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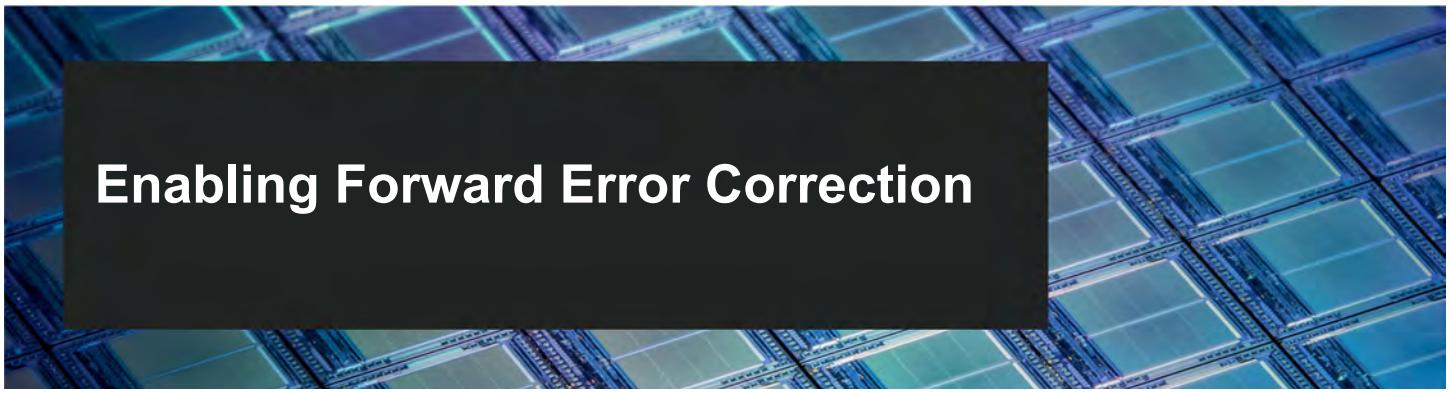

Enabling Forward Error Correction

Application Note

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Enabling Forward Error Correction

Applicable Products

Marvell Adapters	Models
Enhanced Gen 5 16GFC	QLE2690 QLE2692 QLE2694 QLE2694L

1 Introduction

This application note provides instructions for setting up the Marvell QLogic QLE269*x* Fibre Channel Adapters to enable forward error correction (FEC). FEC can be enabled either within a browser using QConvergeConsole® (QCC) GUI or in a terminal window using QConvergeConsole CLI. The Marvell implementation of FEC is supported on 16GFC platforms and enables Brocade® and Cisco® switches to recover bit errors in 16GFC data streams.

NOTE

This application note applies only to 16GFC optical connections, on which FEC is disabled by default. For a 16GFC copper environment, FEC is enabled by default.

1.1 Purpose of FEC

FEC improves the storage area network's (SAN's) resiliency and maintains performance. FEC provides the ability to automatically recover from transmission errors. Recovery dramatically helps performance and link integrity, which can then support higher end-to-end data rates across the SAN.

With FEC enabled, the sender adds systematically generated error-correcting code (ECC) onto its data transmission. On the receiving end, ECC allows for detection and correction of any errors in the data, without additional information from the sender. FEC encoding can correct, on a single burst, up to 11 error bits within every 2,112 bits that are transmitted. The error correction covers both frames and primitives. The 16G Fibre Channel link experiences no loss of bandwidth or added transmission data rate overhead.

1.2 Intended Audience

This document is intended for users who need to enable FEC on their Marvell QLogic QLE269*x* Fibre Channel Adapters. You should have prior experience or knowledge of installing the QCC GUI or QCC CLI packages. Ensure that you understand the contents of this document before attempting to enable FEC. You must also know how to access and view administrative login details on a Brocade or Cisco Gen 5 switch.

