing the divisor value) or to turn TSO off. For example, to set the divisor level to a value of 8, run:

```
echo 8 > /proc/sys/net/ipv4/tcp_tso_win_divisor
```

To turn TSO on or off, run one of the following `ethtool` commands:

```
ethtool -K eth<N> tso on
ethtool -K eth<N> tso off
```

where `eth`<*N*> is the name of the Ethernet device on which you are working (for example, eth0).

3.7.4 Flow Control

Emulex adapters support Institute of Electrical and Electronics Engineers (IEEE) 802.3x standard flow control, which uses control packets to temporarily pause the transmission of packets between two endpoints. These control messages are point-to-point and are not forwarded by switches or routers. The adapter can respond to flow control packets by temporarily pausing transmits. The adapter can send flow control pause packets when the transmitter is overwhelming the system's receive bandwidth.

Flow control can greatly improve performance, as described in the following examples:

- The adapter is installed in a 4x PCIe slot or an underpowered server system.

  If the PCIe bus does not provide 10Gb/s of throughput due to chipset limitations or the bus width, the adapter cannot maintain 10Gb/s of incoming receive data. It starts dropping packets quickly. In this situation, it might be beneficial to enable receive flow control in the adapter, and enable flow control in the attached switch for all devices. This action helps to slow down the transmitters.

- The adapter transmits to 1Gb/s devices, especially when using a non-TCP protocol.

  If the adapter transmits to a 10Gb/s switch with attached 1Gb/s clients, the adapter might overwhelm the switch. The switch is then forced to start dropping packets because, although it may receive a 10Gb/s stream, the client can only sink a 1Gb/s stream. In this situation, it may be beneficial to enable transmit flow control in the adapter and enable flow control for the 10Gb/s switch port.

You can configure the adapter to respond to flow control pause frames from the other side (switch or router) using the following `ethtool` commands:

```
ethtool -A eth<N> pause rx on
ethtool -A eth<N> pause rx off
```

where `eth<N>` is the name of the Ethernet device on which you are working (for example, eth0).

You can configure the adapter to send flow control pause frames using the following ethtool commands:

```
ethtool -A eth<N> pause tx on
ethtool -A eth<N> pause tx off
```

where `eth<N>` is the name of the Ethernet device on which you are working (for example, eth0).

RX and TX flow control are enabled by default. When priority flow control is enabled in the adapter, normal flow control cannot be enabled.

Refer to the switch or router documentation to determine how link level flow control can be configured on the switch or router to which the port is connected.

NOTE In multichannel configurations where multiple PCI functions are exposed for a single 10GbE port, the flow control parameter for a port can be configured through any interface associated with the physical port, and the configured property will apply to all interfaces associated with the port.

3.7.5 RX Frame Coalescing

The Ethernet driver coalesces regular-sized TCP segments to a large frame before passing it to the network stack, which may improve TCP receive performance. RX frame coalescing is implemented using the Generic Receive Offload (GRO) mechanism (in Linux driver versions that support GRO) or the LRO mechanism (in older Linux driver versions).

RX frame coalescing is enabled by default. In some configurations where the end point for the TCP connection to which the packets belong is not in the current server (for example, the end point is a router), RX coalescing should not be enabled.

GRO can be disabled using the –K option with the ethtool command:

```
ethtool –K eth<N> gro off
```

LRO can be disabled using the –C option with the ethtool command:

```
ethtool -C eth<N> rx-frames 1
```

where `eth<N>` is the name of the Ethernet device you are working on (for example, eth0).

3.7.6 Maximum Transmission Unit (MTU)

The Ethernet driver supports MTUs between 256 bytes and 9000 bytes. The default MTU is set to 1500. If other elements in the network path support a larger MTU, you can increase the MTU up to 9000 using the `ifconfig` command. To do this, run:

```
ifconfig eth<N> mtu 9000
```

where `eth<N>` is the name of the Ethernet device on which you are working (for example, eth0).

3.7.7 Interrupt Coalescing

The Ethernet driver tries to reduce the number of interrupts by delaying the interrupts from the adapter or CNA. This action reduces CPU utilization during a high traffic rate. The interrupt delay duration can be set to change dynamically within a range of values, depending on the receive rate (known as Adaptive Interrupt Coalescing [AIC]), or can be set to a constant value.

3.7.7.1 Setting the Interrupt Delay Duration to a Range of Values (AIC)

For receive interrupts, AIC is enabled by default. When AIC is enabled, the default low limit is 0 microseconds, and the default high limit is 96 microseconds. In low traffic, the interrupt delay is set to 0 for best latency. As the number of interrupts per second increases, the delay is increased to higher values proportional to the receive rate, up to the default high limit of 96 microseconds. You can change the low and high limits using ethtool. For example, to set a low limit of 8 and a high limit of 40, run

```
ethtool -C eth<N> rx-usecs-low 8
ethtool -C eth<N> rx-usecs-high 40
```

where `eth<N>` is the name of the Ethernet device on which you are working (for example, eth0).

For transmit interrupts, AIC is not supported.

To disable AIC and set the interrupt delay duration to a constant value, see the following section.

3.7.7.2 Setting the Interrupt Delay Duration to a Constant Value

The interrupt delay duration can be set to a constant value for both receive and transmit interrupts. The possible interrupt delay duration values are 0 to 96 microseconds, in 8-microsecond increments.

For receive interrupts, disable AIC (because it is enabled by default) and set the interrupt delay duration using `ethtool`. For example, to disable AIC and set the constant RX interrupt delay to 8-microseconds, run

```
ethtool -C eth<N> adaptive-rx off rx-usec 8
```

where `eth<N>` is the number of the Ethernet interface on which you are working.

If your application requires low or predictive latency, turn off AIC and set `rx-usecs` to 0.

For transmit interrupts, the default interrupt delay duration is 96 microseconds. You can change this value using ethtool. For example, to set the transmit interrupt delay to 64 microseconds run

```
ethtool -C eth<N> tx-usec 64
```

where `eth<N>` is the number of the Ethernet interface on which you are working.

3.7.8 Receive-Side Scaling (RSS)

Distributing the incoming traffic across several receive rings with separate interrupt vectors helps to distribute the receive processing across several CPU cores. This could reduce the packet drop and improve the packet rate in certain

applications. RSS is enabled in non-SR-IOV and non-multichannel configurations. In multichannel configurations, RSS is enabled in the first section of each port.

3.7.9 Analyzing Performance Issues

MSI-x interrupts are required for RSS to work. If your motherboard and operating system version support MSI-X, the Ethernet driver automatically uses MSI-X interrupts. If not enough MSI-X vectors are available, the Ethernet driver uses INTx interrupts, which might decrease performance. The `/proc/interrupts` proc node shows the interrupts and their types.

The Linux performance *top* utility can monitor the CPU utilization while troubleshooting performance issues. A low idle CPU percentage in any CPU core is an indication of excessive processing load for that CPU. The `/proc/interrupts` proc node shows the distribution of the interrupts across the CPU cores. If you see too many interrupts per second directed to one CPU, check to see if the `irqbalance` program is running. The `irqbalance` program is normally started at system boot. In some cases, you can get better performance by disabling irqbalance and manually distributing interrupts. You can manually distribute the interrupt load across the available CPU cores by setting the CPU affinity for any interrupt vector by setting the mask in the `/proc/irq/<int-vector>/smp_affinity` proc node.

Use the `netstat` command to look for excessive TCP retransmits or packet drops in the network stack.

In systems having more than one non-uniform memory access (NUMA) node, you can get better performance by pinning interrupts to the NUMA node local to the PCIe device.

Use the –S option of `ethtool` to see all statistics counters maintained by the Ethernet and driver. Excessive drop or error counters are an indication of a bad link or defective hardware. See Table 19, Ethtool -S Option Statistics, and Table 20, Transmit/Receive Queue Statistics.

Turning off auditing and SELinux can improve CPU utilization and, in some cases increase throughput. You can disable auditing by appending `audit=0` in the boot command line. You can turn off SELinux by specifying `selinux=0` in the boot command line. For example, the following command boots the Linux kernel with the SELinux and auditing options disabled:

```
kernel /boot/vmlinux-2.6.18 ro root=/dev/md0 selinux=0 audit=0
```

You can get better CPU utilization, and in some cases better throughput, by disabling kernel debug options, such as `CONFIG_DEBUG_SLAB`. This situation requires you to build the kernel image and modules. Turning off the firewall and disabling Hyper-Threading can also improve performance.

Chapter 4: Troubleshooting

This section explains some of the situations in which your system can operate in an unexpected manner and some possible resolutions.

4.1 Hardware Situations and Resolutions

Table 8 lists the hardware situations and their resolutions.

Table 8 Hardware Situations and their Resolutions

Situation	Resolution
An unapproved optical transceiver is used to connect the adapter.	Unapproved optical transceivers include: ■ 10GBASE-SR ■ 10GBASE-LR ■ 40GBASE-SR The system log can generate one or more of these events if an unapproved optical transceiver is detected: ■ Unsupported module ■ Optics faulted, incorrectly installed, or not installed ■ Incompatible optics ■ Unknown port SFB status To resolve this issue, do the following: 1. Power the system off. 2. Replace the unapproved optical transceiver with an approved one. 3. Power the system on. **NOTE** For more information on replacing an optical transceiver, refer to the adapter hardware guide available at the Documents and Downloads area of http://www.broadcom.com.

4.2 FCoE Driver Situations and their Resolutions

Table 9 lists the FCoE driver situations and their resolutions.

Table 9 FCoE Driver Situations and their Resolutions

Situation	Resolution

"Authentication is enabled but authentication service is not running." error message	If you see this message in `/var/log/messages` file and the adapter is in an error state, the `fcauthd` daemon probably is not running. To determine whether `fcauthd` is running, run:
	`/etc/init.d/fcauthd status`
	To start `fcauthd`, run:
	`/etc/init.d/fcauthd start`

If a SAN configuration has 256 targets mapped by the FCoE driver, any additional added targets do not get a target ID mapping by the driver and cause target discovery to fail.	Removing targets or re-initializing the link does not solve this issue. Unload and reload the driver to reset available target IDs. Ensure that the SAN configuration is correct prior to rebooting the driver. This clears the driver's consistent binding table and frees target IDs for new target nodes.
rmmod fails to unload FCoE driver module due to "ERROR: Module lpfc is in use."	This message can appear when you attempt to remove the driver and a Logical Volume Group is dependent on the driver. If you have configured boot from a SAN, you must reboot the system. Otherwise, use these steps to resolved this situation: 1. Make the Logical Volume Group unavailable. Type: `lvchange -a n xxxxxxx` The *xxxxxxx* parameter is the Volume Group Name. 2. Stop the Emulex OneCommand CNA Manager application. 3. Stop Device Mapper.
rmmod hangs and module reference count is 0.	Due to a small race condition in the kernel, it is possible for an `rmmod` command to hang. Issue the `rmmod -w` command. If this command does not help, reboot the computer.

rmmod fails to unload driver due to device or resource busy.	This message occurs when you attempt to remove the driver without first stopping the Emulex OneCommand CNA Manager application or the `fcauthd` daemon when the Emulex OneCommand CNA Manager application is installed and running. To resolve this situation:
	1. Stop the Emulex OneCommand CNA Manager application before attempting to unload the driver. The script is located in the `/usr/sbin/ocmanager` directory. Type:
	`./stop_ocmanager`
	2. Unmount any disks connected to the adapter.
	3. Unload the driver. Type:
	`rmmod lpfc`

An lspci shows recent Emulex adapters as unknown.	This situation occurs because of the delay of getting new product IDs into the Linux development cycle. No resolution exists at this time.
Slow targets or extended link faults on the storage side might result in storage being marked offline by the mid-level and remaining offline (not recovered) when the link faults are corrected.	This version of the driver should eliminate this issue. However, if you experience offline device issues, increase the SCSI command timeout to a value greater than or equal to 60 seconds. Emulex also provides a script that addresses this issue. To access the `lun_change_state.sh` script, go to the Documents and Downloads area of http://www.broadcom.com.

Table 9 FCoE Driver Situations and their Resolutions (Continued)

Situation	Resolution
Under certain conditions of an I/O load, some targets cannot complete an I/O issued by a Linux initiator within the default timeout of 30 seconds given by the SCSI mid-level.	If the situation is not corrected, the initiator-to-target condition deteriorates into abort/recovery storms, leading to I/O failures in the block layer. These types of failures are preceded by a SCSI I/O error of hex 6000000. Emulex provides a script that addresses this issue. To access the `set_target_timeout.sh` script, go to the Documents and Downloads area of http://www.broadcom.com.
The FCoE driver fails to recognize an adapter and logs "unknown IOCB" messages in the system log during driver load.	The adapter is running outdated firmware. Install the latest firmware on the adapter. **NOTE** Before performing a firmware update, driver installation is required. For more information on installing the driver, see Section 2.2.1, Installing the Binary RPM FCoE Driver Kit.
Loading the FCoE driver on SLES 11 SPx reports "unsupported module, tainting kernel" in the system log.	This message is logged by the kernel whenever a module that is not shipped with the kernel is loaded. Ignore this message.
The system panics when it is booted with a failed adapter installed.	Remove the failed adapter, and reboot the system.
Unloading the FCoE driver on SLES 11 SPx might cause a message to be logged in the system log, such as the following: `umount: /dev/disk/bypath/pci-0000:02:04.0-scsi-0:0:1:0: not mounted`	These messages are normal output from the SLES 11 SPx hot plug scripts and can be ignored.
Driver installation fails.	The `brcmfcoe_install` script fails to install the driver. The installation script might fail for the following reasons: ■ A previous version of the driver is installed. Run the `brcmfcoe_install` --uninstallation script and then try to install the driver. ■ The current driver is already installed. Ensure that you are running a supported RHEL or SLES kernel.
"No module lpfc found for kernel KERNELVERSION" RPM error message appears when upgrading the kernel. A recently upgraded kernel cannot find the ramdisk. After upgrading the kernel, the kernel cannot find the ramdisk, which halts or panics the system. The driver is not loaded after a system reboot after upgrading the kernel.	These three situations can be resolved by upgrading the kernel. There are two ways to install the driver into an upgraded kernel. The method you use depends on whether you are updating the driver. ■ Upgrade the kernel using the same version of the driver. ■ Upgrade the kernel using a new version of the driver. For more information on upgrading the kernel, see Chapter 2, Installing and Uninstalling.
Driver uninstall fails.	The `brcmfcoe_install` --uninstallation script fails with an error. Try the following solutions: ■ Uninstall the Emulex OneCommand CNA Manager application. For instructions, refer to the *Emulex OneCommand CNA Manager Application for OneConnect Adapters User Guide*. ■ Unmount all FC disk drives. ■ Unload the lpfcdfc and FCoE driver. ■ Use rpm `-e brcmfcoedriver` and `-e ocmanager` and uninstall the new kits.

Table 9 FCoE Driver Situations and their Resolutions (Continued)

Situation	Resolution
`brcmfcoe_install` script exit code.	The `brcmfcoe_install` script contains exit codes that are useful in diagnosing installation issues. Refer to the `brcmfcoe_install` script for a complete listing of codes and definitions.

The Emulex driver for Linux does not load in ramdisk for a custom-built kernel.	Broadcom® does not support custom built kernels. However, the Emulex installation script attempts to install the driver into a ramdisk that follows the naming scheme used by RHEL or SLES kernels.
	■ The RHEL Hat naming scheme for ramdisk images is:
	`/boot/initrd-KERNELVERSION.img.`
	■ The SLES naming scheme for ramdisk images is:
	`/boot/initrd.`
	If a custom-built kernel has a ramdisk image that does not follow the appropriate naming scheme, change the name of the image using the following procedure:
	1. Change the name of the ramdisk image to match the SLES naming scheme.
	2. Update any file links to the ramdisk image.
	3. Edit the boot loader configuration file (for example, `/etc/lilo.conf`, `/etc/yaboot.conf`, `/boot/grub/grub.conf`, `/boot/grub/menu.lst`), find any references to the old ramdisk image name, and replace them with the new name.
	4. Reboot the system to verify the changes.
	5. Install the brcmfcoe driver kit.

The Linux SCSI subsystem sees only eight LUNs when more are present.	Some SCSI drivers do not scan past eight LUNs when the target reports itself as a SCSI-2 device. To resolve this situation, force a SCSI bus scan with the following command: `/usr/sbin/brcmlpfc/lun_scan.` SUSE supplies a `/bin/rescan-scsi-bus.sh` script, which can be changed to scan everything.

4.3 Ethernet Driver Situations and their Resolutions

The following table lists the Ethernet driver situations and their resolutions.

Table 10 Ethernet Driver Situations and their Resolutions

Situation	Resolution
The ethtool configuration settings are not restored after system reboot.	The ethtool settings do not persist across reboot. For persistence, invoke configuration commands from a boot script that is executed at system start, such as `/etc/rc.local`.
The Ethernet driver works, but the transmit and receive data rates are not near a 10Gb/s line rate.	Several reasons exist for poor performance. For best performance practices, see Section 3.7, Network Performance Tuning.

When MILI and Simple Network Management Protocol (SNMP) daemons start, they trigger warning messages within SELinux for certain operations.	This issue is known, and no solution is available. However, to avoid SElinux warning messages, you can disable SELinux. To disable SELinux, open a terminal, and enter the following command at the prompt:
	`echo 0 > /selinux/enforce`
	To enable SELinux, use the following command:
	`echo 1 > /selinux/enforce`
	In addition, see Section 3.7.9, Analyzing Performance Issues.

4.4 iSCSI Driver Situations and their Resolutions

The following table lists the iSCSI driver situations and their resolutions for OneConnect CNAs.

Table 11 iSCSI Driver Situations and their Resolutions

Situation	Resolution
When you log out of a target while an I/O is running and you log into the target again, you will get an error trace in `/var/log/messages` beginning with the error message, "trying to free buffer."	No solution is available.

4.5 Log Messages

4.5.1 FCoE Driver Log Messages

The following section describes retrieving and interpreting FC and FCoE driver log messages.

4.5.1.1 Retrieving FC and FCoE Driver Log Messages

FCoE error log messages are logged in the `/var/log/messages` file.

An example of an FCoE message:

```
Jul 2 04:23:34 daffy kernel: lpfc 0000:03:06.0: 0:1305 Link Down Event x2f2
received Data: x2f2 x20 x110
```

In this example:

- `lpfc 0000:03:06.0` – Identifies the PCI location of the particular LPFC hardware port.
- `0:` – Indicates Emulex adapter 0
- `1305` – Indicates a log message number of 1305.

NOTE

- If `Data:` is present in a log message, any information following `Data:` is intended only for Broadcom Technical Support and Engineering use.
- If an error message instructs you to perform a firmware update, ensure that the driver is installed first. For more information on installing the driver, see Chapter 2, Installing and Uninstalling.

4.5.1.2 FCoE Error Log Messages and their Descriptions

The following table lists the FCoE error log messages and their descriptions.

Table 12 FCoE Error Log Messages and their Descriptions

`0111: Dropping received ELS cmd` The driver decided to drop an ELS Response ring entry. Data: (1) ulpStatus (2) ulpWord[4] (3) ulpTimeout Severity: Error Log: Always Action: This error could indicate a software driver or firmware issue. If this issue persists, report these errors to Broadcom Technical Support.
`0113: An FLOGI ELS command <elsCmd> was received from DID <did> in Loop Mode` While in Loop Mode, an unknown or unsupported ELS command was received. Data: None Severity: Error Log: Always Action: Check the device DID.
`0115: Unknown ELS command <elsCmd> received from NPORT <did>` Received an unsupported ELS command from a remote N_Port. Data: None Severity: Error Log: Always Action: Check the remote N_Port for a potential issue.
`0125: FDISC Failed (x%x). Fabric out of resources` The fabric rejected an FDISC because the switch cannot support additional virtual ports. Data: lsRjtError Severity: Error Log: Always Action: Reconfigure the switch to support more NPIV logins. If this issue persists, contact Broadcom Technical Support.
`0126: FDISC failed ulpStatus ulpWord4` Data: lsRjtError Severity: Error Log: Always Action: Reconfigure the switch to support more NPIV logins. If this issue persists, contact Broadcom Technical Support.
`0127: ELS timeout` An ELS IOCB command was posted to a ring and did not complete within ULP timeout seconds. Data: (1) elscmd (2) remote_id (3) ulpcommand (4) ulpIoTag Severity: Error Log: Always Action: If no ELS command is going through the adapter, reboot the system. If the issue persists, contact Broadcom Technical Support.
`0133: PLOGI: no memory for reg_login` A memory allocation error occurred. Data: (1) nlp_DID (2) nlp_state (3) nlp_flag (4) nlp_rpi Severity: Error Log: LOG_ELS Action: Memory allocation error. Check system resources. Unload unused modules.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