2 Requirements

This section lists the adapter and Fibre Channel switch hardware and software requirements:

- Marvell QLE269*x* Adapter:
  - One or more adapters installed with a 16G Fibre Channel transceiver
  - Adapters updated to the most recent firmware and driver packages available from www.marvell.com
- QConvergeConsole GUI or CLI:
  - QConvergeConsole must be recently updated or newly installed with the latest version from www.marvell.com
  - QConvergeConsole GUI uses the existing Apache™ Tomcat™ 6 security login framework, thus no additional environment is required. Although Marvell does not distribute Tomcat 7, QCC GUI is expected to work seamlessly with existing Tomcat 7 deployment.
- Fibre Channel switch
  - Brocade Gen 5 switch with Fabric OS (FOS) version 7.4.*x* or later; or Cisco Gen 5 switch with NX-OS version 8.2.1 or later
  - 16G Fibre Channel transceivers installed in the switch ports that are connected to the Marvell adapters

- ❑ Access and login details to the switch for running administrative commands

NOTE

FEC is enabled by default on 32GFC switches and no configuration is necessary. 16GFC FEC TTS is configurable on the following switches:

- Brocade 6505, 6510, 6520, M6505, 6547, 6548, 7840, and the Brocade DCX 8510 Backbone family.
- Cisco MDS 9396 and 9700 switches. For more information about configuring FEC on Cisco MDS 9000 switches, see the *Cisco MDS 9000 Series NX-OS Interfaces Configuration Guide*.

3 Before You Begin

To successfully configure FEC, you must correctly match the Marvell adapter ports to the ports on the Fibre Channel switch. If every port on the switch is to be configured for FEC, it is easier to enable all of them at once.

Before you start configuration, gather the following essential information:

- Administrator login for the server or servers
- QConvergeConsole GUI password (if different from the default password)
- Fibre Channel switch's login details for admin commands
- SAN connection topology for all the Marvell adapters to their respective switch ports

4 Configuration Instructions

Configuration instructions for FEC include the following:

- Configuring FEC on the Switch
- Configuring FEC on the Marvell Adapter

4.1 Configuring FEC on the Switch

The following sections describe how to enable FEC on a Brocade switch and a Cisco switch.

CAUTION

Enabling or disabling FEC on a switch port is disruptive to data traffic, as warned by the switch.

4.1.1
Enabling FEC on a Brocade Switch

To enable FEC on a Brocade switch port:

1. Determine FEC status on the Brocade switch port:
   a. Log in to the switch.
   b. Determine the FEC status on each switch port that you want to configure by issuing the following `portcfgfec` command. In this example, the command shows FEC status for Brocade switch port 35.

```
DS_6510B-40155:admin> portcfgfec --show 35
Port: 35
FEC Capable: YES
FEC Configured: OFF
FEC via TTS Configured: OFF
FEC State: Inactive
```

   The example shows that FEC on port 35 is not configured and is inactive.
2. Enable FEC on each switch port that requires it by issuing the following `portcfgfec` command. In this example, the command enables FEC for Brocade switch port 35.

```
DS_6510B-40155:admin> portcfgfec --enable -FEC -TTS 35
FEC TTS is supported only on F-port
WARNING: Enabling TTS on E-port, EX-port, and D-port will
disable the port.
Are you sure you want to enable TTS on the port now?
(yes, y, no, n): [no] y
Warning: FEC changes will be disruptive to the traffic FEC and
TTS have been enabled for port 35.
```

   Marvell uses the transmitter training signal (TTS) to enable FEC on the Brocade switch port.

4.1.2 Enabling FEC on a Cisco Switch

To enable FEC on a Cisco switch port:

1. For each Cisco switch port that you want to configure, set the port speed to 16GFC by issuing the following commands. The following example sets the speed at 16GFC for Cisco switch port 16.

```
# config t
(config-if)# int fc1/16
# (config-if)# switchport speed 16000
```

2. Enable FEC on each switch port that requires it by issuing the following command:

```
(config-if)# switchport fec tts
```

3. Confirm that FEC is enabled by issuing the following command:

```
(config-if)# sh interface fc1/16
fc1/16 is up
    Admin Speed is 16 Gbps
    Operating Speed is 16 Gbps
    Rate mode is dedicated
    Port flow-control is R_RDY
    Beacon is turned off
    Admin fec state is up      FEC is enabled.
    Pper fec state is up       The FEC link is up.
```

4.2 Configuring FEC on the Marvell Adapter

You can configure the adapter for Linux®, Microsoft® Windows® Server, or VMware® ESX® operating systems (OSs). Linux and Windows configuration is nearly identical because you can use either the QCC GUI or QCC CLI for these OSs. For VMware, use Marvell's QConvergeConsole VMware vSphere™ Web Client Plug-in utility.