`0134: PLOGI cannot issue reg_login` The ELS PLOGI mailbox command has failed. Data: (1) nlp_DID (2) nlp_state (3) nlp_flag (4) nlp_rpi Severity: Error Log: LOG_ELS Action: Check the port and switch configuration.
`0135: cannot format reg_login` Could not allocate an remote port indicator (RPI) or DMA buffer for the mailbox command. Data: (1) nlp_DID (2) nlp_state (3) nlp_flag (4) nlp_rpi Severity: Error Log: LOG_ELS Action: None required.
`0136: PLOGI completes to NPort <DID> completion` A PLOGI has completed for which there is no NDLP. Data: (1) ulpStatus (2) ulpWord[4] Severity: Error Log: LOG_ELS Action: None required.
`0137: No retry ELS command <ELS_CMD> to remote` Data: (1) ulpStatus (2) ulpWord[4] Severity: Error Log: LOG_ELS Action: None required.
`0138: ELS rsp: Cannot issue reg_login for <DID>` REG_LOGIN mailbox command failed. Data: (1) nlp_DID (2) nlp_state (3) nlp_flag (4) nlp_rpi Severity: Error Log: LOG_ELS Action: None required.
`0139: Ignoring ELS cmd tag <ioTag> completion Data` This ELS command was aborted. Data: (1) ulpStatus (2) ulpWord[4] (3) ulpTimeout Severity: Error Log: LOG_ELS Action: None required.
0140: PLOGI Reject: invalid name Invalid node WWN was provided. Data: None Severity: Error Log: LOG_ELS Action: None required.
0141: PLOGI Reject: invalid pname Invalid port WWN provided. Data: None Severity: Error Log: LOG_ELS Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0142: PLOGI RSP: Invalid WWN The PLOGI sent to the port by a remote port had an invalid WWN. Data: None Severity: Error Log: LOG_ELS Action: None required.
0143: SLI4 Adapter Hardware Error Data: <status0>/<status1> The HBA has encountered an unrecoverable error. Data: None Severity: Error Log: LOG_INIT Action: Use hbacmd to retrieve a dump file.
0144: Not a valid WCQE code: <Completion Code> The completion queue handler detected an invalid type. Data: None Severity: Error Log: LOG_SLI Action: None required.
0147: Failed to allocate memory for RSCN event Memory could not be allocated to send the RSCN event to the management application. Data: None Severity: Error Log: LOG_ELS Action: None required.
0148: Failed to allocate memory for LOGO event Memory could not be allocated to send the LOGO event to the FC transport. Data: None Severity: Error Log: LOG_ELS Action: None required.
0149: Failed to allocate memory for ELS event Memory could not be allocated to send the ELS event to the FC transport. Data: None Severity: Error Log: LOG_ELS Action: None required.
0154: Authentication not complete Authentication was restarted because the previous authentication did not complete. Data: None Severity: Error Log: LOG_DISCOVERY Action: Check the switch configuration.
0200: CONFIG_LINK bad hba state <hba_state> A CONFIG_LINK mailbox command completed, and the driver was not in the right state. Data: None Severity: Error Log: Always Action: Software driver error. If this issue persists, report these errors to Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0203: Devloss timeout on WWPN <address> NPort <nlp_DID> A remote N_Port that was discovered by the driver disappeared for more than `lpfc_devloss_tmo` seconds. Data: (1) nlp_flag (2) nlp_state (3) nlp_rpi Severity: Error Log: Always Action: If the device generating this message is not a target to which the HBA is connected, this error will not affect the data integrity of the I/O between the HBA and the attached storage and can be ignored.
0206: Device discovery completion error This message indicates that an uncorrectable error was encountered during device discovery after a link up. FC devices will not be accessible if this message is displayed. Data: None Severity: Error Log: Always Action: Reboot the system. If this issue persists, report the error to Broadcom Technical Support. Run with verbose mode enabled for more information.
0207: Device <DID> (<WWN>) sent invalid service parameters. Ignoring device. Invalid service parameters were received from DID. Ignoring this remote port. Data: DID, WWN Severity: Error Log: Always Action: Verify the remote port's configuration. If this issue persists, report the error to Broadcom Technical Support. Run with verbose mode on for more details.
0217: Block sgl registration required DMAsize <reqlen> great than a page The request to post SGL pages does not fit on a page. Data: None Severity: Warning Log: LOG_INIT Action: None required.
0221: FAN timeout A linkup event was received without the login bit set, so the driver waits E_D_TOV for the fabric to send a FAN. If no FAN is received, a FLOGI will be sent after the timeout. Data: None Severity: Warning Log: LOG_DISCOVERY verbose Action: None required. The driver recovers from this condition by issuing a FLOGI to the fabric.
0222: Initial FLOG/FDISKI timeout The driver sent the initial FLOGI or FDISK to the fabric and never received a response. Data: None Severity: Error Log: Always Action: Check the fabric configuration. The driver recovers from this situation and continues with device discovery.
0223: Timeout while waiting for NameServer login A login request to the NameServer was not acknowledged within R_A_TOV. Data: None Severity: Error Log: Always Action: Check the fabric configuration. The driver recovers from this and continues with device discovery.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0224: NameServer Query timeout Node authentication timeout or node Discovery timeout occurred. A NameServer Query to the fabric or discovery of reported remote N_Ports is not acknowledged within R_A_TOV. Data: (1) fc_ns_retry (2) fc_max_ns_retry Severity: Error Log: Always Action: Check fabric configuration. The driver recovers from this and continues with device discovery.
0226: Device discovery completion error This indicates that an uncorrectable error was encountered during device discovery after a link up. FC devices will not be accessible if this message is displayed. Data: None Severity: Error Log: Always Action: Reboot the system. If this issue persists, report the error to Broadcom Technical Support. Run with verbose mode on for more details.
0227: Node Authentication timeout The driver has lost track of what N_Ports are being authenticated. Data: None Severity: Error Log: Always Action: None required. The driver should recover from this event.
0228: CLEAR LA timeout The driver issued a CLEAR_LA that never completed. Data: None Severity: Error Log: Always Action: None required. The driver should recover from this event.
0230: Unexpected timeout, hba linkstate <link_state> Discovery has timed out, and the HBA state is not ready. Data: None Severity: Error Log: LOG_DISCOVERY Action: None required.
0231: RSCN timeout The driver has lost track of which N_Ports have RSCNs pending. Data: (1) fc_ns_retry (2) lpfc_max_ns_retry Severity: Error Log: Always Action: None required. The driver should recover from this event.
0233: Nodelist not empty Driver unloaded or hot plug detected a node still in use. Data: None Severity: Error Log: LOG_DISCOVERY Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0237: Pending Link Event during Discovery: State <hba_state> Received link event during discovery. Causes discovery restart. Data: None Severity: Warning Log: LOG_DISCOVERY verbose Action: None required, unless this issue persists. If persistent, check cabling.
0241: NameServer rsp error The driver received a NameServer response containing a status error. Data: (1) CommandResponse.bits.CmdRsp (2) ReasonCode (3) Explanation (4) fc_flag Severity: Error Log: LOG_DISCOVERY verbose Action: Check the fabric configuration. The driver recovers from this and continues with device discovery.
0246: RegLogin failed The firmware returned a failure for the specified RegLogin. Data: (1) Did (2) mbxStatus (3) hbaState Severity: Error Log: Always Action: This message indicates that the firmware could not perform a RegLogin for the specified DID. A limitation may exist on how many nodes an HBA can see.
0249: Cannot issue Register Fabric login: Err %d\ Could not issue the fabric reg login, the error value is unique for each possible failure. Data: None Severity: Error Log: LOG_ELS Action: None required.
0251: NameServer login: no memory Could not allocate memory for the NDLP structure. Data: None Severity: Error Log: LOG_ELS Action: None required.
0252: Cannot issue NameServer login Could not issue an ELS PLOGI to the NameServer DID. Data: None Severity: Error Log: LOG_ELS Action: Check the port connection and the switch configuration.
0253: Register VPI: Can't send mbox\ Could not issue the REG_VPI mailbox command for this VPort. Data: None Severity: Error Log: LOG_MBOX Action: None required.
0254: Register VPI: no memory" goto mbox_err_exit Could not allocate memory for the REG_VPI mailbox command. Data: None Severity: Error Log: LOG_MBOX Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0255: Issue FDISC: no IOCB All of the pre-allocated IOCBs are in use. Data: None Severity: Error Log: LOG_ELS Action: None required.
0256: Issue FDISC: Cannot send IOCB\ Unable to send the fabric IOCB. Data: None Severity: Error Log: LOG_ELS Action: None required.
0257: GID_FT Query error The GID_FT CT request for the NameServer has failed. Data: None Severity: Error Log: LOG_ELS Action: Check the switch configuration.
0258: Register Fabric login error: The REG_LOGIN for the fabric has failed. Data: None Severity: Error Log: LOG_MBOX Action: Check the port connection and the switch configuration.
0259: No NPIV Fabric support The switch to which the port is connected does not support NPIV. Data: None Severity: Error Log: LOG_ELS Action: Check the switch configuration.
0260: Register NameServer error: The REG_LOGIN mailbox command has failed for the NameServer. Data: None Severity: Error Log: LOG_ELS Action: Check the switch configuration
0261: Cannot register NameServer login: Either a memory allocation issue occurred or an invalid parameter was sent to the REG_LOGIN. Data: None Severity: Error Log: LOG_ELS Action: At least one message (0142 0121 0133 0134 0135) should precede this message.
0262: No NPIV Fabric support The switch to which the port is connected does not support NPIV. Data: None Severity: Error Log: LOG_ELS Action: Check the switch configuration.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0263: Discovery Mailbox error: state: Either the driver could not allocate resources or it could not send sparam_mbox or cfglink_mbox. Data: (1) address of sparam_mbox command (2) address of cfglink_mbox command Severity: Error Log: LOG_MBOX Action: Attempt to unload and reload the driver when it is convenient.
0264: No NPIV Fabric support The switch to which the port is connected does not support NPIV. Data: None Severity: Error Log: LOG_ELS Action: Check the switch configuration.
0266: Issue NameServer Req <cmdcode> err <rc> Data: <fc_flag> <fc_rscn_id_cnt> The driver was unable to send the NameServer CT command. Data: (1) vports fc_flag (2) vports fc_rscn_id_cnt Severity: Error Log: LOG_DISCOVERY Action: Check the port and switch configurations.
0267: NameServer GFF Rsp <did> Error (<ulpStatus> <un.ulpWord[4]>) Data: <fc_flag> <fc_rscn_id_cnt> The NameServer GFF CT request failed. Data: (1) vports fc_flag (2) vports fc_rscn_id_cnt Severity: Error Log: LOG_DISCOVERY Action: Check the port and switch configurations.
0268: NS cmd <cmdcode> Error (<ulpStatus> <un.ulpWord[4]>) The NameServer CT request failed. Data: None Severity: Error Log: LOG_DISCOVERY Action: Check the port and switch configurations.
0271: Illegal State Transition: node <nlp_DID> event <evt>, state <nlp_state> Data: <nlp_rpi> <nlp_flag> The current node state does not have a handler for this event. Data: (1) nlp_rpi (2) nlp_flag Severity: Error Log: LOG_DISCOVERY Action: Verify that all targets are still visible to the SCSI mid-layer.
0272: Illegal State Transition: node <nlp_DID> event <evt>, state <nlp_state> Data: <nlp_rpi> <nlp_flag> The driver is completing a PLOGI but does not have the rcv_plogi flag set. Data: (1) nlp_rpi (2) nlp_flag Severity: Error Log: LOG_DISCOVERY Action: Verify that all targets are still visible to the SCSI mid-layer.
0273: Unexpected discovery timeout, vport State x%x The discovery process has timed out. Data: None Severity: Error Log: LOG_DISCOVERY Action: Verify that all targets are still visible.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0274: lpfc_nlp_put: ndlp:x%pusgmap:x%x refcnt:%d, void *)ndlp, ndlp->nlp_usg_map, atomic_read(&ndlp->kref.refcount) Data: None Severity: Warning Log: LOG_NODE Action: None required.
0275: lpfc_nlp_put: ndlp:x%pusgmap:x%x refcnt:%d, void *)ndlp, ndlp->nlp_usg_map, atomic_read(&ndlp->kref.refcount) A kref_put was called again after the node was already inactive. Data: None Severity: Warning Log: LOG_NODE Action: None required.
0276: lpfc_nlp_get: ndlp:x%pusgmap:x%x refcnt:%d, void *)ndlp, ndlp->nlp_usg_map, atomic_read(&ndlp->kref.refcount) A kref_get was attempted on a node that was being released. Data: None Severity: Warning Log: LOG_NODE Action: None required.
0277: lpfc_enable_node: ndlp:x%pusgmap:x%x refcnt:%d, void *)ndlp, ndlp->nlp_usg_map, atomic_read(&ndlp->kref.refcount) An enable node was attempted on an inactive node. Data: None Severity: Warning Log: LOG_NODE Action: None required.
0278: lpfc_enable_node: ndlp:x%pusgmap:x%x refcnt:%d, void *)ndlp, ndlp->nlp_usg_map, atomic_read(&ndlp->kref.refcount) An enable node was attempted on an inactive node. Data: None Severity: Warning Log: LOG_NODE Action: None required.
0280: lpfc_cleanup_node: ndlp:x%pusgmap:x%x refcnt:%d, void *)ndlp, ndlp->nlp_usg_map, atomic_read(&ndlp->kref.refcount) Node cleanup was attempted on a node that has already been marked for memory free. Data: None Severity: Warning Log: LOG_NODE Action: None required.
0281: lpfc_cleanup_node: ndlp:x%pusgmap:x%x refcnt:%d, void *)ndlp, ndlp->nlp_usg_map, atomic_read(&ndlp->kref.refcount) Node cleanup was called to prepare the node for release. Data: None Severity: Warning Log: LOG_NODE Action: None required.
0282: ldid:x%x ndlp:x%pusgmap:x%x refcnt:%d, ndlp->nlp_DID, (void *)ndlp, lpfc_init.c-ndlp->nlp_usg_map, Driver clean-up has found a node that is still on the node list during driver unload or PCI hotplug removal. Data: None Severity: Error Log: LOG_NODE Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0283: Failed to allocate mbox cmd memory A mailbox allocation error occurred. Data: None Severity: Error Log: LOG_INIT Action: None required.
0285: Allocated DMA memory size <alloclen> is less than the requested DMA memorysize<reqlen> Memory allocation was truncated. Data: None Severity: Error Log: LOG_INIT Action: None required.
0286: lpfc_nlp_state_cleanup failed to allocate statistical data buffer <nlp_DID> Memory allocation failed for the node statistical data. Data: None Severity: Error Log: LOG_INIT Action: None required.
0287: lpfc_alloc_bucket failed to allocate statistical data buffer DID <nlp_DID> Memory allocation failed for the node statistical data. Data: None Severity: Error Log: LOG_NODE Action: None required.
0288: Unknown FCoE event type <event_type> event tag <event_tag> The firmware has detected an unknown FCoE event. Data: None Severity: Error Log: LOG_SLI Action: Check the FCoE switch configuration and the HBA DCBX mode.
0289: Issue Register VFI failed: Err <rc> The driver could not register the Virtual Fabric Index for the FCFI. Data: None Severity: Error Log: LOG_ELS Action: Check the switch and port configurations.
0290: The SLI4 DCBX asynchronous event is not handled yet The SLI-4 DCBX asynchronous event is not handled yet. Data: None Severity: Error Log: LOG_SLI Action: None required.
0291: Allocated DMA memory size (x%x) is less than the requested DMA memory size (x%x) The asynchronous DCBX events are not handled in the driver. Data: None Severity: Error Log: LOG_INIT Action: Check the switch configuration.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0293: PM resume failed to start worker thread: error=<error> The PCI resume (hotplug) could not start the worker thread for the driver. Data: None Severity: Error Log: LOG_INIT Action: Unload and reload the driver.
0294: PM resume Failed to enable interrupt The PCI resume (hotplug) could not get an interrupt vector. Data: None Severity: Error Log: LOG_INIT Action: Unload and reload the driver.
0297: Invalid device group<pci_dev_grp> While unloading the driver, the driver detected a PCI device that it should not have claimed. Data: None Severity: Error Log: LOG_INIT Action: None required.
0299: Invalid SLI revision <sli_rev> While processing a host attention or unrecoverable error, the driver detected an invalid SLI revision. Data: None Severity: Error Log: LOG_INIT Action: None required.
0300: LATT: Cannot issue READ_LA: Data:<rc> The link attention handler could not issue a READ_LA mailbox command. Data: None Severity: Error Log: LOG_MBOX Action: None required.
0301: READ_SPARAM: no buffers The driver attempted to issue a READ_SPARAM mailbox command to the adapter, but there no buffers were available. Data: None Severity: Warning Log: LOG_MBOX verbose Action: This message indicates: (1) Kernel virtual memory is depleted. Check that the system meets minimum RAM requirements for the Emulex FC adapter. Try closing other applications to free some memory. (2) A possible driver buffer management issue occurred. If this issue persists, report the error to Broadcom Technical Support.
0302: REG_LOGIN: no buffers The driver attempted to issue a REG_LOGIN mailbox command to the adapter, but no buffers were available. Data: (1) Did, (2) flag Severity: Warning Log: LOG_MBOX verbose Action: This message indicates: (1) Kernel virtual memory is depleted. Check that the system meets minimum RAM requirements for the Emulex FC adapter. Try closing other applications to free some memory. (2) A possible driver buffer management issue occurred. If this issue persists, report the error to Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0313: Ring <ringno> handler: unexpected Rctl <Rctl> Type <Type> received The RCTL/Type of a received frame did not match any for the configured masks for the specified ring. Data: None Severity: Warning Log: LOG_SLI verbose Action: This error could indicate a software driver, firmware, or hardware issue. Report these errors to Broadcom Technical Support.
0303: Ring <ringno> handler: portRspPut <portRspPut> is bigger then rsp ring <portRspMax> The port rsp ring put index is larger than the size of the rsp ring. Data: None Severity: Error Log: Always Action: This error could indicate a software driver, firmware or hardware issue. Report these errors to Broadcom Technical Support.
0304: Stray mailbox interrupt, mbxCommand <mbxcommand> mbxStatus <mbxstatus> Received a mailbox completion interrupt, and no outstanding mailbox commands exist. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0306: CONFIG_LINK mbxStatus error <mbxStatus> HBA state <hba_state> The driver issued a CONFIG_LINK mailbox command to the HBA that failed. Data: None Severity: Error Log: Always Action: This error could indicate a firmware or hardware issue. Report these errors to Broadcom Technical Support.
0310: Mailbox command <mbxcommand> timeout A mailbox command was posted to the adapter and did not complete within 30 seconds. Data: (1) hba_state (2) sli_flag (3) mbox_active Severity: Error Log: Always Action: This error could indicate a software driver or firmware issue. If no I/O is going through the adapter, reboot the system. If this issue persists, report the error to Broadcom Technical Support.
0312: Ring <ringno> handler: portRspPut <rspPutInx> is bigger then rsp ring <numRiocb> The IOCB command rings put pointer is ahead of the get pointer. Data: None Severity: Error Log: LOG_SLI Action: None required.
0313: Ring <ringno> handler: unexpected Rctl <Rctl> Type <Type> received The RCTL/Type of a received frame did not match any of the configured masks for the specified ring. Data: None Severity: Warning Log: LOG_SLI verbose Action: This error could indicate a software driver, firmware, or hardware issue. Report these errors to Broadcom Technical Support.
0315: Ring <ringno> issue: portCmdGet <local_getidx> is bigger then cmd ring <max_cmd_idx> The port command ring get index is greater than the size of the command ring. Data: None Severity: Error Log: Always Action: This error could indicate a software driver, firmware, or hardware issue. Report these errors to Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0317: iotag <ulp_IoTag> is out of range: max iotag <max_iotag> wd0 <wd0> The IoTag in the completed IOCB is out of range. Data: None Severity: Error Log: Always Action: This error could indicate a software driver, firmware, or hardware issue. Report these errors to Broadcom Technical Support.
0318: Failed to allocate IOTAG. last IOTAG is <last_allocated_iotag> The driver cannot allocate an IoTag. Display the last value used. Data: None Severity: Error Log: Always Action: This message indicates the adapter HBA I/O queue is full. Typically, this occurs when heavy I/O is running on a low-end (3 digit) adapter. Upgrade to a higher-end adapter.
0319: READ_SPARAM mbxStatus error <mbxStatus> hba state <hba_state> The driver issued a READ_SPARAM mailbox command to the HBA that failed. Data: None Severity: Error Log: Always Action: This error could indicate a firmware or hardware issue. Report these errors to Broadcom Technical Support.
0320: CLEAR_LA mbxStatus error <mbxStatus> hba state <hba_state> The driver issued a CLEAR_LA mailbox command to the HBA that failed. Data: None Severity: Error Log: Always Action: This error could indicate a firmware or hardware issue. Report these errors to Broadcom Technical Support.
0322: Ring <ringno> handler: unexpected completion IoTag <IoTag> The driver could not find a matching command for the completion received on the specified ring. Data: (1) ulpStatus, (2) ulpWord[4], (3) ulpCommand, (4) ulpContext Severity: Warning Log: LOG_SLI verbose Action: This error could indicate a software driver or firmware issue. If this issue persists, report these errors to Broadcom Technical Support.
0323: Unknown Mailbox command <mbxCommand> Cmpl An unknown mailbox command completed. Data: None Severity: Error Log: Always Action: This error could indicate a software driver, firmware, or hardware issue. Report these errors to Broadcom Technical Support.
0324: Config port initialization error, mbxCmd <mbxCommand> READ_NVPARM, mbxStatus <mbxStatus> The READ_NVPARMS mailbox command failed during port configuration. Data: None Severity: Error Log: Always Action: This error could indicate a software driver, firmware, or hardware issue. Report these errors to Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0328: Rsp Ring <ring number> error: IOCB Data: The firmware has returned an error for this IOCB. Data: (1) <iocb word[0]:iocb word[7]>, (2) <rsp word[0]:rsp[word[7]> Severity: Warning Log: LOG_SLI Action: None required.
0330: IOCB wake NOT set The completion handler associated with the IOCB was never called. Data: (1) timeout (2) timeleft/jiffies Severity: Error Log: Always Action: This error could indicate a software driver, firmware or hardware issue. If this issue persists, report the error to Broadcom Technical Support.
0334: Unknown IOCB command Received an unknown IOCB command completion. Data: (1) type (2) ulpCommand (3) ulpStatus (4) ulpIoTag (5) ulpContext) Severity: Error Log: Always Action: This error could indicate a software driver or firmware issue. If this issue persists, report these errors to Broadcom Technical Support.
0335: Unknown IOCB command Received an unknown IOCB command completion. Data: (1) ulpCommand (2) ulpStatus (3) ulpIoTag (4) ulpContext) Severity: Error Log: Always Action: This error could indicate a software driver or firmware issue. If this issue persists, report these errors to Broadcom Technical Support.
0336: Rsp Ring <ringno> error: IOCB An IOCB error has occurred on the specified ring. Data: (1) ulpWord[0], (2) ulpWord[1], (3) ulpWord[2], (4) ulpWord[3], (5) ulpWord[4], (6) ulpWord[5], (7) irsp+6, (8) irsp+7 Severity: Warning Log: LOG_SLI verbose Action: If this issue persists, check the targets. If the targets are correct, report the error to Broadcom Technical Support.
0340: Adapter temperature is OK now The adapter temperature has reverted to normal range. Data: Temperature in Celsius Severity: Error Log: LOG_TEMP verbose Action: No action needed, informational.
0341: Ring <ringno> Cannot find buffer for an unsolicited iocb tag <un.ulpWord[3]> No more pre-allocated buffers are available to handle unsolicited buffers. Data: None Severity: Error Log: LOG_SLI Action: Ensure this port is not being managed by multiple ports.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0342: Ring <ringno> Cannot find buffer for an unsolicited iocb tag <unsli3.sli3Words> This is a multiple IOCB unsolicited command and sufficient buffer space cannot be allocated for it. Data: None Severity: Error Log: LOG_SLI Action: None required.
0343: Ring <ringno> Cannot find buffer for an unsolicited iocb tag <un.ulpWord[3]> No more pre-allocated buffers are available to handle unsolicited buffers. Data: None Severity: Error Log: LOG_SLI Action: None required.
0344: Ring <ringno> Cannot find buffer for an unsolicited iocb tag <unsli3.sli3Words[7]> No more pre-allocated buffers are available to handle unsolicited buffers. Data: None Severity: Error Log: LOG_SLI Action: None required.
0345: Resetting board due to mailbox timeout iocb. tag 0x%x A mailbox command failed to complete. The driver is resetting the port. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: If the mailbox command fails again, set the lpfc_log_verbose to LOG_MBOX and retry.
0346: Ring <ring number> handler: unexpected ASYNC_STATUS evt_code <evt code> W0 <hex w0> W1 <hex w1> W2 <hex W2> W3 <hex W3> W4 <hex W4> W5 <hex W5> W6 <hex W6> W7 <hex W7> W8 <hex W8> W9 <hex W9> W10 <hex W10> W11<hex W11> The HBA received an asynchronous event that was not a temperature event. Data: None Severity: Error Log: LOG_SLI Action: None required.
0347: Adapter is very hot, please take corrective action Adapter temperature is above normal range. Data: Temperature in Celsius Severity: Error Log: LOG_TEMP verbose Action: Shutdown and remove the HBA. Contact Broadcom Technical Support.
0348: NameServer login: node freed The enable mode failed to free up the NameServer login. Data: None Severity: Error Log: LOG_ELSI Action: None required.
0349: rc should be MBX_SUCCESS The next mailbox command on the mailbox queue has failed. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0350: rc should have been MBX_BUSY Attempting to unregister a default RPI from an interrupt context and the mailbox state is not busy. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
0351: Config MSI mailbox command failed, mbxCmd <u.mb.mbxComm>, mbxStatus <u.mb.mbxStatus> The mailbox command sent to the firmware to configure the adapter to use MSI-X has failed. Data: None Severity: Warning Log: LOG_MBOX Action: Ensure that the hardware platform supports MSI-X.
0352: Config MSI mailbox command failed, mbxCmd <u.mb.mbxCommand>, mbxStatus <u.mb.mbxStatus> The mailbox command sent to the firmware to configure the HBA to use MSI-X has failed. Data: None Severity: Error Log: LOG_MBOX Action: Ensure that the hardware platform supports MSI-X.
0353: Active Mailbox cleared - mailbox timeout exiting The mailbox timeout handler has determined that the driver is in the process of completing this mailbox command. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
0357: MSI-X interrupt with no EQE An SLI-4 adapter interrupt on the slow path occurred, but there is no associated EQE. Data: None Severity: Warning Log: LOG_SLI Action: None required.
0358: MSI-X interrupt with no EQE An SLI-4 adapter interrupt on the fast path occurred, but there is no associated EQE. Data: None Severity: Warning Log: LOG_SLI Action: None required.
0359:Not a valid slow-path completion `event: majorcode=x%x, minorcode=x%x\n`, bf_get(lpfc_eqe_major_code, eqe), bf_get(lpfc_eqe_minor_code, eqe)); SLI-4: The EQE is invalid. Data: None Severity: Error Log: LOG_SLI Action: None required.
0360:Unsupported EQ count. <entry_count> Cannot create an event queue of this size. Data: None Severity: Error Log: LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0361:Unsupported CQ count. <entry_count> Cannot create an completion queue of this size. Data: None Severity: Error Log: LOG_SLI Action: None required.
0362:Unsupported MQ count. <entry_count> Cannot create MQ of this size. Data: None Severity: Error Log: LOG_SLI Action: None required.
0364:Invalid param: SLI-4: The post-SGL function was passed an invalid extensible resource indicator (XRI). Data: None Severity: Error Log: LOG_SLI Action: None required.
0365:Slow-path CQ identifier <CQID> does not exist: The Completion Queue ID passed in the event queue entry does not reference a valid completion queue. Data: None Severity: Error Log: LOG_SLI Action: None required.
0366:Not a valid fast-path completion event: majorcode=<major code hex>, minor-code=<minor code hex> The major or minor code in the Event Queue field is invalid. Data: None Severity: Error Log: LOG_SLI Action: None required.
0367: Fast-path completion queue does not exist The fast path completion queue referenced by the CQID does not exist. Data: None Severity: Error Log: LOG_SLI Action: None required.
0368: Mis-matched fast-path completion queue identifier: eqcqid=%d, fcpcqid=%d The CQID in the event queue entry does not match the fcp_cqid that was passed into the routine. Data: None Severity: Error Log: LOG_SLI Action: None required.
0369: No entry from fast-path completion queue fcpcqid=<queue_id> No completions in the completion queue were referenced by fcp_cqid. Data: None Severity: Error Log: LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0370: Invalid completion queue type <type> The event queue entry is not for a mailbox or a work queue entry. Data: None Severity: Error Log: LOG_SLI Action: None required.
0371: No entry from the CQ: identifier <queue_id>, type <type> No completion queue event existed for this event queue entry. Data: None Severity: Error Log: LOG_SLI Action: None required.
0372: iotag <iotag> is out of range: max iotag (<sli.last_iotag>) The IOCB lookup cannot be performed because the iocb_tag is out of range. Data: None Severity: Error Log: LOG_SLI Action: None required.
0373: FCP complete error: status=<status> hw_status=<hw status>, total_data_specified=<total data transferred>, parameter=<rsp word[4]>, word3=<wcqe word 3> Logs the FCP failure. Status and parameter are equivalent to ulpStatus and ulpWord[4]. Data: None Severity: Warning Log: LOG_SLI Action: None required.
0374: FCP complete with no corresponding cmdiocb: iotag <iocb iotag> No IOCB was on the in-progress list that matched this iotag. Data: None Severity: Warning Log: LOG_SLI Action: None required.
0375: FCP cmdiocb not callback function iotag: <iocb iotag> The IOCB found for this iotag does not have a completion handler set in it. Data: None Severity: Warning Log: LOG_SLI Action: None required.
0377: Error <rc> parsing vpd. Using defaults. Could not parse the vital product data (VPD) data, so the driver is using the default values. Data: None Severity: Error Log: Always Action: None required.
0378: No support for fcpi mode. Could not configure the port to run in FCP initiator mode. Data: None Severity: Warning Log: LOG_MBOX, LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0379: Feature Mismatch Data: <req ftr word2 hex> <req_ftr word3 hex> <cfg_enable_npiv> <max vpi hex> The features passed in to the driver as module parameters do not match what the firmware can do. Set to default values. Data: None Severity: Warning Log: LOG_MBOX, LOG_SLI Action: None required.
0381: Error %d during queue setup. Could not set up all the queues that the driver requires to exchange I/Os with the HBA. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: Reload the driver.
0382: READ_SPARAM command failed status <issue status>, mbxStatus <mailbox status> The READ_SPARAM mailbox command has failed during initialization. The HBA has been set to error state. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI: Action: Perform a dump with `hbacmd` and then try reloading the driver.
0383: Error <rc> during scsi sgl post operation The SGL entries could not be registered with the adapter. Data: None Severity: Warning Log: LOG_MBOX, LOG_SLI Action: Reset the adapter using `hbacmd`.
0384: There is pending active mailbox cmd The mailbox commands have overlapped. This command should have been added to the mailbox queue. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
0385: rc should have been MBX_BUSY The completion handler for REG_LOGIN detected the IMMED_UNREG flag and tried to issue the UNREG_LOGIN command from an interrupt level. The mailbox status should still be busy. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
0386: ELS complete with no corresponding cmdiocb: iotag <iotag> The completion that the ISR is handling cannot find a tag associated with the IOTAG. Data: None Severity: Warning Log: LOG_SLI Action: None required.
0387:Failed to allocate an iocbq Failed to get an IOCBQ from the list of available IOCBQs. Data: None Severity: Error Log: LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0388:Not a valid WCQE code: x<hex cqe_code> The event code is invalid. This event will be dropped. Data: None Severity: Error Log: LOG_SLI Action: Ensure the adapter firmware is current.
0391:Error during rpi post operation The driver was trying to post pages to the firmware to be used to keep target login information and encountered a failure. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: Unload and reload the driver.
0393:Error <rc> during rpi post operation The driver was trying to post pages to the firmware to keep target login information and encountered a failure. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: Unload and reload the driver.
0394: Failed to allocate CQ_EVENT entry The asynchronous event handler was unable to allocate an event queue entry to which to transfer the asynchronous event. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: This could be a V-LINK clear from the switch or a fatal error from the firmware. Perform a dump from the Emulex OneCommand CNA Manager application.
0395: The mboxq allocation failed The asynchronous link event handler could not allocate a mailbox command to issue the READ_LA (read link attention) mailbox command. Data: None Severity: Error Log: LOG_SLI Action: None required.
0396:The lpfc_dmabuf allocation failed The asynchronous link event handler could not allocate a mailbox command to issue the READ_LA mailbox command. Data: None Severity: Error Log: LOG_SLI Action: None required.
0397:The mbuf allocation failed The asynchronous link event handler could not allocate DMA-able memory for the READ_LA mailbox command. Data: None Severity: Error Log: LOG_SLI Action: None required.
0398 Invalid link fault code: <hex link_fault> The attempt to read the link attention register has returned an unknown value. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0399 Invalid link attention type: <hex link_type> The READ_LA mailbox command has returned an invalid link type. Data: None Severity: Error Log: LOG_INIT Action: None required
0400: lpfc_nodev_tmo attribute cannot be set to <val>, allowed range is [<LPFC_MIN_DEVLOSS_TMO>, <LPFC_MAX_DEVLOSS_TMO>] The attempt to set the devloss timeout value failed because the value is out of the allowable range. Data: None Severity: Error Log: LOG_INIT Action: Use a value between the minimum and maximum values.
0401: Ignoring change to nodev_tmo because devloss_tmo is set Attempted to change the nodev timeout when the devloss has already been set. Data: None Severity: Error Log: LOG_INIT Action: None required.
0402:Cannot find virtual addr for buffer tag on ring <ringno> A DMA buffer is unavailable for this unsolicited command. Data: (1) tag (2) next (3) prev (4) postbufq_cnt Severity: Error Log: LOG_INIT Action: None required.
0403: lpfc_nodev_tmo attribute cannot be set to <val>, allowed range is [<LPFC_MIN_DEVLOSS_TMO>, <LPFC_MAX_DEVLOSS_TMO>] Attempted to set the nodev timeout value is outside the range of the devloss timeout range. Data: None Severity: Error Log: LOG_INIT Action: Set the nodev timeout between the minimum and maximum timeout range.
0404: lpfc_devloss_tmo attribute cannot be set to <val>, allowed range is [<LPFC_MIN_DEVLOSS_TMO>, <LPFC_MAX_DEVLOSS_TMO>] Attempted to set the devloss timeout value is outside the allowed range. Data: None Severity: Error Log: LOG_INIT Action: Set the devloss timeout between the minimum and maximum devloss range.
0405: lpfc_link_speed attribute cannot be set to %d, allowed values are ["LPFC_LINK_SPEED_STRING"] Attempted to set the link speed value is outside the allowed range. Data: None Severity: Error Log: LOG_INIT Action: Set the link speed between 0 and the maximum.
0406: Adapter maximum temperature exceeded <temperature>, taking this port offline The driver has received an error for the HBA indicating that the maximum allowable temperature has been exceeded. Data: (1) work_hs (2) work_status[0] (3) work_status[1] Severity: Error Log: LOG_INIT Action: Ensure that the server fans are not blocked. Shut down the server if the airflow is restricted.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0407: Ignoring nodev_tmo module parameter because devloss_tmo is set. Both module parameters (`nodev` and `devloss`) were set so the driver is ignoring the `nodev` parameter. Data: None Severity: Error Log: LOG_INIT Action: Only one of these parameters must be set.
0410: Cannot find virtual addr for mapped buf on ring <ringno> The driver cannot find the specified buffer in its mapping table. Therefore, it cannot find the virtual address needed to access the data. Data: (1) phys (2) next (3) prev (4) postbufq_cnt Severity: Error Log: Always Action: This error could indicate a software driver or firmware issue. If this issue persists, report these errors to Broadcom Technical Support.
0421: MSI-X slow-path request_irq failed <rc> The kernel application programming interface (API) to request an IRQ has failed. Data: None Severity: Warning Log: LOG_INIT Action: Use module parameter `lpfc_use_msi=0 (INTx)`.
0422: lpfc_restrict_login attribute cannot be set to <val>, allowed range is [0, 1] Attempted to set the restrict login parameter to something other than on or off. Data: None Severity: Error Log: LOG_INIT Action: Use 0 (Off) or 1 (On)
0423: lpfc_"#attr" attribute cannot be set to %d, allowed range is ["#minval", "#maxval"] This compile time macro is used by several module parameters during initialization. Each module parameter has its own minimum and maximum values that are displayed. Data: None Severity: Error Log: LOG_INIT Action: Set the module parameter between the minimum and maximum values.
0424:lpfc_"#attr" attribute cannot be set to %d, allowed range is ["#minval", "#maxval"] This compile time macro is used by several module parameters to set the value. Data: None Severity: Error Log: LOG_INIT Action: Set the module parameter between the minimum and maximum values.
0425:lpfc_restrict_login attribute cannot be set to %d, allowed range is [0, 1] The module parameter `lpfc_restrict_login` can only be set to 0 (off) or 1 (on). Data: None Severity: Error Log: LOG_INIT Action: Set `lpfc_restrict_login=[0,1]`.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0426: Failed to enable interrupt The driver failed to start the interrupt. Data: None Severity: Error Log: LOG_INIT Action: Unload and reload the driver.
0427: Cannot re-enable interrupt after slot reset The driver was unable to enable the interrupt after an HBA reset. Data: None Severity: Error Log: LOG_INIT Action: Unload and reload the driver.
0429: MSI-X fast-path request_irq failed (<rc>) The driver received an error for the request_irq_call. Data: None Severity: Warning Log: LOG_INIT Action: Unload and reload the driver.
0430: PM resume Failed to enable interrupt The driver's power management resume function could not enable the interrupt. Data: None Severity: Error Log: LOG_INIT Action: Perform another PM suspend and resume or HBA reset.
0431: Failed to enable interrupt. The driver failed to start the interrupt. Data: None Severity: Error Log: LOG_INIT Action: Unload and reload the driver.
0433: Wakeup on signal: rc=<rc> A signal other than the LPFC_DATA_READY was received on the worker thread. Data: None Severity: Error Log: LOG_ELS Action: Unload and reload the driver.
0434: PM resume failed to start worker thread: error=<error> The driver's power management resume function could not start the worker thread. Data: None Severity: Error Log: LOG_INIT Action: Unload and reload the driver.
0435: Adapter failed to get Option ROM version status <rc> The driver could not read the HBA's option ROM. Data: None Severity: Error Log: LOG_INIT Action: Reset the HBA. Ensure that the adapter's firmware is current.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0436: Adapter failed to init, timeout, status reg <status> The adapter failed during power-up diagnostics after it was reset. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0437: Adapter failed to init, chipset, status reg <status> The adapter failed during power-up diagnostics after it was reset. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0438: Adapter failed to init, chipset, status reg <status> The adapter failed during power-up diagnostics after it was reset. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0439: Adapter failed to init, mbxCmd <mbxCommand> READ_REV, mbxStatus <mbxStatus> Adapter initialization failed when issuing a READ_REV mailbox command. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0440: Adapter failed to init, READ_REV has missing revision information A firmware revision initialization error was detected. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. Install the latest firmware revision. If this issue persists, report the error to Broadcom Technical Support.
0442: Adapter failed to init, mbxCmd <mbxCommand> CONFIG_PORT, mbxStatus <mbxStatus> Adapter initialization failed when issuing a CONFIG_PORT mailbox command. Data: (1) hbainit Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0446: Adapter failed to init, mbxCmd <mbxCommand> CFG_RING, mbxStatus <mbxStatus>, ring <num> Adapter initialization failed when issuing a CFG_RING mailbox command. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0447: Adapter failed init, mbxCmd <mbxCommand> CONFIG_LINK mbxStatus <mbxStatus> Adapter initialization failed when issuing a CONFIG_LINK mailbox command. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0448: Adapter failed to init, mbxCmd <mbxCommand> READ_SPARM, mbxStatus <mbxStatus> Adapter initialization failed when issuing a READ_SPARM mailbox command. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0449: lpfc_%attr attribute cannot be initialized to %d, allowed range is [%min, %max] The sysfs attribute value written exceeds the attribute range. Data: (1) attribute name (2) value written (3) minimum value (3) maximum value Severity: Error Log: Always Action: Write a value within the supported range.
0450: lpfc_%attr attribute cannot be set to %d, allowed range is [%min, %max] The sysfs attribute value written exceeds the attribute range. Data: (1) attribute name (2) value written (3) minimum value (3) maximum value Severity: Error Log: Always Action: Write a value within the supported range.
0451: Enable interrupt handler failed The driver attempted to register the HBA interrupt service routine with the host operating system but failed. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or driver issue. If this issue persists, report the error to Broadcom Technical Support.
0453: Adapter failed to init, mbxCmd <mbxCommand> READ_CONFIG, mbxStatus <mbxStatus> Adapter initialization failed when issuing a READ_CONFIG mailbox command. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0454: Adapter failed to init, mbxCmd <mbxCommand> INIT_LINK, mbxStatus <mbxStatus> Adapter initialization failed when issuing an INIT_LINK mailbox command. Data: None Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.
0456: Adapter failed to issue ASYNCEVT_ENABLE mbox status x%x The mailbox command to enable an asynchronous event notification failed. Data: None Severity: Error Log: LOG_INIT Action: Ensure that the adapter firmware is current. Reload the driver.
0457: Adapter Hardware Error The driver received an interrupt indicating a possible hardware issue. Data: (1) status (2) status1 (3) status2 Severity: Error Log: Always Action: This error could indicate a hardware or firmware issue. If this issue persists, report the error to Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0458: Bring adapter online The FC driver has received a request to bring the adapter online. This error might occur when running `lputil`. Data: None Severity: Warning Log: LOG_INIT verbose Action: None required.
0459: Adapter heartbeat failure, taking this port offline. The Heartbeat mailbox command failed. Data: None Severity: Error Log: LOG_INIT Action: Ensure the adapter firmware is current. Reload the driver.
0460: Bring adapter offline The FC driver has received a request to bring the adapter offline. This error might occur when running `lputil`. Data: None Severity: Warning Log: LOG_INIT verbose Action: None required.
0466: Outstanding I/O when bringing Adapter offline The I/O is still pending while attempting to stop the driver. Data: None Severity: Warning Log: LOG_INIT Action: None required.
0467: lpfc_topology attribute cannot be set to %d, allowed range is [0, 6], phba->brd_no, val. The `lpfc_topology` module parameter is invalid. Data: None Severity: Error Log: LOG_INIT Action: Use a value in the valid range.
0468: lpfc_restrict_login must be 0 for Physical ports. “vport->cfg_restrict_login = 0; Cannot restrict the login for the physical port. Data: None Severity: Error Log: LOG_INIT Action: None required.
0469: lpfc_link_speed attribute cannot be set to %d, allowed range is [0, 8] The link speed module parameter is invalid. Data: None Severity: Error Log: LOG_INIT Action: Use a link speed parameter in the valid range.
0472: PCI channel I/O permanent failure The PCI bus has detected an error. Data: None Severity: Error Log: LOG_INIT Action: Issue an HBA reset.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0474: Unable to allocate memory for issuing MBOX_CONFIG_MSI command A mailbox memory pool allocation error occurred. Data: None Severity: Error Log: LOG_INIT Action: None required.
0475: Not configured for supporting MSI-X cfg_use_msi: 0x%x The lpfc_use_msi module parameter should have been set to 2. Data: None Severity: Error Log: LOG_INIT Action: Set the module parameter `lpfc_use_msi = 2`.
0476: HBA not supporting SLI-3 or later SLI Revision: <sli_rev> The HBA does not support SLI-3 or SLI-4. Data: None Severity: Error Log: LOG_INIT Action: This HBA does not support MSI. Set `lpfc_use_msi=0`.
0478: MSI request_irq failed (<rc>). The request_irq kernel API has failed. Data: None Severity: Warning Log: LOG_INIT Action: Set lpfc_use_msi=0.
0479: Deferred Adapter Hardware Error An adapter hardware error was sent to the driver. Data: (1) work_hs, (2) work_status[0], (3) work_status[1] Severity: Error Log: LOG_INIT Action: Perform a dump using `hbacmd`.
0483:Invalid link-attention link speed: x%x", bf_get(lpfc_acqe_link_speed, acqe_link). The link speed reported in the link attention interrupt is invalid. Data: None Severity: Error Log: LOG_INIT Action: Check the switch configuration.
0485: MSI-X slow-path request_irq failed (<rc>). The request_irq kernel API has failed. Data: None Severity: Warning Log: LOG_INIT Action: Set the module parameter `lpfc_use_msi=0`.
0486: MSI-X fast-path (<index>) request_irq failed (<rc>). The request_irq kernel API has failed. Data: None Severity: Warning Log: LOG_INIT Action: Set the module parameter `lpfc_use_msi=0`.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0490: MSI request_irq failed (<rc>). The request_irq kernel API has failed. Data: None Severity: Warning Log: LOG_INIT Action: Set module parameter lpfc_use_msi=0.
0492: Unable to allocate memory for issuing SLI_CONFIG_SPECIAL mailbox command A mailbox memory pool allocation error occurred. Data: None Severity: Error Log: LOG_INIT Action: None required.
0493: SLI_CONFIG_SPECIAL mailbox failed with status<rc> A mailbox command failed. Data: None Severity: Error Log: LOG_INIT Action: Ensure that the adapter firmware is current. Unload and reload the driver.
0494: Unable to allocate memory for issuing "SLI_FUNCTION_RESET mailbox command" A mailbox memory pool allocation error occurred. Data: None Severity: Error Log: LOG_INIT Action: None required.
0495: SLI_FUNCTION_RESET mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc>. A mailbox command failed. Data: None Severity: Error Log: LOG_INIT Action: Reset the HBA.
0496: Failed allocate slow-path EQ The event queue for the slow path was not allocated. Data: None Severity: Error Log: LOG_INIT Action: Unload and reload the driver.
0497: Failed allocate fast-path EQ The event queue for the fast path was not allocated. Data: None Severity: Error Log: LOG_INIT Action: Unload and reload the driver.
0499: Failed allocate fast-path FCP CQ (<fcp_cqidx>). The completion queue event for the fast path could not be allocated. Data: None Severity: Error Log: LOG_INIT Action: Unload and reload the driver.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0500: Failed allocate slow-path mailbox CQ Failed to allocate a slow-path mailbox CQ. Data: None Severity: Error Log: LOG_INIT Action: None required.
0501: Failed allocate slow-path ELS CQ Failed to allocate a slow-path ELS CQ. Data: None Severity: Error Log: LOG_INIT Action: None required.
0503: Failed allocate fast-path FCP Failed to allocate a fast-path FCP. Data: None Severity: Error Log: LOG_INIT Action: None required.
0504: Failed allocate slow-path ELS WQ Failed to allocate a slow-path ELS WQ. Data: None Severity: Error Log: LOG_INIT Action: None required.
0505: Failed allocate a slow-path ELS MQ Data: None Severity: Error Log: LOG_INIT Action: None required.
0506: Failed allocate receive HRQ\n Data: None Severity: Error Log: LOG_INIT Action: None required.
0507: Failed allocate receive DRQ Failed to allocate a receive DRQ. Data: None Severity: Error Log: LOG_INIT Action: None required.
0520: Slow-path EQ not allocated The slow-path EQ is not allocated. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0522: Fast-path EQ <fcp_eqidx> not allocated The fast-path EQ is not allocated. Data: None Severity: Error Log: LOG_INIT Action: None required.
0523: Failed setup of fast-path EQ <fcp_eqidx>, rc = <rc> The fast-path EQ set up failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
0526: Fast-path FCP CQ <fcp_cqidx> not allocated The fast-path FCP is not allocated. Data: None Severity: Error Log: LOG_INIT Action: None required.
0527: Failed setup of fast-path FCP CQ <fcp_cqidx>, rc = <rc> The fast-path FCP CQ set up failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
0528: Mailbox CQ not allocated The mailbox CQ is not allocated. Data: None Severity: Error Log: LOG_INIT Action: None required.
0530: ELS CQ not allocated The ELS CQ is not allocated Data: None Severity: Error Log: LOG_INIT Action: None required.
0534: Fast-path FCP WQ <fcp_wqidx> not allocated The fast-path FCP WQ is not allocated. Data: None Severity: Error Log: LOG_INIT Action: None required.
0535: Failed setup of fast-path FCP WQ <fcp_wqidx>, rc = <rc> The fast-path FCP WQ set up failed. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0536: Slow-path ELS WQ not allocated The slow-path ELS WQ is not allocated. Data: None Severity: Error Log: LOG_INIT Action: None required.
0538: Slow-path MQ not allocated The slow-path MQ is not allocated. Data: None Severity: Error Log: LOG_INIT Action: None required.
0540: Receive Queue not allocated The Receive Queue is not allocated. Data: None Severity: Error Log: LOG_INIT Action: None required.
0542: lpfc_create_static_vport failed to allocate mailbox memory Failed to allocate mailbox memory for VPort creation. Data: None Severity: Error Log: LOG_INIT Action: None required.
0543: lpfc_create_static_vport failed to allocate vport_info\n")) Failed to allocate vport_info. Data: None Severity: Error Log: LOG_INIT Action: None required.
0544: lpfc_create_static_vport failed to issue dump mailbox command ret <rc> status <mbxStatus> Failed to issue a dump mailbox command for static VPort creation. Data: None Severity: Warning Log: LOG_INIT Action: None required.
0545: lpfc_create_static_vport bad information header 0x%x 0x%x\n"\, le32_to_cpu(vport_info->signature), le32_to_cpu(vport_info->rev) & VPORT_INFO_REV_MASK); Invalid information header; the signature or revision is invalid. Data: None Severity: Error Log: LOG_INIT Action: None required.
0546: lpfc_create_static_vport failed to create vport Failed to create a VPort. Data: None Severity: Warning Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0582: Error <rc> during sgl post operation The SGL post operation failed. Data: None Severity: Error Log: LOG_MBOX, LOG_IP verbose Action: None required.
0602: Failed to allocate CQ_EVENT entry Failed to allocate a CQ_EVENT entry. Data: None Severity: Error Log: LOG_SLI Action: None required.
0603: Invalid work queue CQE subtype (x%x)\n", cq-<subtype> Invalid work queue completion queue entry (CQE) occurred. Data: None Severity: Error Log: LOG_SLI Action: None required.
0700: Bus Reset on target <i> failed The bus reset for the specified target failed. Data: None Severity: Error Log: LOG_FCP Action: None required.
0704: At limitation of <total> preallocated command buffers The maximum number of command buffers have already been allocated. Data: None Severity: Warning Log: LOG_FCP verbose Action: None required.
0705: Allocation request of <num> command buffers will exceed max of <hba_queue_depth>. Reducing allocation request to <size> The number of command buffers requested will exceed the maximum so a smaller quantity will be allocated. Data: None Severity: Warning Log: LOG_FCP verbose Action: None required.
0708: Allocation request of <num_to_alloc> command buffers did not succeed. Allocated <num_allocated> buffers. The allocation request for the specified command buffers did not succeed. However, the specified number of buffers has been allocated. Data: None Severity: Warning Log: LOG_FCP Action: None required.
0711: detected queue full - lun queue depth adjusted to%d The driver detected a queue full status on a SCSI command response. A new LUN queue depth is reported. Data: (1) New LUN queue depth Severity: Warning Log: LOG_FCP verbose Action: This might indicate an oversubscribed target array. Check your SAN configuration and I/O workload.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0713: SCSI layer issued Device Reset (%d, %d) A device reset was issued. Data: None Severity: Error Log: LOG_FCP Action: None required.
0714: SCSI layer issued bus reset The SCSI layer is requesting the driver to abort all I/Os to all targets on this HBA. Data: (1) ret Severity: Error Log: Always Action: Check the state of the targets in question.
0720: FCP command <cmnd[0]> residual overrun error A residual overrun error has occurred while processing the specified FCP command. Data: (1) request_bufflen (2) resid Severity: Warning Log: LOG_FCP verbose Action: If this issue persists, check the targets for errors.
0721: Device Reset rport failure: rdata <rdata> The reset of the R_Port failed. Data: None Severity: Error Log: LOG_FCP Action: None required.
0722: Target Reset rport failure: rdata <rdata> The reset of the target failed. Data: None Severity: Error Log: LOG_FCP Action: None required.
0723: SCSI layer issued Target Reset (%d, %d) The SCSI layer issued a target reset. Data: None Severity: Error Log: LOG_FCP Action: None required.
0724: I/O flush failure for context <“LUN”,”TGT”,”HOST”,”Unknown”>: cnt <cnt> The I/O flush to the LUN, target, or host has failed. Data: None Severity: Error Log: LOG_FCP Action: None required.
0727: TMF <cmd> to TGT <TGT#> LUN <LUN#> failed (<ulpStatus>, <ulpWord[4]>) The task management command failed. Data: None Severity: Error Log: LOG_FCP Action: None required

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

0729: FCP cmd <cmnd> failed <target>/<lun> status: <status> result: <result> The specified device failed an FCP command. Data: (1) ulpContext (2) iotag Severity: Warning Log: LOG_FCP verbose Action: Check the state of the target in question.
0730: FCP command failed: RSP The FCP command failed with a response error. Data: (1) resp_info (2) scsi_status (3) ResId (4) SnsLen (5) RspLen (6)rspInfo3 Severity: Warning Log: LOG_FCP verbose Action: Check the state of the target in question.
0734: FCP read check error The issued FCP command returned a read check error. Data: (1) fcpDl (2) rspResId (3) fcpi_parm (4) cmd[0] Severity: Warning Log: LOG_FCP verbose Action: Check the state of the target in question.
0735: FCP Read Check Error and Underrun Data HBA reported under run from storage array. Data: (1) vpi (2) fcpDI (3) res_id (4) fcpi_parm Severity: Warning Log: LOG_FCP_ERROR verbose Action: No action needed, informational.
0748: Abort handler timed out waiting for abort to complete:ret <status> D <target id> LUN <lun id> The abort handler timed out waiting for abort to complete. Data: None Severity: Error Log: Always Action: None required.
0749: SCSI layer issued abort device The SCSI layer aborted a device. Data: (1) ret, (2) id, (3) lun, (4) snum Severity: Warning Log: LOG_FCP verbose Action: None required.
0915 Register VPI failed:<mbxStatus> Could not register the VPI. Data: None Severity: Error Log: LOG_MBOX Action: None required.
1005: AUTHENTICATION_FAILURE Nport:<port> The system detected a Diffie-Hellman Challenge Handshake Authentication Protocol (DHCHAP) authentication failure on a port. Data: (1) nlp_DID Severity: Error Log: LOG_SECURITY Action: Verify the authentication settings and keys on the local and remote ports.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1006: Bad Name tag in auth message < message > The DHCHAP Authentication process failed when an invalid tag was detected. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1007: Bad Name length in auth message < message > The DHCHAP Authentication process failed when an invalid name was detected. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1008: Bad Number of Protocols <message> The DHCHAP Authentication process failed due to an unexpected protocol number. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1009: Bad param type <message> The DHCHAP Authentication process failed when an invalid protocol was detected. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1010: Bad Tag 1 <message> The DHCHAP Authentication process failed when a bad Tag was detected. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1011: Auth_neg no hash function chosen The DHCHAP Authentication process failed when an incorrect hash function was specified. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1012: Auth_negotiate Bad Tag <message> DHCHAP Authentication process failed due to bad Tag for auto negotiation. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1013: Auth_negotiate no DH_group found DHCHAP Authentication process failed when incorrect or missing DH Group was detected. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to the Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1014: dhchap challenge bad name tag <message> DHCHAP Authentication process failed when incorrect Challenge name tag was detected. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to the Broadcom Technical Support.
1015: dhchap challenge bad name length <message> DHCHAP Authentication process failed due to unexpected Challenge name length. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1016: dhchap challenge Hash ID not Supported <message> The DHCHAP Authentication process failed due to an uncorroborated Challenge Hash ID. Data: (1) message Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1017: dhchap challenge could not find DH Group The DHCHAP Authentication process failed due to an uncorroborated Challenge Group. Data: None Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1018: dhchap challenge No Public key for non-NULL DH Group No Public key exists for the non-NULL DH Group. Data: None Severity: Error Log: LOG_SECURITY Action: None required.
1019: Request tranid <tran_id> timed out A transaction with the storage array could not complete due to timeout. Data: (1) tran_id Severity: Warning Log: LOG_SECURITY verbose Action: Software driver warning. If this issue persists, report these errors to Broadcom Technical Support.
1021: ERROR: attempted to queue security work, when no workqueue created The driver encountered a missing queue required for processing security information. Data: None Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report these errors to Broadcom Technical Support.
1022: Security request does not exist A security request operation failed because no match was found for such request. Data: None Severity: Warning Log: LOG_SECURITY Action: Software driver warning. If this issue persists, report these errors to Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1023: Warning - data may have been truncated. Data: <data> reqdl: <data_len> mesdl:<data_len> A security message exchange operation failed because the response was missing or unreliable. Data: None Severity: Warning Log: LOG_SECURITY Action: Software driver warning. If this issue persists, report these errors to Broadcom Technical Support.
1028: Start Authentication: No buffers The authentication failed because some memory resources were not allocated. Data: None Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1029: Reauthentication Failure The driver encountered errors and a failure to re-authenticate occurred. Data: None Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1031: Start Authentication: Get config failed The authentication failed due to some error during port configuration. Data: None Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1032: Start Authentication: get config timed out The node authentication was aborted because a timeout occurred while waiting for port configuration to complete. Data: None Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1033: Received auth_negotiate from Nport: < nlp_DID> An unsolicited authentication negotiation message was received from a port. Data: (1) nlp_DID Severity: Warning Log: LOG_SECURITY Action: No action, this message is informational.
1034: Not Expecting Challenge - Rejecting Challenge An unsolicited authentication challenge received from a port was rejected. Data: None Severity: Warning Log: LOG_SECURITY Action: Software driver warning. If this issue persists, report errors to Broadcom Technical Support.
elx_mag1036: Authentication transaction reject - re-auth request reason <reason> exp <explanation> An authentication was rejected and requested again due to the reason as displayed with the explanation. Data: (1) reason (2) explanation. Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1037: Authentication transaction reject - restarting authentication, reason <reason> exp <explanation> An authentication process was rejected and then restarted and the authentication requested again due to the reason as displayed with the explanation. Data: (1) reason (2) explanation. Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1039: Not Expecting Reply - rejecting. State <state> An unanticipated reply was received during authentication and was subsequently rejected. Data: (1) auth_state. Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1040: Bad Reply trans_id- rejecting. Trans_id < trans_id > Expecting: < trans_id> An unexpected transaction id was received during authentication and was subsequently rejected. Data: (1) auth_state Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1043: Authentication LS_RJT The authentication request was rejected. Data: None Severity: Error Log: LOG_ELS Action: None required.
1045: Issue AUTH_NEG failed Status:%x The authentication negotiation failed. Data: None Severity: Error Log: LOG_ELS Action: None required.
1048: Issue AUTH_REJECT failed Could not issue the reject for the authentication request. Data: None Severity: Error Log: LOG_ELS Action: None required.
1049: Authentication is enabled but authentication service is not running Discovery failed because DHCHAP authentication was enabled while no authentication service was established. Data: None Severity: Error Log: LOG_SECURITY Action: Start the authentication daemon (`fcauthd`).

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

elx_ msg1050: Authentication mode is disabled, but is required by the fabric Discovery failed because the switch fabric required authentication, but authentication was not configured or the authentication mode for this port pair is disabled. Data: None Severity: Error Log: LOG_SECURITY Action: Configure the driver to authenticate with the switch or disable authentication on the switch to this port.
1053: Start Authentication: Security service offline The authentication failed because security service was unavailable. Data: None Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1055: Authentication parameter is disabled, but is required by the fabric FLOGI failed because the fabric has indicated that authentication is required, but authentication has not yet been configured or enabled on the HBA. Data: None Severity: Error Log: LOG_SECURITY Action: Configure authentication on this HBA.
1057: Authentication transaction reject. reason <reason> exp <explanation> An authentication was rejected and requested again due to the reason as displayed with the explanation. Data: (1) reason (2) explanation. Severity: Error Log: LOG_SECURITY Action: Software driver error. If this issue persists, report errors to Broadcom Technical Support.
1058: Waiting for authentication service A delay occurred when the authentication service was not initially available as expected. Data: None Severity: Warning Log: LOG_SECURITY Action: Software driver warning. If this issue persists, report these errors to Broadcom Technical Support.
1059: Authentication became available The authentication service came online, but it was not initially available as expected. Data: None Severity: Warning Log: LOG_SECURITY Action: Software driver warning. If this issue persists, report these errors to Broadcom Technical Support.
1201: Failed to allocate dfc_host Failed to allocate memory for the dfc_host_struct. Data: None Severity: Error Log: LOG_ELS Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1210: Invalid cmd size: cmd <cmd> cmdsz <cmdsize> rspsz <rspsize> The management command for LPFC 2100 has failed. Data: None Severity: Error Log: LOG_LIBDFC Action: None required.
1211: genreq alloc failed\n"); A resource allocation failure occurred. Data: (1) return code Log: LOG_LIBDFC Severity: Error Action: Kernel memory resources too low.
1213: FCoE cmd overflow: off <#> + cnt <#> > cmdsz <#> The application has tried to read more data than originally requested. Data: (1) response offset (2) size (3) cmd size Log: LOG_LIBDFC Severity: Error Action: The application might have sent an invalid command.
1214: Cannot issue FCoE cmd SLI not active: <#> rc= -EACCESS The SLI layer has not been initialized. Data: (1) offset Log: LOG_LIBDFC Severity: Error Action: Restart the HBA.
1215: Cannot issue FCoE cmd: not ready or not in maint mode The external link is unplugged, the link is down, or the FCoE is not in maintenance mode. Data: (1) current offset (2) return code. Log: LOG_LIBDFC Severity: Error Action: Plug in the external cable or set FCoE in maintenance mode.
1216: FCoE IOCB failed: off <#> rc <#> The FCoE command generated by the application has failed. Data: (1) offset (2) return code. Log: LOG_LIBDFC Severity: Error Action: The application should retry the command.
1223: menlo_write: couldn't alloc genreq Resource allocation failure. Data: None Log: LOG_LIBDFC Severity: Error Action: Kernel memory resources too low.
1224: FCoE iocb failed off <#> rc=<#>", FCoE command failed in SLI. Data: (1) offset (2) return code Log: LOG_LIBDFC Severity: Informational. Action: Retry the command, if it fails again, reset HBA when convenient.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1227: FCoE IOCB TMO: handler set for <context3> The management command for the LPFC 2100 has timed out. Data: None Severity: Warning Log: LOG_LIBDFC Action: None required.
1228: FCoE IOCB TMO: handler set for <context3> A management IOCB for the LPFC 2100 has timed out Data: None. Severity: Warning Log: LOG_LIBDFC Action: None required.
1229: Waiting for menlo mnt Waiting for the LPFC 2100 to enter maintenance method. Data: None. Severity: Warning Log: LOG_LIBDFC Action: None required.
1230: Could not find buffer for FCoE cmd:off <#> indmp <addr> off <#> Could not find resources associated with this FCoE command. Data: (1) current offset (2) buffer desc pointer (3) size. Severity: Error Log: LOG_LIBDFC Action: Try reloading the driver when convenient.
1231: bad bpl: A invalids buffer list was detected upon completion. Data: None. Severity: Error Log: LOG_LIBDFC Action: None required.
1235: Could not find buffer for FCoE cmd: off:<#> poff:<#> cnt:<#> mlastcnt:<#> addl:<x> addh:<x> mdsz:<#> FCoE command failed because it could not find the resource. Data: (1) current offset (2)previous offset (3) count (4) last count (5) address low (6) address high Severity: Error Log: LOG_LIBDFC Action: No action needed, informational.
1238: FCoE IOCB failed: off <#> rc=<#> The command generated by the driver to check the FCoE has failed. Data: (1) offset (2) return code Log: LOG_LIBDFC Severity: Error Action: Make sure link is up or the adapter has set menlo in maintenance mode.
1240: Unable to allocate command buffer memory Could not allocate memory for the command buffer. Data: None. Severity: Error Log: LOG_LINK_EVENT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1243: Menlo command error. code=%d.\n", mlorsp->code The Menlo maintenance command failed. Data: None. Severity: Error Log: LOG_LINK_EVENT Action: None required.
1244: Unable to allocate response buffer memory. Could not allocate memory for the management command response. Data: None. Severity: Error Log: LOG_LINK_EVENT Action: None required.
1246: FCoE chip is running golden firmware. Update FCoE chip firmware immediately <fw_type> The FCoE is running the golden firmware. Data: (1) firmware-type Severity: Error Log: LOG_LINK_EVENT Action: Try resetting the FCoE to operational mode and disable maintenance mode.
1247: FCoE chip is running diagnostic firmware. Operational use suspended. <fw_type> The FCoE is running a diagnostic. DATA:(1) firmware-type Severity: Error Log: LOG_LINK_EVENT Action: Try resetting the FCoE to operational mode.
1248: FCoE chip is running unknown firmware. <fw_type> The FCoE is running an unknown firmware version. Data: (1) firmware-type Severity: Error Log: LOG_LINK_EVENT Action: Try resetting the FCoE to operational mode. Try loading latest FCoE firmware.
1249: Invalid FRU data found on adapter. Return adapter to Emulex for repair. The FRU data on the FCoE chip is invalid. Data: (1) firmware-type Severity: Error Log: LOG_LINK_EVENT Action: Try resetting the FCoE to operational mode. Try loading latest FCoE firmware or send the HBA back to Broadcom for repair.
1250: Menlo command error. code=<#> The IOCB driver sent to check FCoE state has bad header size. Data: (1) return code Log: LOG_LINK_EVENT Severity: Error Action: Try resetting the FCoE to operational mode.
1251: Menlo command error. code=<#> The IOCB driver sent to check FCoE state has failed, no resources. Data: (1) return code Log: LOG_LINK_EVENT Severity: Error Action: Try resetting the FCoE to operational mode.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1252: Menlo command error. code=<#> The IOCB driver sent to check FCoE state has failed. Data: (1) return code Log: LOG_LINK_EVENT Severity: Error Action: Try resetting the FCoE to operational mode.
1257: lpfc_menlo_issue_iocb: handler set for <context3>. Data: None Log: LOG_LIBDFC Severity: Warning Action: None required.
1259: mbox: Issued mailbox cmd <u.mb.mbxCommand> while in stopped state. Only the dump mailbox command and reset adapter mailbox command are allowed when in the stopped state. Data: None Severity: Warning Log: LOG_MBOX Action: None required.
1262: Failed to allocate dfc_host Could not allocate memory the dfc_host_struct. Data: None Log: LOG_LIBDFC Severity: Error Action: None required.
1268: Find ndlp returned NULL for oxid:x%x SID:x%x, oxid, sid.(int)off, rc. Could not find the node for this DID. Data: None Severity: Warning Log: LOG_ELS Action: None required.
1302: Invalid speed for this board: Reset link speed to auto: <cfg_link_speed> The driver is re-initializing the link speed to auto-detect. Data: None Severity: Warning Log: LOG_LINK_EVENT verbose Action: None required.
1303: Link Up Event <eventTag> received A link up event was received. It is possible for multiple link events to be received together. Data: (1) fc_eventTag (2) granted_AL_PA (3) UlnkSpeed (4) alpa_map[0] Detail: If link events received, log (1) last event number received, (2) ALPA granted, (3) Link speed (4) number of entries in the loop init LILP ALPA map. An ALPA map message is also recorded if LINK_EVENT verbose mode is set. Each ALPA map message contains 16 AL_PAs. Severity: Error Log: Always Action: If numerous link events are occurring, check the physical connections to the FC network.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1304: Link Up Event ALPA map A link up event was received. Data: (1) wd1, (2) wd2, (3) wd3, (4) wd4 Severity: Warning Log: LOG_LINK_EVENT verbose Action: If numerous link events are occurring, check the physical connections to the FC network.
1305: Link Down Event <eventTag> received A link down event was received. Data: (1) fc_eventTag (2) hba_state (3) fc_flag Severity: Error Log: Always Action: If numerous link events are occurring, check the physical connections to the FC network.
1306: Link Up Event in loop back mode x%x received Data: x%x x%x x%x x%x Link up notification; configured for loopback. Data: (1) fc_eventTag (2) granted_AL_PA (3) ULnkSpeed (4) alpa_map[0] Severity: Error Log: LOG_LINK_EVENT Action: None required.
1308: Menlo Maint Mode Link up Event x%x rcvd Data: x%x x%x x%x Link down notification; configured for loopback. Data: (1) fc_eventTag (2) port_state (3) vport fc_flag Severity: Error Log: LOG_LINK_EVENT Action: None required.
1309: Link Up Event npiv not supported in loop topology NPIV is not supported in loop topology. Data: None Severity: Error Log: LOG_LINK_EVENT Action: None required.
1310: Menlo Maint Mode Link up Event <eventTag> rcvd The link is up in maintenance mode; only management commands are allowed. Data: (1) fc_eventTag (2) port_state (3) vport fc_flag Severity: Error Log: LOG_LINK_EVENT Action: None required.
1312: Link Down Event <eventTag> received Maintenance mode link up notification received without entering link down. Data: (1) fc_eventTag (2) port_state (3) vport fc_flag Severity: Error Log: LOG_LINK_EVENT Action: None required.
1400: Failed to initialize sgl list. Failed to initialize SGL list during initialization. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1401: Failed to enable pci device. Failed to enable PCI device during initialization. Data: None Severity: Error Log: LOG_INIT Action: None required.
1402: Failed to set up pci memory space. PCI initialization failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
1403: Failed to set up driver resource. Driver resource initialization failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
1404: Failed to set up driver resource. Driver resource initialization failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
1405: Failed to initialize iocb list. Driver resource initialization failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
1406: Failed to set up driver resource. Initialization failed to set up driver resource. Data: None Severity: Error Log: LOG_INIT Action: None required.
1407: Failed to create scsi host. Initialization failed to create SCSI host. Data: None Severity: Error Log: LOG_INIT Action: None required.
1408: Failure HBA POST Status: sta_reg=0x%x, ""perr=x%x, sfi=x%x, nip=x%x, ipc=x%x, xrom=x%x, ""dl=x%x, pstatus=x%x\n", sta_reg.word0, bf_get(lpfc_hst_state_perr, &sta_reg), The HBA power-on self-test (POST) has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1409: Failed to enable pci device. Failed to enable PCI device during initialization. Data: None Severity: Error Log: LOG_INIT Action: None required.
1410: Failed to set up pci memory space. Initialization failed to set up PCI memory space. Data: None Severity: Error Log: LOG_INIT Action: None required.
1411: Failed to set up driver resource. Data: None Severity: Error Log: LOG_INIT Action: None required.
1412: Failed to set up driver resource. Initialization failed to set up driver resource. Data: None Severity: Error Log: LOG_INIT Action: None required.
1413: Failed to initialize iocb list. Initialization failed to initialize the IOCB list. Data: None Severity: Error Log: LOG_INIT Action: None required.
1414: Failed to set up driver resource. Initialization failed to set up driver resource. Data: None Severity: Error Log: LOG_INIT Action: None required.
1415: Failed to create scsi host. Initialization failed to create SCSI host. Data: None Severity: Error Log: LOG_INIT Action: None required.
1416: Failed to allocate sysfs attr Initialization failed to sysfs attribute. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1418: Invalid HBA PCI-device group: <dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.
1419: Invalid HBA PCI-device group: <dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.
1420: Invalid HBA PCI-device group:<dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.
1421: Failed to set up hba Initialization failed to set up the HBA. Data: None Severity: Error Log: LOG_INIT Action: None required.
1422: HBA Unrecoverable error: uerr_lo_reg=<ue lo>, uerr_hi_reg=<ue hi>, online0_reg=<Online0>, online1_reg=<Online1> The HBA has notified the driver that it has encountered an unrecoverable error. Data: None Severity: Error Log: LOG_INIT Action: A dump from the Emulex OneCommand CNA Manager application should be taken. Then, the driver should be unloaded and reloaded.
1423: HBA Unrecoverable error: uerr_lo_reg=<ue lo>, uerr_hi_reg=<ue hi>, online0_reg=<Online0>, online1_reg=<Online1> The HBA has notified the driver that it has encountered an unrecoverable error. Data: None Severity: Error Log: LOG_INIT Action: A dump from the Emulex OneCommand CNA Manager application should be taken. Then, the driver should be unloaded and reloaded.
1424: Invalid PCI device group:<pci_dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1425: Invalid PCI device group: <pci_dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.
1426: Invalid PCI device group: <pci_dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.
1427: Invalid PCI device group: <pci_dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.
1428: Invalid PCI device group: <pci_dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.
1429: Invalid PCI device group: <pci_dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.
1430: Failed to initialize sql list Failed to initialize SQL list. Data: None Severity: Error Log: LOG_INIT Action: None required.
1431: Invalid HBA PCI-device group: <pci_dev_grp> Invalid HBA PCI-device group detected. Data: None Severity: Error Log: LOG_INIT Action: None required.
1432: Failed to initialize rpi headers. Failed to initialize RPI headers. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1476: Failed to allocate sysfs attr Failed to allocate sysfs attrIbutes. Data: None Severity: Error Log: LOG_INIT Action: None required.
1477: Failed to set up hba Failed to set up the HBA. Data: None Severity: Error Log: LOG_INIT Action: None required.
1603: Loopback test did not receive expected data length. actual length <len>expected length <full_size>. The loopback test did not receive the same amount of data that it transmitted. Data: None Severity: Error Log: LOG_LIBDFC Action: None required.
1800: Could not issue unreg_vpi Driver attempt to unregister VPI failed. Data: None Severity: Error Log: LOG_VPORT verbose Action: Software driver error. If this issue persists, report these errors to Broadcom Technical Support.
1801: Create vport work array FAILED: cannot do scsi_host_get The driver was unable to get a reference to a SCSI host. Data: None Severity: Warning Log: LOG_VPORT verbose Action: Software driver warning. If this issue persists, report these errors to Broadcom Technical Support.
1816: FLOGI NPIV supported, response data <port> The fabric reports support for NPIV upon FLOGI. Data: (1) response_multiple_NPort Severity: Warning Log: LOG_VPORT verbose Action: No action needed, informational.
1817: Fabric does not support NPIV - configuring single port mode The fabric reports no support for NPIV upon FLOGI. Data: None Severity: Warning Log: LOG_VPORT verbose Action: No action needed, informational.
1818: VPort failed init, mbxCmd <mailbox command> READ_SPARM mbxStatus <mailbox status> , rc = <status> A pending mailbox command that was issued to initialize the port failed. Data: (1) mbxCommand (2) mbxStatus (3) rc Severity: Error Log: LOG_VPORT verbose Action: Software driver error. If this issue persists, report these errors to Broadcom Technical Support.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1819: Unrecognized lpfc_sli_mode parameter: <mode> An attempt was made to set the SLI mode to an invalid value. The valid values for the SLI mode are 0, 2, and 3. Data: (1) lpfc_sli_mode Severity: Error Log: LOG_VPORT verbose Action: The lpfc_sli_mode driver parameter setting must be corrected. Valid values are 0, 2, and 3.
1820: Unable to select SLI-3. Not supported by adapter. The HBA is incapable of operating in a given mode. Data: None Severity: Error Log: LOG_VPORT verbose Action: SLI-3 mode is only available on some HBAs. Do not attempt to force the SLI mode to 3 on HBAs that do not support SLI-3 mode. This is an informational message. HBAs that do not support SLI-3 will be configured to run in SLI-2 mode, but it is recommended to use the auto setting (0).
1821: Create VPORT failed. Invalid WWN format The port could not be created due to an invalid WWNN or WWPN format. Data: None Severity: Error Log: LOG_VPORT verbose Action: Provide a valid WWN when creating Vports.
1822: Invalid <name>: <xx: xx: xx: xx: xx: xx: xx: xx> An invalid WWN was used when creating a VPort. Data: (1) type_name (2) wwn[1] (3) wwn[3] (3) wwn[5] (4) wwn[7] Severity: Error Log: LOG_VPORT verbose Action: When creating a VPort you must furnish a valid WWN.
1823: Create VPORT failed. Duplicate WWN on HBA. The port could not be created because it would duplicate an existing WWNN HBA address. The resources for the port had to be discarded. Data: None Severity: Error Log: LOG_VPORT verbose Action: Provide a WWN that is unique.
1824: NPIV enabled: Override lpfc_sli_mode parameter (<mode>) to auto(0) The lpfc_enable_npiv and lpfc_sli_mode driver parameter settings conflict. The HBA must be configured for SLI-3 mode to support NPIV. Data: (1) lpfc_sli_mode Severity: Error Log: LOG_VPORT verbose Action: This is an informational message that indicates that the lpfc_enable_npiv and lpfc_sli_mode parameter settings are not compatible. Resolve the parameter conflict by setting the SLI mode to 0 or 3 or, if SLI-2 mode is required then disable NPIV.
1825: Vport Created. This message is displayed to indicate that a port was created in the system. It is displayed at this level to ensure it is always appears at all log levels. Data: None Severity: Error Log: LOG_VPORT verbose Action: No action, informational.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1826: Vport Disabled. The port had to be disabled in the system. Data: None Severity: Error Log: LOG_VPORT verbose Action: No action, informational.
1827: Vport Enabled The port had to be enabled after possible recovery from some errors. Data: None Severity: Error Log: LOG_VPORT verbose Action: No action, informational.
1828: Vport Deleted A Vport was deleted. Data: None Severity: Error Log: LOG_VPORT verbose Action: No action, informational.
1829: CT command failed to delete objects on fabric. A command issued to the fabric to delete an associated resource for an object, such as for a port, failed. Data: None Severity: Error Log: LOG_VPORT verbose Action: Software driver error. If this issue persists, report these errors to Broadcom Technical Support.
1830: Signal aborted mbxCmd <command> A pending mailbox command was aborted because the thread received a signal. Data: None Severity: Error Log: LOG_VPORT verbose Action: You should retry the attempted command.
1831: Create VPORT Interrupted The port creation process was unexpectedly interrupted at a critical time and the operation was unsuccessful. Data: None Severity: Error Log: LOG_VPORT verbose Action: The process was interrupted while creating a VPort. Retry the command.
1832: No pending MBOX command to handle Data: None Severity: Error Log: LOG_MBOX Action: None required.
1835: Vport discovery quiesce failed: state <port_state> fc_flags <fc_flag> wait msecs <jiffies_to_msecs(jiffies - start_time)> Could not pause discovery on this VPort. Data: None Severity: Error Log: LOG_VPORT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

1836: Could not issue unreg_login(all_rpis) status <rc> The unreg_login cannot be issued. Data: None Severity: Error Log: LOG_MBOX, LOG_VPORT Action: None required.
1837: Vport_delete failed: Cannot delete static vport Static VPorts cannot be deleted. Data: None Severity: Error Log: LOG_VPORT Action: None required.
1838: Failed to INIT_VPI on vpi <vpi> status <rc> Failed to INIT_VPI. Data: None Severity: Error Log: LOG_VPORT Action: None required.
2000: Failed to allocate mbox for read_FCF cmd Failed to allocate mailbox for READ_FCF command. Data: None Severity: Error Log: LOG_INIT Action: None required.
2001: Unable to allocate memory for issuing SLI_CONFIG_SPECIAL mailbox command Unable to allocate memory for issuing the SLI_CONFIG_SPECIAL mailbox command. Data: None Severity: Error Log: LOG_SLI Action: None required.
2002: Error Could not grow rpi count An error occurred because the RPI count could not be increased. Data: None Severity: Error Log: LOG_SLI Action: None required.
2004: Failed to allocate XRI.last XRITAG is <XRI> Max XRI is <MAX_XRI>, Used XRI is <USED_XRI>. All XRIs are in use. Data: None Severity: Warning Log: LOG_SLI Action: None required.
2005: Unable to deregister pages from HBA: <rc> The SGL pages could not be unregistered from the firmware. Data: None Severity: Error Log: LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2007: Only Limited Edition cmd Format supported <iocb.ulpCommand> The SGL pages could not be unregistered from the firmware. Data: None Severity: Error Log: LOG_SLI Action: None required.
2008: Error <rc> posting all rpi headers The RPI headers could not be posted to the firmware. Data: None Severity: Error Log: LOG_SLI Action: None required.
2009: Failed to allocate mbox for ADD_FCF cmd Failed to allocate mailbox for ADD_FCF command. Data: None Severity: Error Log: LOG_INIT Action: None required.
2010: Resume RPI Mailbox failed status <status>, mbxStatus <mbx status> Data: None Severity: Error Log: LOG_SLI Action: None required.
2011: Unable to allocate memory for issuing SLI_CONFIG_SPECIAL mailbox command Data: None Severity: Error Log: LOG_SLI Action: None required.
2012: Mailbox failed , mbxCmd <mbx_cmd> READ_CONFIG, mbxStatus <mbx status> The READ_CONFIG mailbox command failed. Data: None Severity: Error Log: LOG_SLI Action: None required.
2013: Could not manually add FCF record 0, status <rc> Could not add Fibre Channel over Ethernet Forwarder (FCF) record to the FCF list. Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2014: Invalid command <iocb.ulpCommand> The IOCB command is invalid. Data: None Severity: Error Log: LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2015: Invalid CT %x command <iocb.ulpCommand> Invalid Command-Type in the IOCB is not supported. Data: None Severity: Error Log: LOG_SLI Action: None required.
2017: REG_FCFI mbxStatus error <mbx status> HBA state <port_state> The REG_FCFI mailbox command has failed. Data: None Severity: Error Log: LOG_MBOX Action: None required.
2018: REG_VFI mbxStatus error <mbx status> HBA state <port_state> The REG_VFI mailbox command has failed. Data: None Severity: Error Log: LOG_MBOX Action: None required.
2020: Failed to allocate mbox for ADD_FCF cmd Failed to allocate mailbox for ADD_FCF command. Data: None Severity: Error Log: LOG_INIT Action: None required.
2022: VPI Mailbox failed status <status>, mbxStatus <mbxStatus> The INIT VPI mailbox command has failed. Data: None Severity: Error Log: LOG_SLI Action: None required.
2401: Failed to allocate memory for ELS XRI management array of size <els_xri_cnt>. Initialization failed to allocate memory for the ELS XRI management array. Data: None Severity: Error Log: LOG_SLI Action: None required.
2500: EQ_CREATE mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to create the event queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2501: CQ_CREATE mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to create the completion queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2502: MQ_CREATE mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to create the mailbox queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2503: WWQ_CREATE mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to create the work queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2504: RQ_CREATE mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to create the receive queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2505: EQ_DESTROY mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to delete the event queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2506: CQ_DESTROY mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to delete the completion queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2507: MQ_DESTROY mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to delete the mailbox queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2508: WQ_DESTROY mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to delete the work queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2509: RQ_DESTROY mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to delete the work queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2510: RQ_DESTROY mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to delete the work queue has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2511: POST_SGL mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc>n The mailbox command sent to post the SGL pages to the firmware has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2512: REMOVE_ALL_SGL_PAGES mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to delete the SGL pages from the firmware has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2513: POST_SGL_BLOCK mailbox command failed status <shdr_status> add_status <shdr_add_status> mbx status <rc> The mailbox command sent to post the SGL pages to the firmware has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2514: POST_RPI_HDR mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx status <rc> The mailbox command sent to post the RPUI header pages to the firmware has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2515: ADD_FCF_RECORD mailbox failed with status <rc> The mailbox command to add the FCF record has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2516: DEL FCF of default FCF Index failed mbx status <rc>, status <shdr_status> add_status<shdr_add_status> The mailbox command to delete the FCF record has failed. Data: None Severity: Error Log: LOG_SLI Action: None required.
2517: Unregister FCFI command failed status %d, mbxStatus x%x", rc, bf_get(lpfc_mqe_status, &mbox->u.mqe) The driver was unable to unregister the Fibre Channel Forwarder Indicator (FCFI) from the firmware. Data: None Severity: Error Log: LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2518: Requested to send 0 NOP mailbox cmd Data: None Severity: Warning Log: LOG_INIT Action: None required.
2519: Unable to allocate memory for NOP mailbox command Memory allocation for this mailbox command has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2520: NOP mailbox command failed status x%x add_status x%x mbx status x%x, shdr_status, shdr_add_status, rc. The NOP mailbox command has failed. Data: None Severity: Warning Log: LOG_INIT Action: None required.
2521: READ_FCF_RECORD mailbox failed with status <shdr_status> add_status <shdr_add_status>, mbx The READ_FCF_RECORD mailbox command failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2523: Allocated DMA memory size (<alloc_len>) is less than the requested DMA memory size (<req_len>) The ADD_FCF_RECORD mailbox command failed to retrieve the length required from the firmware. Data: None Severity: Error Log: LOG_INIT Action: None required.
2524: Failed to get the non-embedded SGE virtual address The READ_FCF_RECORD mailbox command could not retrieve the Oracle (formerly Sun) grid engine (SGE) that was requested. Data: None Severity: Error Log: LOG_MBOX Action: None required.
2527: Failed to allocate non-embedded SGE array. Failed to allocate the non-embedded SGE array. Data: None Severity: Error Log: LOG_MBOX Action: None required.
2528: Mailbox command <vpi> cannot issue The mailbox command could not be issued because the mailbox interrupt is disabled. Data: (1) mbxCommand (2) sli_flag (3) flag Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2529: Mailbox command <vpi> cannot issue Data: (1) mbxCommand (2) sli_flag (3) flag Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2530: Mailbox command <vpi> cannot issue The SLI layer in the driver is inactive. Data: (1) mb.mbxCommand (2) sli_flag (3) flag Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2531: Mailbox command <cpi> cannot issue Data: (1) mb.mbxCommand (2) sli_flag (3) flag Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2532: Mailbox command <vpi> (<mbxCommand>) cannot issue The mailbox bootstrap code detected that the SLI layer is active. Data: (1) sli4_mbox_opcode (2) sli_flag,(3) MBX_POLL Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2533: Mailbox command <vpi> (<mbxCommand>) cannot issue Data: (1) sli4_mbox_opcode (2) sli_flag (3) MBX_NOWAIT Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2535: Unsupported RQ count. (<entry_count>) The receive queue ring can only be 512, 1024, 2048, or 4096. Data: None Severity: Error Log: LOG_SLI Action: None required.
2536: Unsupported RQ count. (<entry_count>) The receive queue ring can only be 512, 1024, 2048, or 4096. Data: None Severity: Error Log: LOG_SLI Action: None required.
2537: Receive Frame Truncated! The receive unsolicited handler detected a truncated frame. Data: None Severity: Error Log: LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2539: Dropped frame rctl:%s type:%s\n An unsupported frame was received by the port and dropped. Data: (1) rctl_names[fc_hdr->fh_r_ctl], (2) type_names[fc_hdr->fh_type] Severity: Error Log: Always Action: No action needed, informational.
2540: Ring <ring #> handler: unexpected Rctl <fh_rctl> Type <fh_type> The received frame has an unsupported RCTL or FH_TYPE. Data: None Severity: Warning Log: LOG_SLI Action: None required.
2541: Mailbox command <vpi> (<mbxCommand>) cannot issue Data: (1) sli_mbox_opcode (2) sli_flag (3) flag Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2542: Try to issue mailbox command <vpi> (<mbxCommand>) synchronously ahead of async mailbox command queue Attempting to send a synchronous mailbox command ahead of the asynchronous mailbox commands. Data: (1) sli4_mbx_opcode or sli_mbox_opcode, (2) sli_flag, (3) flag Severity: Warning Log: LOG_MBOX, LOG_SLI Action: None required.
2543: Mailbox command <vpi> (<mbxCommand>) cannot issue The mailbox command does not have all of the fields set correctly. Data: (1) sli_mbox_opcode (2) sli_flag (3) flag Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2544: Mailbox command <vpi> (<mbxCommand>) cannot issue The HBA cannot be accessed on the PCI bus. Data: (1) sli_mbox_opcode (2) sli_flag (3) flag Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2546: New FCF found index <index> tag <event_tag> A new FCF has been found. Data: None Severity: Error Log: LOG_DISCOVERY Action: None required.
2547: Read FCF record failed Could not read the FCF record from the firmware. Data: None Severity: Error Log: LOG_DISCOVERY Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2548: FCF Table full count <count> tag <event_tag> The FCF table is full. Data: None Severity: Error Log: LOG_SLI Action: None required.
2549: FCF disconnected from network index <index> tag <event_tag> The FCF has disconnected from the network. Data: None Severity: Error Log: LOG_DISCOVERY Action: None required.
2550: UNREG_FCFI mbxStatus error <u.mb.mbxStatus> HBA state <port_state>. The UNREG_FCFI mailbox command has failed. Data: None Severity: Error Log: LOG_DISCOVERY. LOG_MBOX Action: None required.
2551: UNREG_FCFI mbox allocation failed HBA state <port_state> The allocation for the UNREG_FCFI mailbox command has failed. Data: None Severity: Error Log: LOG_DISCOVERY, LOG_MBOX Action: None required.
2552: UNREG_FCFI issue mbox failed rc <rc> HBA state <port_state>. The UNREG_FCFI mailbox command has failed. Data: None Severity: Error Log: LOG_DISCOVERY, LOG_MBOX Action: None required.
2553: lpfc_unregister_unused_fcf failed to read FCF record HBA state. Data: None Severity: Error Log: LOG_DISCOVERY, LOG_MBOX Action: None required.
2554: Could not allocate memory for fcf record Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2555: UNREG_VFI mbxStatus error <u.mb.mbxStatus> HBA state <port_state> The UNREG_VFI mailbox command has failed. Data: None Severity: Error Log: LOG_DISCOVERY, LOG_MBOX Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2556: UNREG_VFI mbox allocation failed HBA state <port_state> Could not allocate memory for UNREG_VFI mailbox command. Data: None Severity: Error Log: LOG_DISCOVERY, LOG_MBOX Action: None required.
2557: UNREG_VFI issue mbox failed rc <rc> HBA state <port_state> Could not issue the UNREG_VFI mailbox command. Data: None Severity: Error Log: LOG_DISCOVERY, LOG_MBOX Action: None required.
2558: ADD_FCF_RECORD mailbox failed with status<shdr_status> add_status <shdr_add_status> The ADD_FCF_RECORD mailbox command has failed. Data: None Severity: Error Log: LOG_INIT Action: None required.
2559: Block sgl registration required DMA size <reqlen> great than a page. Attempting to register more SGEs with the firmware than can fit in a page. Data: None Severity: Warning Log: LOG_INIT Action: None required.
2560: Failed to allocate mbox cmd memory\n Failed to allocate mailbox command memory. Data: None Severity: Error Log: LOG_INIT Action: None required.
2561: Allocated DMA memory size (<alloclen>) is less than the requested DMA memory size (<reqlen>) Could not get the memory required for the number of XRIs that are attempting to be posted. Data: None Severity: Error Log: LOG_INIT Action: None required.
2562: No room left for SCSI XRI allocation max_xri=<sli4_hba.max_cfg_param.max_xri>, els_xri=<els_xri_cnt>n The number of allocated XRIs has reached the max_xri value. Data: None Severity: Error Log: LOG_SLI Action: None required.
2563: Failed to allocate memory for SCSI XRI management array of size <sli4_hba.scsi_xri_max>. Initialization could not allocate memory to hold the XRIs. Data: None Severity: Error Log: LOG_SLI Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2564: POST_SGL_BLOCK mailbox command failed status <shdr_status> add_status <shdr_add_status> mbx status <rc> The list of XRI SGEs failed to be registered with the firmware. Data: None Severity: Error Log: LOG_SLI Action: None required.
2566: Failed to allocate table entry Failed to allocate connection table entry. Data: None Severity: Error Log: LOG_INIT Action: None required.
2567: Config region 23 has bad signature The driver was unable to read Config Region 23 because it has an invalid signature. Data: None Severity: Error Log: LOG_INIT Action: None required.
2568: Config region 23 has bad version The driver was unable to read Config Region 23 because it is an invalid version. Data: None Severity: Error Log: LOG_INIT Action: None required.
2569: lpfc_dump_fcoe_param: memory allocation failed Memory allocation has failed. Data: None Severity: Warning Log: LOG_MBOX Action: None required
2570: Failed to read FCoE parameters The driver failed to read FCoE parameters. Data: None Severity: Error Log: LOG_MBOX, LOG_INIT Action: None required.
2572: Failed allocate memory for fast-path per-EQ handle array Failed to allocate memory for the fast-path per-EQ handle array. Data: None Severity: Error Log: LOG_INIT Action: None required.
2573: Failed allocate memory for msi-x interrupt vector entries The driver was unable to allocate memory during initialization of the MSI-X interrupt array. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2574: Not enough EQs (<sli4_hba.max_cfg_param.max_eq>) from the pci function for supporting FCP EQs (<cfg_fcp_eq_count>) Failed to create the minimum fast-path event queues. Data: None Severity: Error Log: LOG_INIT Action: None required.
2575: Not enough EQs (<max_eq>) from the pci function for supporting the requested FCP EQs (<cfg_fcp_eq_count>), the actual FCP EQs can be supported: <eq_count> The driver was not configured with enough fast-path event queues. Data: None Severity: Warning Log: LOG_INIT Action: None required.
2576: Failed allocate memory for fast-path EQ record array Failed to allocate memory for the fast-path EQ record array. Data: None Severity: Error Log: LOG_INIT Action: None required.
2577: Failed allocate memory for fast-path CQ record array Failed to allocate memory for the fast-path EQ record array. Data: None Severity: Error Log: LOG_INIT Action: None required.
2578: Failed allocate memory for fast-path WQ record array Failed to allocate memory for the fast-path EQ record array. Data: None Severity: Error Log: LOG_INIT Action: None required.
2579: Slow-path wqe consume event carries miss-matched qid: wcqe-qid=<wcqe_quid>, sp-qid=<sp_quid> The consumed entry does not have the slow path's queueID. Data: None Severity: Warning Log: LOG_SLI Action: None required.
2580: Fast-path wqe consume event carries miss-matched qid: wcqe-qid=<fcp_wqid>. The consumed entry does not have the fast path's queueID. Data: None Severity: Warning Log: LOG_SLI Action: None required.
2581: Not enough WQs (<sli4_hba.max_cfg_param.max_wq>) from the pci function for supporting FCP WQs (<cfg_fcp_wq_count>) The driver was not configured with the minimum number of fast-path work queues. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2582: Not enough WQs (<max_wq>) from the pci function for supporting the requested FCP WQs (<cfg_wq_count>), the actual FCP WQs can be supported: <wq_count> The driver was not configured with enough fast-path work queues. Data: None Severity: Warning Log: LOG_INIT Action: None required.
2593: The FCP EQ count(<cfg_fcp_eq_count>) cannot be greater than the FCP WQ count(<cfg_fcp_wq_count>), limiting the FCP EQ count to <cfg_fcp_wq_count> The fast-path event queue cannot be greater than the fast-path work queue count. Data: None Severity: Warning Log: LOG_INIT Action: None required.
2597: Mailbox command <vpi> (<mbxCommand>) cannot issue Synchronou(2) sli_flag (3) flag Data: None Severity: Error Log: LOG_MBOX, LOG_SLI Action: None required.
2598: Adapter Link is disabled. The adapter link has been disabled. Data: None Severity: Error Log: LOG_INIT Action: None required.
2599: Adapter failed to issue DOWN_LINK mbox command rc <rc> The driver was unable to issue the DOWN_LINK mailbox command. Data: None Severity: Error Log: LOG_INIT Action: None required.
2600: lpfc_sli_read_serdes_param failed to allocate mailbox memory Failed to allocate mailbox memory. Data: None Severity: Error Log: LOG_INIT Action: None required.
2605: lpfc_dump_static_vport: memory allocation failed Failed to allocate mailbox memory. Data: None Severity: Error Log: LOG_MBOX Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2606: No NPIV Fabric support No NPIV fabric support. Data: None Severity: Error Log: LOG_ELS Action: None required.
2607: Failed to allocate init_vpi mailbox Failed to allocate the INIT_VPI mailbox command. Data: None Severity: Error Log: LOG_MBOX Action: None required.
2608: Failed to issue Init VPI mailbox The driver was unable to send an INIT_VPI mailbox command. Data: None Severity: Error Log: LOG_MBOX Action: None required.
2609: Init VPI mailbox failed <u.mb.mbxStatus> The INIT_VPI mailbox command failed. Data: None Severity: Error Log: LOG_MBOX Action: None required.
2610: UNREG_FCFI mbox allocation failed Failed to allocate mailbox memory. Data: None Severity: Error Log: LOG_DISCOVERY, LOG_MBOX Action: None required.
2611: UNREG_FCFI issue mbox failed Could not issue the UNREG_FCFI mailbox command. Data: None Severity: Error Log: LOG_DISCOVERY, LOG_MBOX Action: None required.
2619: Config region 23 has bad signature Configuration region 23 has an invalid signature. Data: None Severity: Error Log: LOG_INIT Action: None required.
2620: Config region 23 has bad version Configuration region 23 has an invalid version. Data: None Severity: Error Log: LOG_INIT Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2621: Failed to allocate mbox for query firmware config cmd Failed to allocate mailbox memory. Data: None Severity: Error Log: LOG_INIT Action: None required.
2622: Query Firmware Config failed mbx status <rc>, status <shdr_status> add_status <shdr_add_status> Could not read the firmware configuration. Data: None Severity: Error Log: LOG_SLI Action: None required.
2623: FCoE Function not supported by firmware. Function mode = <function_mode>> FCoE is not supported by this firmware. Data: None Severity: Error Log: LOG_SLI Action: Use the Emulex OneCommand CNA Manager application to update to the latest firmware.
2707: Ring <Ring#> handler: Failed to allocate iocb Rctl <fh_rctl> Type <fh_type> received The driver was unable to allocate memory to send a query config mailbox command. Data: None Severity: Error Log: LOG_SLI Action: None required.
2717: CT context array entry [<index>] over-run: oxid:<fh_ox_id>, sid:<fh_SID> All of the array slots to hold buffers that are passed to the application are in use. Data: None Severity: Warning Log: LOG_ELS Action: None required.
2718: Clear Virtual Link Received for VPI <index> tag <event_tag> A Clear virtual link was received from the fabric for this VPI. Data: None Severity: Error Log: LOG_DISCOVERY Action: None required.

Table 12 FCoE Error Log Messages and their Descriptions (Continued)

2719: Invalid response length: tgt <TGT_ID> lun <LUN> cmnd <CMD> rsplen <RSPLEN> The response length for this FCP command is not supported. Data: None Severity: Error Log: LOG_FCP Action: None required.
2721: ndlp null for oxid %x SID %x\n, icmd->ulpContext, dfchba->ct_ctx[tag].SID); The Node value for this SID is not in the node list. Data: None Severity: Warning Log: LOG_ELS Action: None required.
2726: READ_FCF_RECORD Indicates empty FCF table The driver requested the firmware provide a list of FCF entries to connect to and the firmware responded that the FCF table is empty. Data: None Severity: Error Log: LOG_INIT Action: None required.

4.5.2 Ethernet Driver Log Messages

The following section describes how to retrieve and interpret Ethernet log messages.

4.5.2.1 Retrieving Ethernet Driver Log Messages

Ethernet driver messages are logged in the `/var/log/messages` file. This log file is an ASCII text file and can be viewed and searched with a text editor, such as vim. A log file automatically rotates as it gets larger. Rotated log files are named `messages.`*x*, where *x* is an integer.

To search the log file for error messages, at the command prompt, type:

```
# cd /var/log
# vim messages
```

A message is displayed similar to the following:

```
Aug 15 09:57:48 S74 kernel: Invalid MTU requested. Must be between 256 and
8974 bytes
```

4.5.2.2 Ethernet Driver Log Messages and their Descriptions

When reporting an issue with the adapter, check the kernel message log using the `dmesg` command or the `/var/log/messages` file, and report any of these entries that may be present.

There are three types of Ethernet log messages: error, information, and warning.

Ethernet driver warning messages logged by an adapter start with `be2net <BID>`, where <*BID*> is the PCI bus identifier string. For example:

```
be2net 0000:0d:00.1: MTU must be between 256 and 9000 bytes.
```

NOTE In the following table, <*D*>, <*DD*>, or <*DDD*> refers to decimal values that appear in the log messages, and <*S*> refers to strings.

Table 13 Ethernet Driver Log Messages of Type

Ethernet Log Message	Description	Type
`<S> initialization failed`	Initialization of the adapter or allocation of a resource for initializing the driver failed. In most cases, this message is accompanied by a more specific error message. Try rebooting the system after power cycling. If the issue persists, this could be a symptom of a hardware issue or corrupted firmware.	Error
`<S>: Physical link <S>`	This informational message is about a change in physical link status.	Information
`Adapter busy, could not reset FW. Reboot server to activate new FW`	After flashing firmware on the adapter, the adapter is busy activating the new firmware. Reboot the machine for the new firmware to be active.	Error
`Cannot set rx filter flags <XX>` `Interface is capable of <XX> flags only`	Failed to change RX filter settings on an interface as requested, as interface does not have the capability.	Warning
`Could not create sysfs group`	The creation of the `flash_fw` entry under the `/sys/class/net/eth`<*x*> failed. The driver is fully functional, but you cannot install later firmware versions on the adapter.	Error
`Failed to enable VLAN promiscuous mode`	The firmware command failed to enable VLAN promiscuous mode.	Error
`Could not enable Wake-on-lan`	Enabling Wake-on-LAN on the adapter failed.	Error
`Could not get CRC for <DD> region`	The driver could not get enough information from the adapter to decide whether a region from a firmware image should be flashed. The driver skips updating this section. This is a very unlikely error.	Error
`Could not get <DD> MSI-x vector(s)` `Using <DD> vector(s)`	Enabled only a subset of MSI-x vectors was requested.	Information
`Could not set PCI DMA Mask`	The operating system call to set the DMA mask failed.	Error
`created <DD> RX queue(s)`	An informational message logging the number of receive rings was created.	Information
`created <DD> TX queue(s)`	An informational message logging number of transmit rings created.	Information
`<DD> VFs are already enabled`	When unloading the driver while a VF is still assigned to the VM, the VFs remain enabled. When the driver is reloaded, this message is logged and indicates the number of VFs that are enabled and active.	Information
`Debug data event - <DDDD>,` `<DDDD>, <DDDD>, <DDDD>`	Firmware generates these log messages to identify certain infrequent hardware and firmware events and aid further analysis if required. These messages by themselves are not indicative of any problem. Data from these logs might help Broadcom troubleshoot other problems, if any, that are observed along with these messages.	Information
`enabled <D> (out of <DD>) MSI-x vector(s) for NIC`	The number of MSI-x vectors enabled for the NIC function.	Information
`Enable VLAN promiscuous mode` `Disabling VLAN promiscuous mode`	This informational log message occurs when the driver enables or disables VLAN promiscuous mode.	Information

Table 13 Ethernet Driver Log Messages of Type (Continued)

Ethernet Log Message	Description	Type

`Error detected in the card`
`ERR: sliport status <DDDDDD>`
`ERR: sliport error1 <DDDDDD>`
`ERR: sliport error2 <DDDDDD>`
	An SLIPORT error is detected in the adapter, followed by status and error messages.	Error

`Error in mapping PCI BARs`	Initialization of the adapter failed due to an error while mapping PCI BARs.	Error
`Failed to optimize SR-IOV resources`	When the adapter is in SRIOV capable configuration, the driver failed to redistribute the PF-pool resources among the PF and requested number of VFs.	Error
`FW config: function_mode=<DD>, function_caps=<DD>`	This message indicates the function mode and function capabilities set on the adapter during initialization.	Information
`FW dump deleted successfully`	The previously generated firmware (FW) dump is successfully deleted.	Information
`FW dump initiated successfully`	FW dump is successfully initiated on the adapter.	Information
`FW dump not generated`	Failed to initiate FW dump on the adapter.	Error
`Firmware flashed successfully`	This informational message states that the firmware on the adapter has been updated.	Information
`Firmware load error`	Updating the adapter with new firmware failed. Usually this message is accompanied by a detailed message on the failure.	Error
`Firmware load not allowed (interface is down)`	Flashing firmware failed because the status of the interface is down.	Error
`Firmware update in progress`	A firmware update is in progress on the adapter.	Information
`Flash incomplete. Reset the server` `Download FW image again after reset`	A firmware is older than version 10.0.*xx.xxx* is upgraded to a newer version on an OCe14000-series adapter, reboot the server and flash the firmware a second time.	Error
`Flashing firmware file <filename>`	This informational message states that the firmware in the adapter is being updated with the firmware image in the indicated file.	Information
`Flashing section type <DD> failed`	The driver could not get enough information from the FW UFI image to flash a section in the UFI image, after which the FW download will be aborted.	Error
`FW image size should be multiple of 4`	The FW UFI image size is invalid. Download the correct FW image and try again.	Error
`FW version is <DD.DD.DDD.DDD>`	This is an informational log to log the FW version loaded on the adapter.	Information
`INTx request IRQ failed – err <DDD>`	The request for INTx interrupt registration failed. The driver is nonfunctional if the INTx interrupt cannot be registered.	Error
`Invalid Cookie. FW image may be corrupted`	The firmware image under `/lib/firmware/<`*`filename`*`>` does not have the expected cookie. The firmware in this file will not be flashed. Copy the proper file and try flashing again.	Error
`Invalid digital signature`	Updating the adapter with new firmware failed. The firmware image being updated does not have a valid digital signature.	Error
`invalid mailbox completion`	The driver received an unexpected completion status for a firmware command.	Error

Table 13 Ethernet Driver Log Messages of Type (Continued)

Ethernet Log Message	Description	Type
`Link down event type: <DD>`	The reason that the application-specific integrated circuit (ASIC) signaled the link status as down. Possible values are: ■ 0 = Link down due to reasons other than those listed here. ■ 1 = Link down caused by Dynamic Control channel protocol. ■ 3 = Link down triggered by Virtual NIC configuration (for example, a zero bandwidth is assigned to a VNIC). ■ 4 = Link down caused by Ethernet Pause frame flooding. ■ 5 = Link down due to physical thermal temperature going up.	Information
`Link down/Link up`	This is an informational message about a change in link status.	Information
`LPVID <DD>`	VLAN filter is configured in BIOS in multichannel configuration.	Information
`Mac address assignment failed for VF <DD>` `MAC <S>M set on VF <DD> Failed`	Firmware command fails to add a MAC address to a virtual function during initialization, or when requested.	Error
`MAC address change to <S> failed`	Failed to change to new MAC address as requested.	Warning
`Mac hash table alloc failed`	Hash table to remember learned MAC addresses could not be allocated.	Error
`Max: txqs <DD>, rxqs <DD>, rss <DD>, eqs <DD>, vfs <DD>` `Max: uc-macs <DD> , mc-macs <DD>, vlans <DD>`	An information message logging maximum resources available to the function. TX rings, RX rings, RX rings with RSS capability, number of VFs supported, unicast MACs, multicast MACs and VLAN filters, respectively.	Information
`Memory allocation failure`	The driver could not allocate the memory required for the requested operation.	Error
`Memory allocation failure during GET_MAC_LIST`	Failed to allocate memory to issue GET_MAC_LIST FW command.	Error
`Missing digital signature`	Updating the adapter with new firmware failed. The firmware image being updated does not have a digital signature.	Error
`Module param rx_frag_size must be 2048/4096/8192.` `Using 2048`	An unsupported receive buffer size was passed for the rx_frag_size module parameter. The driver ignores the specified value and uses the default RX buffer size of 2048.	Warning
`MSIx enable failed`	Request for enabling MSIx interrupts registration failed. Driver will then use INTx interrupts.	Warning
`MAC address changed to <S>`	MAC address is changed successfully as requested.	Information
`MSIX request IRQ failed –err <DDD>`	The request for MSI-X interrupt registration failed. The driver will use INTx interrupts.	Warning
`MTU changed from <DDD> to <DDD> bytes`	This is an informational message that the MTU value changed as requested.	Information
`MTU must be between 256 and 9000 bytes`	Request to change the MTU was issued with an invalid MTU value. The request failed and MTU will not be changed.	Warning
`opcode <DDD>-<D> failed: status <DD>-<DD>`	A firmware command with opcode failed with the indicated status code and extended status code.	Error
`PCIe error reporting enabled`	PCIe error reporting is successfully enabled on this function.	Information
`POST timeout; stage=<DD>`	The power-on self test of the adapter failed. This is an indication of a hardware or firmware issue. Try rebooting the system after a reset.	Error
`Previous dump not cleared, not forcing dump`	Initiating dump on the adapter failed, as previous dump is present. Clear the previous dump (Using `ethtool -W eth<x> 2` command) before initiating new dump.	Error
`queue_setup failed`	Firmware command failed to create requested number of queues.	Error
`Setting HW VLAN filtering failed`	Adding a VLAN filter to HW failed.	Error

Table 13 Ethernet Driver Log Messages of Type (Continued)

Ethernet Log Message	Description	Type
SRIOV enable failed	Could not enable SRIOV since the call to enable SRIOV failed.	Error
TX-rate must be between 100 and <DDDD> Mbps	Request to change transmission rate was issued with an invalid TX rate value. Request failed and speed will not be changed.	Error
TX-rate must be a multiple of <DDD> Mbps	Transmission rate on a virtual function should be given as multiples of %1Mb/s of link speed.	Error
TX-rate setting not allowed when link is down	Transmission rate on a virtual function cannot be modified when physical link is down.	Error
Tx-rate setting of <DDD>Mbps on VF<DD> failed : <DDD>	Firmware command failed to change transmission rate as requested.	Error
txq<D>: cleaning <D> pending tx-wrbs	The driver did not get completions for some transmit requests from the adapter while unloading the driver. This usually indicates an issue with the adapter.	Error
Flash image is not compatible with adapter	Requested UFI image is not compatible with the chip on which the flash was requested.	Error
Unknown debug event <DD>	Other than QNQ type debug event, driver logs as unknown for other asynchronous debug events received.	Warning
Unqualified SFP+ detected on <D> from <S> part no: <S>	The SFP module indicated in the message is not qualified or supported by Broadcom.	Information
Unrecoverable Error detected in the adapter Please reboot server to recover UE LOW: <S> bit set UE HIGH: <S> bit set	There is an unrecoverable error detected in the adapter that requires a reboot to recover. Low and high bits set in the data path in which error occurred.	Error
User has aborted FW download	User requested abort when FW download is in progress.	Error
Using profile <DD>	An informational message of profile type currently enabled in the adapter.	Information
VF<DD> has FILTMGMT privilege	VF is provided with FILTMGMT privilege to program MAC/VLAN filters.	Information
VF is not privileged to issue opcode <DD>-<DD>	VF does not have enough privileges to issue opcode mentioned in the log message.	Warning
VFs are assigned to VMs: not disabling VFs	Do not disable virtual functions on the port during driver unload, on which VFs are assigned to guests which are powered ON.	Warning
VF setup failed	Failed to create VFs as FW commands failed to provide required resources.	Error
VLAN <DDDD> config on VF <DD> failed	Firmware command failed to set VLAN filter as requested.	Error
Waiting for FW to be ready after EEH reset	After a PCI EEH reset, wait until firmware becomes ready.	Information
Waiting for POST aborted	Waiting for power-on self-test of the adapter is aborted.	Error
Waiting for POST, <D>s elapsed	This is an informational log which logs the seconds elapsed while waiting for power-on self-test of the adapter.	Information
Disable/re-enable i/f in VM to clear Transparent VLAN tag	After clearing transparent VLAN tagging for a VF, disable and re-enable the VF interface in guest operating system to clear VLAN-tagging for the traffic from guest.	Warning
Cannot disable VFs while they are assigned	Cannot disable VFs on the PF, when any of the VF is assigned to guest. Detach any VFs from guest to disable VFs on that PF.	Error
Invalid FW UFI file	Firmware UFI file is corrupted. Try flashing after copying correct UFI file.	Error

Table 13 Ethernet Driver Log Messages of Type (Continued)

Ethernet Log Message	Description	Type
RSS hash key is longer than <DD> bytes	Requested RSS hash key is longer than 40 bytes. Request for a 40-byte RSS hash key.	Error
Invalid RSS hash key format	Hash key format must be in xx:yy:zz:aa:bb:cc format meaning both the nibbles of a byte should be mentioned even if a nibble is zero.	Error
RSS hash key is too short (<DD> < <DD>)	Requested RSS hash key is less than 40 bytes. Request for only a 40 byte RSS hash key.	Error
<be2net> version is <DD.DD.DDD.DDD>	This is an informational logging of be2net driver version loaded.	Information
MGMT_STATUS_FLASHROM_SAVE_FAILED (0x17) / MGMT_ADDI_STATUS_DIGITAL_SIGNATURE_MISSING(0x57)	The firmware being used for flash is not digitally signed.	Error
MGMT_STATUS_FLASHROM_SAVE_FAILED (0x17) / MGMT_ADDI_STATUS_DIGITAL_SIGNATURE_INVALID (0x56)	The digital signature on the firmware being used for flash cannot be verified.	Error

4.5.3 RoCE Error Log Messages

The following table lists the RoCE error log messages and their descriptions.

Table 14 RoCE Error Log Messages

RoCE Log Message	Description	Type
ocrdma_check_qp_params(<D>) unsupported inline data size=0x<DD> requested ocrdma_check_qp_params(<D>) supported inline data size=0x<DD>	Validation checks during queue pair (QP) create.	Error
ocrdma_check_qp_params(<D>) unsupported send_sge=0x<DD> requested ocrdma_check_qp_params(<D>) supported send_sge=0x<DD>	Validation checks during QP create.	Error
<pci bus info> <hca_name>: <speed> "<model_number> port <port_num>	Prints the information about the RoCE PCI function. For example: 0000:04:00.1 Emulex OneConnect RoCE HCA: 10 Gbps “OneConnect OCe14000” port 1	Information
<pci bus info> ocrdma<D> driver loaded successfully	Driver loaded successfully on the device.	Information
crdma_mbx_cmd() cqe_status=0x<D>, ext_status=0x<DD>	Completion and extended status in case of mailbox errors.	Error
ocrdma is using default service level	Using the default service level.	Information
ocrdma_add_stat: No space in stats buff	Response data for debugfs request has exceeded the stats buffer size.	Error
ocrdma_add() leaving. ret=<D>	Adding device failed with Error = D.	Error
ocrdma_alloc_resources(<D>) error	Failed to allocate driver resources.	Error

Table 14 RoCE Error Log Messages (Continued)

RoCE Log Message	Description	Type
ocrdma_alloc_stats_mem: stats debugfs mem allocation failed	Failed to allocate memory for debugfs.	Error
ocrdma_alloc_stats_mem: stats mbox allocation failed	Failed to allocate memory for statistics command.	Error
ocrdma_build_inline_sges() supported_len=0x<L>,unspported len req=0x<LL>	Failed to build inline SGEs.	Error
ocrdma_check_qp_params(<D>) Consumer QP cannot use GSI CQs	Consumer QPs should not use the CQ of GSI QP.	Error
ocrdma_check_qp_params(<D>) GSI special QPs already created	Validation checks during QP create.	Error
ocrdma_check_qp_params(<D>) unsupported recv_sge=0x<DD> requested ocrdma_check_qp_params(<D>) supported recv_sge=0x<DD>	Validation checks during QP create.	Error
ocrdma_check_qp_params(<D>) unsupported recv_wr=0x<DD> requested ocrdma_check_qp_params(<D>) supported recv_wr=0x<DD>	Validation checks during QP create.	Error
ocrdma_check_qp_params(<D>) unsupported send_wr=0x<DD> requested ocrdma_check_qp_params(<D>) supported send_wr=0x<DD>	Validation checks during QP create.	Error
ocrdma_check_qp_params(<D>) unsupported qp type=0x<DD> requested	Validation checks during QP create.	Error
ocrdma_check_qp_params(<D>) Userspace can't create special QPs of type=0x<DD>	Validation checks during QP create.	Error
ocrdma_copy_cq_uresp(<D>) copy error cqid=0x<DD>	Failed to copy CQ create response.	Error
ocrdma_copy_qp_uresp(<D>) user copy error	Failed to copy the QP create response back to the user.	Error
ocrdma_create_qp(<D>) error=<DD>	Failed QP create command.	Error
ocrdma_dealloc_ucontext_pd(D) Freeing in use pdid=0x<DD>	Dealloc ucontext requested on a protection domain (PD) that is in use.	Information
ocrdma_dereg_mr(<D>) fw not responding	De-registration of (memory region) MR failed because the firmware is not responding.	Information
ocrdma_dispatch_ibevent () unknown type=0x<D>	Received unknown event from the hardware.	Error
ocrdma_dispatch_ibevent: Fatal event received	Device reported a fatal event.	Error
ocrdma_get_dma_mr err, invalid access rights	Invalid access rights while allocating lkey.	Error
ocrdma_init_hw() status=<D>	Initialization of the hardware failed.	Error
ocrdma_init_service_level(): status=<D>	Failed to get the DCBX configuration from the adapter.	Error

Table 14 RoCE Error Log Messages (Continued)

RoCE Log Message	Description	Type
`ocrdma_irq_handler(): Fatal Error, EQ full eq_id = 0x<D>,eqe = 0x<DD>`	EQ full detected.	Error
`ocrdma_mbx_create_cq (<D>) max_cqe=0x<DD>, requester_cqe=0x<DDD>`	Requesting more CQ entries than what the device supports.	Error
`ocrdma_mbx_create_qp(<D>) rq_err`	Failed to create QP.	Error
`ocrdma_mbx_create_qp(<D>) sq_err`	Failed to create QP.	Error
`ocrdma_mbx_create_srq() req. max_wr=0x<D>`	The total number of shared receive queue (SRQ) entries requested is greater than what the device supports.	Error
`ocrdma_modify_port(D) invalid_port=0x<DD>`	Invalid port specified in Modify port.	Error
`ocrdma_modify_qp(<D>) invalid attribute mask=0x<M> specified for qpn=0x<QP> of type=0x<T> old_qps=0x<OS>, new_qps=0x<NS>`	Parameter error while trying to modify the QP.	Error
`ocrdma_parse_dcbxcfg_rsp(): DCBX state is disabled.`	DCBX state is disabled in the adapter.	Information
`ocrdma_parse_dcbxcfg_rsp(): pfc is disabled.`	PFC is disabled in the adapter.	Information
`ocrdma_process_acqe(<D>) invalid evt code=0x<DD>`	Invalid event code <*DD*> reported on the device <*D*>.	Error
`ocrdma_process_mcqe() cqe for invalid tag0x<D> expected=0x<DD>`	Invalid completion tag reported.	Error
`ocrdma_query_port(<D>) invalid_port=0x<DD>`	Invalid port specified in Query port.	Error
`ocrdma_reg_mr() status=<D>`	Failed to register MR.	Error
`ocrdma_resolve_dmac () fail to resolve mac_addr`	Failed to resolve MAC address.	Error
`ocrdma_set_create_qp_rq_cmd() req. max_recv_wr=0x<D>`	The total number of receive queue (RQ) entries requested is greater than what the device supports.	Error
`ocrdma_set_create_qp_sq_cmd:() req. max_send_wr=0x<D>`	The total number of send queue (SQ) entries requested is greater than what the device supports.	Error
`ocrdma_update_stats: stats mbox failed with status = <D>`	The Statistics command failed from the hardware.	Error
`ocrdma_update_wc() invalid opcode received = 0x%x`	Invalid opcode received from the hardware completion.	Information
`ocrdma_wait_mqe_cmpl(<D>) mailbox timeout: fw not responding`	Mailbox failed because of timeout.	Error
`opcode=0x<D>, subsystem=0x<DD>`	Opcode and subsystem IDs of the failed mailbox commands.	Error
`Unable to allocate ib device`	ib_alloc_device failed.	Error

4.5.4 iSCSI Driver Log Messages

The following section describes how to retrieve and interpret iSCSI log messages.

4.5.4.1 Retrieving iSCSI Driver Error Log Messages

NOTE These error log messages are specific to the open-iscsi be2iscsi driver.

For Linux systems, the iSCSI driver generates log messages to the `/var/log/messages` file. The log file is an ASCII text file and can be viewed and searched with your preferred text editor.

To search the log file for error messages, at the command prompt, type:

```
# cd /var/log
# vim messages
```

Archived files for older logs also exist in the same directory.

You can view the latest recently generated messages for the current system boot by running:

```
#dmesg
```

4.5.4.2 iSCSI Driver Error Log Messages and their Descriptions

Table 15 iSCSI Log Messages and Descriptions

Log Message	Description
`beiscsi_module_init - Unable to register beiscsi transport.`	Driver registration failure.
`beiscsi_module_init - Unable to register beiscsi pci driver.`	Driver registration failure.
`BM_# : mgmt_invalidate_icds could not be submitted`	Driver error messages for error handling. Cannot submit an abort request due to no memory available.
`BM_# : Unsupported fw version`	Driver init error message. This failure indicates that the driver version that is running on the system does not match the version of the firmware flashed on the board. This issue can be addressed by running the installer from the desired version.
`BM_# : hwi_init_controller failed`	Driver init error message. This failure may be due to the firmware not being present or running currently. This failure may also indicate a hardware issue.
`BM_# : beiscsi_dev_probe -Failed in beiscsi_alloc_memory`	Driver init error message. Cannot allocate required memory for driver initialization.
`BM_# : No boot session`	Driver init error message. Informational message indicating this port does not have a boot-able session configured.
`BM_# : EEH error detected`	Driver pci error message. PCI error detected by system.
`BM_# : EEH : State PERM Failure`	Driver pci error message. PCI error cannot be recovered.
`BM_# : AER EEH Resume Failed`	Driver pci error message. Driver failed to resume after PCI error recovery via a chip reset.

Table 15 iSCSI Log Messages and Descriptions (Continued)

Log Message	Description
`beiscsi_ep_connect shost is NULL`	Driver session management error message. This host no longer exists. Indication of system trying to connect to previously configured sessions through a port that no longer exists, or its MAC address has been changed.
`BS_# : PCI_ERROR Recovery`	Driver session management error message. Cannot create session, controller is busy recovering from PCI error.
`BS_# : Failed in beiscsi_open_conn`	Driver session management error message. Some possible reasons for this include: non-existing targets, wrong destination address, and target rejected login.
`BS_# : The Adapter Port state is Down!!!`	Driver session management error message. An attempt was made to login to a target through a port with link down.
`BS_# : upload failed for cid #`	Driver session management error message. Failed to properly disconnect.

Appendix A: iSCSI Driver

The following section describes iSCSI error handling and log messages.

A.1 iSCSI Error Handling

This section describes iSCSI error handling.

A.1.1 Error Handling Using ETO and LDTO Parameters

The goal of iSCSI error handling is to be tolerant of link-level and target-level failures up to configured timeout values so that I/O errors are not seen by the application or operating system.

The error handling is triggered under the following conditions:

- Loss of connection to the target due to target or network disconnection at the target.

  If the driver has I/O requests pending with the target and the target becomes unavailable (due to the target going down or failing over, or network issues at the target), the driver queues up the I/O requests internally for a configured period of time. The threshold value of this period is the extended timeout (ETO) value.
- Loss of immediate link to the initiator (such as cable disconnect or port failure).

  The adapter firmware detects and notifies the driver of a loss of the link. When this happens, the driver queues up the I/O requests internally to a configured period of time so that the operating system does not see I/O errors. The threshold value of this period is the link down timeout (LDTO) value.

When the configured ETO or LDTO value is reached, and the initiator is still unable to connect to the target, the driver fails all I/O requests. At this point, I/O errors are seen by the application and operating system.

NOTE Following a link up, switch ports can take a long time to initialize and go to the forwarding state. Because of this, additional time should be added to the ETO and LDTO settings to eliminate I/O disruption or target unavailability. If the switch port is connected to a single host, then the PortFast mode can be enabled on the switch port to eliminate delays when it transitions to the forwarding state.

A.1.2 Error Handling Under MPIO and Cluster Configurations

In an multipath I/O (MPIO) or cluster configuration, fault tolerant software is present on the system that makes the iSCSI driver error handling redundant. These configurations also require that I/O errors be reported as soon as they are detected so that the software can fail over to an alternate path or an alternative node as quickly as possible.

When the iSCSI driver runs under these configurations, the error handling implemented in the driver must be turned off by setting the default values of LDTO and ETO to zero. The changes take effect during the next driver load.

A.2 iSCSI Driver Log Messages

This section describes retrieving and interpreting iSCSI log messages.

A.2.1 Retrieving iSCSI Driver Error Log Messages

NOTE These error log messages are specific to the proprietary `be2iscsi` driver.

For Linux systems, the iSCSI driver generates log messages to the `/var/log/messages` file. The log file is an ASCII text file and can be viewed and searched with your preferred text editor.

To search the log file for error messages, at the command prompt, type:

```
# cd /var/log
# vim messages
```

A.2.2 iSCSI Driver Error Log Messages and their Descriptions

All iSCSI driver error log messages are preceded by a `scsi`*X*: prefix (if the SCSI host controller can be determined, with *X* being a number representing the Linux SCSI host controller) and OneConnect iSCSI Driver.

For example:

```
scsi2: OneConnect iSCSI Driver: Rejected IOCTL since buffer size limit
exceeded
scsi2: OneConnect iSCSI Driver: Subsystem / Opcode = 0x12345678 / 0x11223344
scsi2: OneConnect iSCSI Driver: Payload Length = 0x1000
```

NOTE

- Some error log entries may be followed by additional entries that provide further information.
- In the following table, `0x`X refers to a hexadecimal value that appears in the log messages.

The following table lists the iSCSI driver error log messages and their descriptions.

Table 16 iSCSI Driver Error Log Messages

iSCSI Error Log Message	Description
`Did not receive an iSCSI Command window update from Target for at least 25 Secs. Session Handle`	Check for any errors reported at the target. The Emulex iSCSI initiator is only supported with certified targets. Check for software updates at the target vendor's website and the Documents and Downloads area of http://www.broadcom.com. If this fails, contact Broadcom Technical Support.
`Driver version does not match Firmware. Please run Installer.`	This failure indicates that the driver version that is running on the system does not match the version of the firmware flashed on the board. This issue can be addressed by running the installer from the desired version.
`Error during iSCSI offload Session Handle / Firmware Error code`	This may indicate a target is in error or may point to transient network connectivity issues. It may also indicate a firmware error.
`Initialization Failure`	This failure may be due to the firmware not being present or running currently. This failure may also indicate a hardware issue.
`Initialization failure during Power Management Bootup`	This failure may be due to the firmware not being present or running currently. This failure may also indicate a hardware issue.
`Internal API failed during Initialization`	This failure may indicate a low memory condition.

Table 16 iSCSI Driver Error Log Messages (Continued)

iSCSI Error Log Message	Description
`Hardware Initialization Failed. Either Hardware/Firmware is not initialized or is malfunctioning.`	This failure indicates that the hardware has not been initialized or is malfunctioning. This may also indicate that the firmware is not running correctly.
`OSM Hardware Initialization Failure`	This failure indicates that the hardware has not been initialized or is malfunctioning. This may also indicate that the firmware is not running correctly.
`OSM Resource Allocation Failure`	The operating system failed to allocate resources for the device. Check low memory conditions and operating system hardware resource conflicts.
`Received a TMF Abort for an I/O that is not present with the driver.`	This may indicate a slow connection to the target. Check network connectivity to the target for any errors.

`Received invalid iSCSI Command Sequence Number update from Target.`
`Session Handle = 0xX`
`MaxCmdSN = 0xX`
`ExpCmdSN = 0xX`
	Check for any errors reported at the target. The Emulex iSCSI initiator is only supported with certified targets. Check for software updates at the target vendor's website and the Documents and Downloads area of http://www.broadcom.com. If this fails, contact Broadcom Technical Support.

`Received unsupported Task Management Function.` `Task Management Function code = 0xX`	The operating system version is not supported.

`Rejected IOCTL since buffer size limit exceeded.`
`Subsystem / Opcode = 0xX / 0xX`
`Payload Length = 0xX`
	This error may indicate an incorrect configuration option for the iSCSI driver. It may also indicate a low memory condition.

`Unrecoverable Error`
`UE_LOW = 0xX`
`UE_HIGH = 0xX`
`Firmware Line Number = 0xX`
	This may be due to hardware errors or due to unhandled exceptions in the hardware or firmware.

Appendix B: Configuring iSCSI Through DHCP

This section describes configuring iSCSI using DHCP.

B.1 IP Address Reservation

If you are using the DHCP server to obtain an IP address for your iSCSI initiator, set up a reservation. A reservation assigns a specific IP address based on the MAC address of your iSCSI function.

If you do not reserve an IP address through DHCP, you must set the lease length for the iSCSI initiator's IP address to unlimited, which allows the IP address lease not to expire.

B.2 DHCP Option 43 (Vendor-Specific Information)

This section describes the format for the data returned in DHCP option 43. The method and format for specifying the Vendor ID is outside the scope of this document and is not included here. The initiator offers this Vendor ID to the DHCP server to retrieve data in the format as described in Section B.2.2, DHCP Option 43 Format.

B.2.1 DHCP Option 43 Parameter Descriptions

The following table describes the parameters used in the format (data string) for option 43.

Table 17 DHCP Option 43 (Vendor-Specific Information)

Parameter	Description	Field Type
<AuthenticationType>	If applicable, replace with D, E, or M. ■ D denotes that authentication is disabled. ■ E denotes that one-way CHAP is enabled (the user name and secret to be used for one-way CHAP must be specified by non-DHCP means). ■ M denotes that mutual CHAP is enabled (the user name and passwords required for mutual CHAP authentication must be specified by non-DHCP means). If a value is not specified, this field defaults to authentication disabled.	Optional
<DataDigest>	Replace with either E or D. ■ E denotes that the data digest is enabled. ■ D denotes that the data digest is disabled. If a value is not provided, it is assumed that the Data Digest is disabled by default.	Optional
<HeaderDigest>	Replace with either E or D. ■ E denotes that the header digest is enabled. ■ D denotes that the header digest is disabled.	Optional
<InitiatorName>	Replace with a valid initiator iSCSI qualified name (IQN) of up to 223 characters. If a value is not provided, the default initiator name (generated by the OneConnect adapter based on the board's MAC address) is used.	Optional
<LUN>	A hexadecimal representation of the logical unit number (LUN) of the boot device. Replace with an 8-byte number that should be specified as a hexadecimal number consisting of 16 digits, with an appropriate number of zeros padded to the left, if required. If a value is not provided, LUN 0 is assumed to be the boot LUN.	Optional

Table 17 DHCP Option 43 (Vendor-Specific Information) (Continued)

Parameter	Description	Field Type
<TargetIP>	Replace with a valid IPv4 address in dotted decimal notation.	Mandatory
<TargetName>	Replace with a valid target iSCSI Qualified Name (IQN) name of up to 223 characters.	Mandatory
<TargetTCPPort>	Replace with a decimal number ranging from 1 to 65535 (inclusive). The default TCP port (3260) is assumed if a value is not specified.	Optional

B.2.2 DHCP Option 43 Format

The following is the format of DHCP option 43 and its guidelines for creating the data string:

```
'iscsi:'<TargetIP>':'<TargetTCPPort>':'<LUN>':'<TargetName>':'<InitiatorNam
e>':'<HeaderDigest>':'<DataDigest>':' <AuthenticationType>
```

- Strings shown in quotation marks are part of the syntax and are mandatory.
- Fields enclosed in angular brackets (including the angular brackets) should be replaced with their corresponding values. Some of these fields are optional and may be skipped.
- If an optional field is skipped, a colon must be used as a placeholder to indicate the default value for that field.
- When specified, the value of each parameter should be enclosed in double quotation marks.
- All options are case sensitive.

B.2.2.1 Default Initiator Name and Data Digest Settings Example

The following is an example of default initiator name and data digest settings.

```
iscsi:"192.168.0.2":"3261":"000000000000000E":"iqn.2009-4.com:1234567890"::
"E"::"E"
```

In this example, the field values are:

- TargetIP: 192.168.0.2
- TargetTCPPort: 3261
- LUN: 0x0E
- TargetName: iqn.2009-04.com:1234567890
- InitiatorName: Not specified. Use the Initiator name already configured. Use the default name if none was configured.
- HeaderDigest: Enabled
- DataDigest: Not specified. Assume disabled.
- AuthenticationType: One-way CHAP is enabled.

B.2.2.2 Default TCP and Mutual CHAP Settings Example

The following is an example of default TCP port and mutual CHAP settings.

```
iscsi:"192.168.0.2"::"000000000000000E":"iqn.2009-4.com:1234567890"::"E":"D
":"M"
```

In this example, the field values are:

- TargetIP: 192.168.0.2
- TargetTCPPort: Use default from RFC 3720 (3260).
- LUN: 0x0E
- TargetName: iqn.2009-04.com:1234567890
- InitiatorName: Not specified. Use the Initiator name already configured. Use the default name if none was configured.

- HeaderDigest: Enabled
- DataDigest: Disabled
- AuthenticationType: Mutual CHAP is enabled.

Appendix C: OneConnect 10GbE Adapter Port Speed Specifications

This section describes how to negotiate port speed on non-mezzanine and mezzanine cards.

C.1 Port Speed Negotiation on Non-Mezzanine Cards

OneConnect 10GbE adapters can support only one Ethernet port speed at a time. On non-mezzanine cards, its preference is 10Gb/s. The type of module used (copper/optical) does not make a difference. If a 10Gb/s module is plugged into one of the ports, the adapter runs at a 10Gb/s speed regardless of its other port's speed, even if I/Os are running on that port. This behavior is an adapter constraint; another adapter can be running on a different speed.

The following table lists negotiated speed specifications per OneConnect 10GbE adapter port connection.

Table 18 OneConnect 10GbE Adapter Negotiated Speed Specifications

Port 0 Speed (Gb/s)	Port 1 Speed (Gb/s)	Port Link Status	OneConnect 10GbE Speed (Gb/s)
10	10	Both ports are link up	10
10	1	Only Port 0 is link up	10
1	10	Only Port 1 is link up	10
1	1	Both ports are link up	1
1	-	Only Port 0 is link up	1
-	1	Only Port 1 is link up	1
10	-	Only Port 0 is link up	10
-	10	Only Port 1 is link up	10

C.2 Port Speed on Mezzanine Cards

For mezzanine cards, only one Ethernet port speed is supported at a time. Its speed is the first negotiated speed (either 1GbE or 10GbE), depending on the switch that is connected.

To change the speed on these cards:

1. Remove the switch from both of the ports.
2. Insert the switch for one port, and wait for the link to come up.

The mezzanine card retains this speed until both links are down.

Appendix D: Updating Ethernet Firmware

NOTE Driver installation is required before performing a firmware update. For more information on installing the driver, see Section 2.3.1, Installing the Ethernet Driver Kit.

NOTE Starting with firmware version 11.0, firmware supports secure firmware update by digitally signing firmware images and verifying authenticity before updating the image to flash memory.

The Emulex Ethernet driver supports updating the firmware image in the adapter flash through the `request_firmware` interface in Linux. You can perform this update when the adapter is online and passing network and storage traffic.

To update the Ethernet firmware image:

1. Copy the latest firmware image under the `/lib/firmware` directory:
   ```
   # cp  be3flash.ufi /lib/firmware
   ```
2. Start the update process.
   - In Linux distributions that support the flash option in `ethtool` (for example, SLES 11 SP*x* and RHEL 6.*x*), use the following command:
     ```
     # ethtool -f eth<X>  be3flash.ufi
     ```
   - In earlier Linux distributions (for example, SLES 10 SP*x* and RHEL 5.*x*), write the name of the flash image file in the sysfs node:
     ```
     # echo 60 > /sys/class/firmware/timeout
     # echo be3flash.ufi > /sys/class/net/eth<X>/flash_fw
     ```
3. Reboot the system to enable the new firmware image to take effect.

D.1 Ethtool Support for Secure Firmware Update

If a secure version of firmware (version 11.0 or later) is installed on an Emulex OCe14000B-series adapter and you want to update to an earlier unsecured version of firmware (version 10.6 or earlier), you must remove the secure firmware jumper block before performing the update.

Appendix E: Ethtool -S Option Statistics

The following table contains a list of `ethtool -S` option statistics and their descriptions.

Table 19 Ethtool -S Option Statistics

Name	Description
`dma_map_errors`	The number of packets dropped due to DMA mapping errors.
`eth_red_drops`	Received packets dropped due to the ASIC's Random Early Drop policy.
`forwarded_packets`	The number of packets generated by the ASIC internally. These packets are not handed to the host. This counter is shared across ports and all functions (NIC/FCoE/iSCSI).
`jabber_events`	The number of jabber packets received. Jabber packets are packets that are longer than the maximum size Ethernet frames and that have bad CRC.
`link_down_reason`	The reason that the ASIC signaled the link status as down. The various values are: ■ 0 – Link down due to reasons other than those listed here. ■ 1 – Link down caused by Dynamic Control channel protocol. ■ 3 - Link down triggered by Virtual NIC configuration (for example: zero bandwidth assigned to a VNIC). ■ 4 – Link down caused by Ethernet Pause frame flooding. ■ 5 – Link down due to physical thermal temperature going up.
`pmem_fifo_overflow_drop`	Received packets dropped when an internal FIFO going into main packet buffer tank (PMEM) overflows.
`rx_address_filtered`	Received packets dropped when they do not pass the unicast or multicast address filtering.
`rx_alignment_symbol_errors`	The number of packets dropped due to L1 alignment errors. This counter is on a per-port basis.
`rx_compl_err`	The number of RX completion errors received.
`rx_control_frames`	The number of control frames received.
`rx_crc_errors`	The number of packets dropped due to CRC errors.
`rx_dropped_header_too_small`	Received packets dropped when the IP header length field is less than 5.
`rx_dropped_runt`	Dropped receive packets due to runt packets (for example, packets shorter than the Ethernet standard).
`rx_dropped_tcp_length`	Received packets dropped when the TCP header length field is less than 5 or the TCP header length + IP header length is more than IP packet length.
`rx_dropped_too_short`	Received packets dropped when IP length field is greater than the actual packet length.
`rx_dropped_too_small`	Received packets dropped when IP packet length field is less than the IP header length field.
`rx_drops_mtu`	Received packets dropped when the frame length is more than 9018 bytes.
`rx_drops_no_erx_descr`	Received packets dropped due to the input receive buffer descriptor FIFO overflowing.
`rx_drops_no_pbuf`	Packets dropped due to lack of available HW packet buffers used to temporarily hold the received packets.
`rx_drops_no_tpre_descr`	Packets dropped because the internal FIFO to the offloaded TCP receive processing block is full. This could happen only for offloaded iSCSI or FCoE traffic.
`rx_drops_too_many_frags`	Received packets dropped when they need more than 8 receive buffers. This counter will always be 0.
`rx_frame_too_long`	Received packets dropped when they are longer than 9216 bytes.
`rx_in_range_errors`	Received packets dropped when the Ethernet length field is not equal to the actual Ethernet data length.
`rx_ip_checksum_errs`, `rx_tcp_checksum_errs`, `rx_udp_checksum_errs`	Packets dropped due to TCP/IP/UDP checksum errors.

Table 19 Ethtool -S Option Statistics (Continued)

Name	Description
rx_out_range_errors	Received packets dropped when their length field is >= 1501 bytes and <= 1535 bytes.
rx_pause_frames	The number of Ethernet pause frames (flow control) received.
rx_priority_pause_frames	The number of Ethernet priority pause frames (priority flow control) received per port.
rx_switched_unicast_packets, rx_switched_multicast_packets, rx_switched_broadcast_packets	The number of unicast, multicast, and broadcast packets switched internally.
rxpp_fifo_overflow_drop, rx_input_fifo_overflow_drop	Number of received packets dropped when a FIFO for descriptors going into the packet demux block overflows. In normal operation, this FIFO must never overflow.
tx_controlframes	The number of Ethernet control frames transmitted per port.
tx_dma_err	The number of errors occurred in the DMA operation associated with the transmit request from the host to the device.
tx_hdr_parse_err	The number of errors while parsing the packet header of a transmit request.
tx_internal_parity_err	The number of parity errors in the transmit request.
tx_pauseframes	The number of Ethernet pause frames (flow control) transmitted per port.
tx_priority_pauseframes	The number of Ethernet priority pause frames transmitted per port.
tx_qinq_err	The number of transmit requests with Q-in-Q style VLAN tagging, when such tagging is not expected on the outgoing interface.
tx_spoof_check_err	The number of spoof TX request failures, when MAC or VLAN spoof checking is enabled on the interface.
tx_tso_err	The number of transmit request errors, while performing TSO offload.

The following table contains a list of transmit/receive statistics per receive queue basis.

Table 20 Transmit/Receive Queue Statistics

Statistic	Description
rxq<x>:rx_bytes	The number bytes received by the driver.
rxq<x>:rx_pkts	The number of packets received by the driver.
rxq<x>:rx_compl	The number of receive completions signaled to the driver by the ASIC.
rxq<x>:rx_mcast_pkts	The number of multicast packets received by the driver.
rxq<x>:rx_post_fail	The number of times the driver could not post received buffers to the ASIC.
rxq<x>:rx_drops_no_skbs	The number of times the driver could not allocate socket buffers.
rxq<x>:rx_drops_no_frags	Packets dropped due to insufficient buffers posted by the driver.
txq<x>:tx_compl	The number of transmit completions signaled by the ASIC.
txq<x>:tx_bytes	The number of bytes transmitted by the driver.
txq<x>:tx_pkts	The number of packets transmitted by the driver.
txq<x>:tx_reqs	The number of transmit request generated by the driver.
txq<x>:tx_stops	The number of times the driver requests the host to stop giving further transmit requests since the hardware transmit queue is filled up.
txq<x>:tx_drv_drops	The number of transmit packets dropped by the driver.

Appendix F: brcmfcoe Driver BlockGuard Functionality

This section describes how to enable BlockGuard and set `brcmfcoe` driver module parameters.

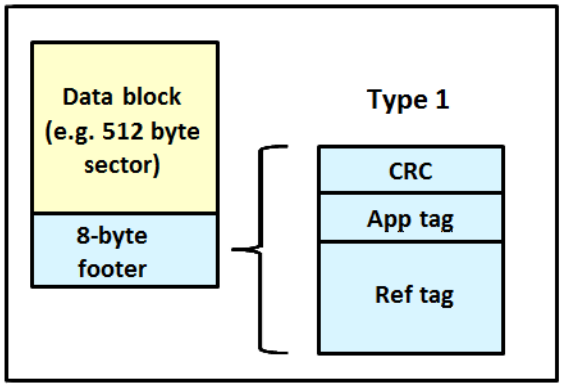
F.1 Overview

The BlockGuard feature checks the integrity of data read from and data written to the host to the disk and back through the SAN. This check is implemented through the Data Integrity Field (DIF) defined in the American National Standards Institute (ANSI) T10 standard.

The Emulex `brcmfcoe` driver supports T10 DIF Type 1. In the Type 1 implementation, the 8-byte DIF consists of a Ref Tag (or logical block address [LBA]), an App Tag, and a Guard Tag (or CRC). A Type 1 DIF is defined as a having a 2-byte Guard Tag, a 2-byte App tag, and a 4-byte Ref tag, which consists of the lower 32 bits of the logical block address.

The following figure shows a data block (with a 512-byte sector) with the 8-byte footer attached to the end. The contents of the 8-byte footer are shown with the fields that make up the Type 1 DIF: the Guard Tag, the App Tag, and the Ref Tag. The App Tag is not used by the lpfc driver.

Figure 1 Data Block Showing Type 1 DIF



When data is written, the DIF is generated by the host, or by the adapter, based on the block data and the logical block address. The DIF field is added to the end of each data block, and the data is sent through the SAN to the storage target. The storage target validates the CRC and Ref tag and, if correct, stores both the data block and DIF on the physical media. If the CRC does not match the data, then the data was corrupted during the write. A Check Condition is returned back to the host with the appropriate error code. The host records the error and retransmits the data to the target. In this way, data corruption is detected immediately on a write and never committed to the physical media. On a read, the DIF is returned along with the data block to the host, which validates the CRC and Ref tags. Because the hardware performs this validation, it adds a very small amount of latency to the I/O.

The format of the Guard Tag can optionally be an IP Checksum instead of the CRC mandated by T10 DIF, which can be beneficial because the Initiator Host uses less CPU overhead to generate an IP Checksum than it does with a CRC. The IP Checksum is typically passed as the Guard Tag between the Initiator Host and the adapter. The adapter hardware will translate the IP Checksum into a CRC, or visa versa, on data being sent to or received from on the wire. The CRC is called a DIF protection type, and the IP Checksum is referred to as DIX protection type.

F.2 Enabling BlockGuard

BlockGuard is disabled by default. To enable it, pass the parameter `lpfc_enable_bg` to the driver as follows:

```
insmod brcmfcoe.ko lpfc_enable_bg=1
```

For a permanent configuration that will persist across system reboots, create the `/etc/modprobe.d/lpfc` file and place the following line into it:

```
options brcmfcoe lpfc_enable_bg=1
```

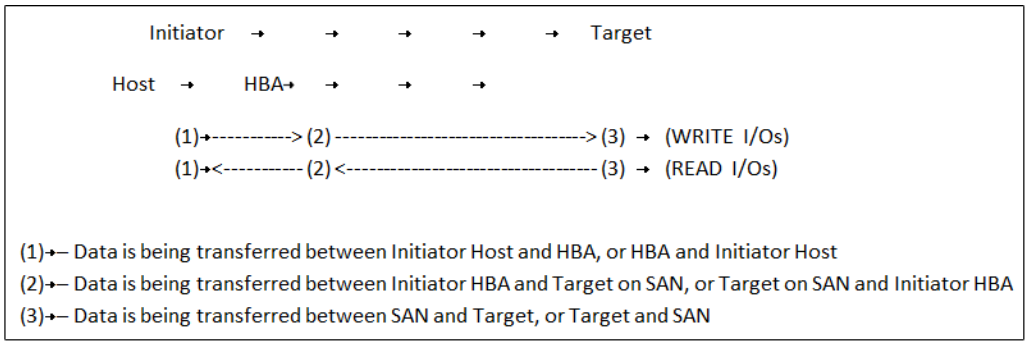
Additional module parameters may be added to this line, separated by spaces.

F.3 SCSI Command Support – SCSI Operation Codes

When both READ and WRITE requests exist, the command descriptor block (CDB) passed to the adapter from the Initiator Host has a read protect/write protect (RDPROTECT/WRPROTECT) field that indicates to the target whether to perform data integrity verification. It also indicates whether to transfer protection data between initiator and target. The adapter does not know if a target supports protection information or with which type of protection it is formatted. The Initiator Host, which has this knowledge, will always prepare a CDB with the appropriate RDPROTECT/WRPROTECT information, depending on target format and capabilities. The request will also include information about with which protection type the target has been formatted.

In addition, the Initiator Host will also provide the adapter with an operation code that tells the controller how to place the protection data for the type of I/O to perform. Each I/O is logically a two-step process. The data is transferred between the Initiator Host and the adapter (over the PCI bus) and between the adapter and the target (over the SAN) as shown in the following figure. The type of operation defines whether the data transfer has protection data.

Figure 2 Data Transfer between Initiator Host and the Adapter



The initiator operations are listed in the following table.

Table 21 Initiator Operations

Initiator Operation	Initiator Host <-> Adapter	Adapter <-> Target	Comment
NORMAL	Unprotected	Unprotected	Used for unprotected I/O
READ_INSERT	Protected	Unprotected	Reads the data from the target. The adapter then generates the protection data and transfers both data and protection data to the Initiator Host. No protection data is sent on the SAN. The adapter can insert the protection data guard tag as CRC or IP CSUM.
READ_PASS	Protected	Protected	Reads the data and protection data from the target on the SAN. The adapter will verify data integrity and transfer both data and protection data to the Initiator Host. The adapter can convert the protection data guard tag from CRC to IP CSUM.
READ_STRIP	Unprotected	Protected	Reads data and protection data from the target. The adapter will verify data integrity, discard protection data, and only transfers the data to the Initiator Host. It does not send the protection data to the Initiator Host. Protection data is only sent on the SAN.
WRITE_INSERT	Unprotected	Protected	Transfers the data from the Initiator Host. The adapter will then generate protection data and write both the data and protection data to the target. Protection data is only sent on the SAN.
WRITE_PASS	Protected	Protected	Transfers the data and protection data from the Initiator Host to the adapter. The adapter will verify protection data and write both data and protection data to the target on the SAN. The adapter can convert the protection data guard tag from IP CSUM to CRC.
WRITE_STRIP	Protected	Unprotected	Transfers data and protection data from the Initiator Host. The adapter will verify data integrity, discard protection data, and writes only the data to the target. No protection data is sent on the SAN.

F.4 brcmfcoe Driver Module Parameters

The `brcmfcoe` driver has two module parameters: `lpfc_prot_mask` and `lpfc_prot_guard`. Using these parameters, you can control which DIF capabilities the lpfc driver registers with the Linux SCSI subsystem. This, in turn, controls which initiator operations (BlockGuard profiles) are used during I/O operations. These parameters are set up when the driver loads and cannot be changed while the driver is running.

F.4.1 lpfc_prot_mask

This parameter controls the DIF operations that the driver registers with the operating system. The operating system selects an operation to use for each I/O command that matches the adapter DIF capability. The driver indicates its capabilities by the operations it registers with the operating system.

If the parameter is not passed to the driver, the default DIX_TYPE0 is used.

The SCSI layer will typically use the bit masks listed in the following table to determine how to place the protection data associated with I/Os to the SCSI Host. The default value for `lpfc_prot_mask` is to allow all of the options.

Table 22 `lpfc_prot_mask` **Protection Types**

Flag	Value	Indicates	Description
SHOST_DIF_TYPE1_PROTECTION	1	Adapter supports T10 DIF Type 1	Adapter to Target Type 1 protection
SHOST_DIX_TYPE0_PROTECTION	8	Adapter supports DIX Type 0	Host to adapter protection only
SHOST_DIX_TYPE1_PROTECTION	16	Adapter supports DIX Type 1	Host to adapter Type 1 protection

The following table shows how protection data gets placed for each supported profile.

Table 23 Protection Data Placement for Supported Profiles

Flag	Value	BlockGuard Profile	Operation
SHOST_DIF_TYPE1_PROTECTION	1	A1	READ_STRIP/ WRITE_INSERT
SHOST_DIX_TYPE0_PROTECTION	8	AST2	READ_INSERT/ WRITE_STRIP
SHOST_DIX_TYPE1_PROTECTION SHOST_DIF_TYPE1_PROTECTION	17	AST1 / C1	READ_PASS/ WRITE_PASS

F.4.2 lpfc_prot_guard

This parameter correlates to the `SCSI_host_guard_type` of the Linux kernel, which specifies the type of CRC the Linux operating system will pass to the lpfc driver. The following table shows the two guard types: CRC, and IP-CSUM, with values of 0x1 and 0x2, respectively.

Table 24 lpfc_prot_guard Guard Types

Flag	Value	Indicates
SHOST_DIX_GUARD_CRC	1	Adapter supports T10 DIF CRC
SHOST_DIX_GUARD_IP	2	Adapter supports both T10 DIF CRC and IP-CSUM

The default value for `lpfc_prot_guard` is `SHOST_DIX_GUARD_IP`. This defines the format for the guard tag when the data is transferred between the Host and the adapter. When data is transferred on the wire, the protection data guard tag is always translated into a T10 DIF CRC. To override the default, you can pass a module parameter value with either `insmod` or `modprobe`.

The SCSI layer will typically use an IP-CSUM as the method for computing the protection data guard tag because it uses less CPU overhead.

Appendix G: Setting Up and Configuring VXLAN

Virtual eXtensible LAN (VXLAN) technology allows a physical layer 3 network to host multiple logical, or virtual, layer 2 networks, which allows for these key advantages over nonvirtualized networks:

- Expands the number of isolated network segments that can exist on a single wire beyond what VLANs alone can provide (significantly beyond 4096).
- Physical switches no longer have to track virtual machine MAC addresses that reside on VXLAN segments.
- VXLANs are seamless to the virtual machines that reside on them (for example, the virtual machines are unaware of the VXLANs presence, reducing complexity in deployment).

The Emulex OCe14000-series converged network adapters support this technology and also provide offloading capabilities of some of the VXLAN functions, decreasing CPU utilization, and potentially increasing I/O throughput, depending on the configuration of the network. This VXLAN offloading technology is only supported in RHEL 7 and SLES 12.

G.1 Setting up VXLAN Networks Across Two Systems

To set up VXLAN networks across two systems:

1. Install all required Emulex software on both systems, such as the NIC driver and the Emulex OneCommand CNA Manager application. Verify that your NIC is recognized.
2. Configure the desired NIC ports with IP addresses, and verify that they can communicate. Set the Maximum Transmission Unit (MTU) option to the desired size.
3. After the physical network has been set up, set up the VXLAN interface on top of it.
   a. From a console, type the following command to create the VXLAN function:

NOTE The default UDP port is 8472.

- For SLES 12:

```
ip link add <vxlan_name> type vxlan id <vxlan_id> group
<multicast_group> dev <ethernet_interface>
```

- For RHEL 7.0:

```
ip link add <vxlan_name> type vxlan id <vxlan_id> group
<multicast_group> dstport <port> dev <ethernet_interface>
```

- Example for RHEL 7.0

```
ip link add vxlan0 type vxlan id 100 group 239.1.1.1
dstport 0 dev eth1
```

This example creates the VXLAN function and associates it with the parent physical function (PF). The MTU automatically adjusts itself based on the PF MTU size, and the `dstport` option to 0 defaults to the standard port of 8472. For VXLAN functions to talk to each other, the ID and multicast group must match. You can have multiple VXLAN functions on the same port, but they must have separate IDs. You cannot use the same ID multiple times in one system.

   b. Verify that the switch you are using supports multicasting. You might have to configure it to do so. Multicast address ranges can be from 224.0.0.0 to 239.255.255.255. Make sure the range matches up with the one you specified in the VXLAN network earlier.

c. Associate an IP address to the tenant and activate it. Type the following:

```
ip address add <ip/subnet> dev <vxlan_name>
ip link set <vxlan_name> up
```

Example:

```
ip address add 20.0.0.1/24 dev eth1
ip link set vxlan0 up
```

You can now ping between IP addresses from within the VXLAN tenant.

4. For VM functionality, you must link the VXLAN function to a macvtap function and connect that to a VM as a NIC or network bridge. The following is an example of creating the macvtap and attaching it directly to a VM from the KVM hypervisor.

a. From a console, type the following to create a macvtap and link it to your VXLAN function:

```
ip link add link <vxlan_name> name <macvtap_name> type macvtap
```

Example:

```
ip link add link vxlan0 name macvtapvxlan0 type macvtap
```

b. Next, you must give the macvtap a MAC address and enable it:

```
ip link set <macvtap_name> address <MAC_address> up
```

Example:

```
ip link set macvtapvxlan0 address 00:11:22:33:44:55 up
```

c. Install your VM using your desired operating system and shut it down.

d. From the Virtual Machine Manager, right-click your VM and select **open**.

- Select **View and Details**.
- At the bottom, click **Add Hardware**.
- Select **Network** and choose the macvtap interface you created from the Host Device drop-down menu and select **virtio** from the Device Model drop-down.
- Click **Finish** to save the changes.

e. Click the newly created NIC, select **Bridge** from the Source Mode drop-down menu and click **Apply**.

f. Power on your VM. The new NIC is detected and you can configure it as normal.

NOTE You must adjust the MTU size of your virtual NIC to accommodate the MTU size of the VXLAN network. For instance, if the VXLAN network is set to 1450, then you must adjust your virtual NIC MTU to 1450.

g. Complete steps 4a to 4f on both systems. The two VMs can now ping each other.

Appendix H: License Notices

H.1 Open-iSCSI GPLv2 Notice

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Version 2, June 1991

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