To configure FEC for Windows or Linux with QCC GUI:

1. Launch QConvergeConsole GUI.
2. In the left pane on the Host page, select the adapter port to be configured.
3. Point to the gear icon  , point to **Wizards**, and then click **FEC Enable/Disable Wizard**.
   The FEC Enable Wizard launches and shows the Select Ports window, which lists all the ports from every Marvell adapter on the server. By default, FEC is disabled on all ports.

4. Enable FEC on a port by selecting the **FEC** check box next to that port, and then click **Next**. Figure 4-1 shows an example.

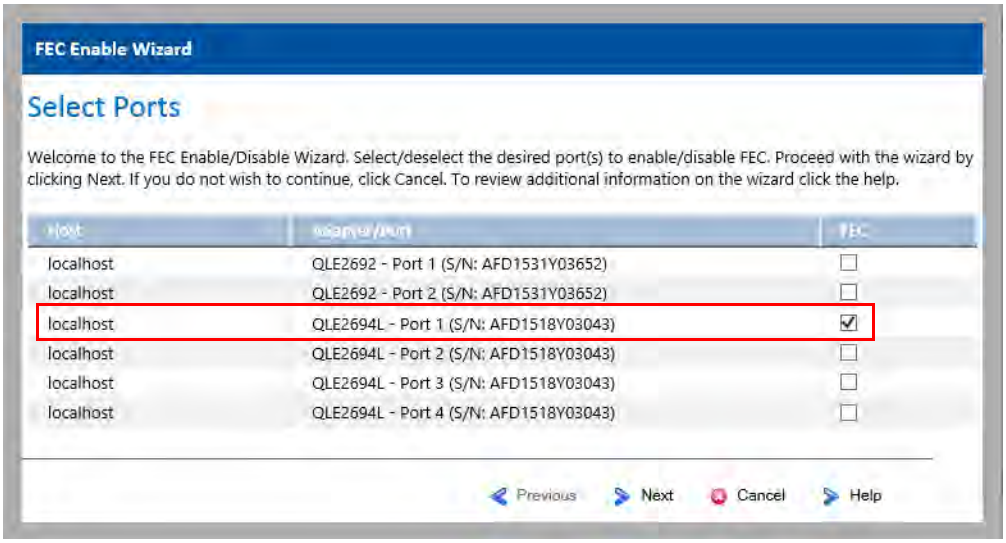

Figure 4-1. Enabling Port FEC in QCC GUI

5. On the wizard's Confirm Changes window, verify the port to be enabled, and then click **Next** to continue.

   On the wizard's Finish window, the status column shows a success message and indicates that a server reboot is required for this change to become active.

6. To complete the wizard and reboot the server, click **Finish**.

7. Following the server reboot, restart QConvergeConsole GUI. Select the adapter again to confirm that it now shows that FEC is enabled and configured for that port.

   Figure 4-2 shows an example.

Figure 4-2. Confirming Port FEC Enabled in QCC GUI

To configure FEC for Windows or Linux with QCC CLI:

1. Launch QConvergeConsole CLI.
2. From the Main Menu, select option 2, **Adapter Configuration**.
3. From the Fibre Channel Adapter Configuration menu, select option 13, **FEC Enable/Disable**.
4. Select the option number that specifies the adapter port for which you want to enable FEC.
5. On the FEC Enable/Disable menu for the selected port, select option 2, **Enable FEC**.
6. At the prompt, `Enable FEC on all port(s) of selected HBA?`, select option 1, **Yes**, to enable FEC.
7. For the FEC change to take effect, reboot the server.

To configure FEC for VMware with the QCC plug-in:

1. Launch VMware's vSphere Web Client and in the right pane, click the **Manage** tab.
2. On the Manage page, click the **QConvergeConsole** tab to access Marvell's QConvergeConsole VMware vSphere Web Client Plug-in.
3. In the plug-in's left pane, select the adapter and the port to be changed.
4. In the plug-in's right pane, click the **Parameters** tab. Figure 4-3 shows an example of the current port parameters.

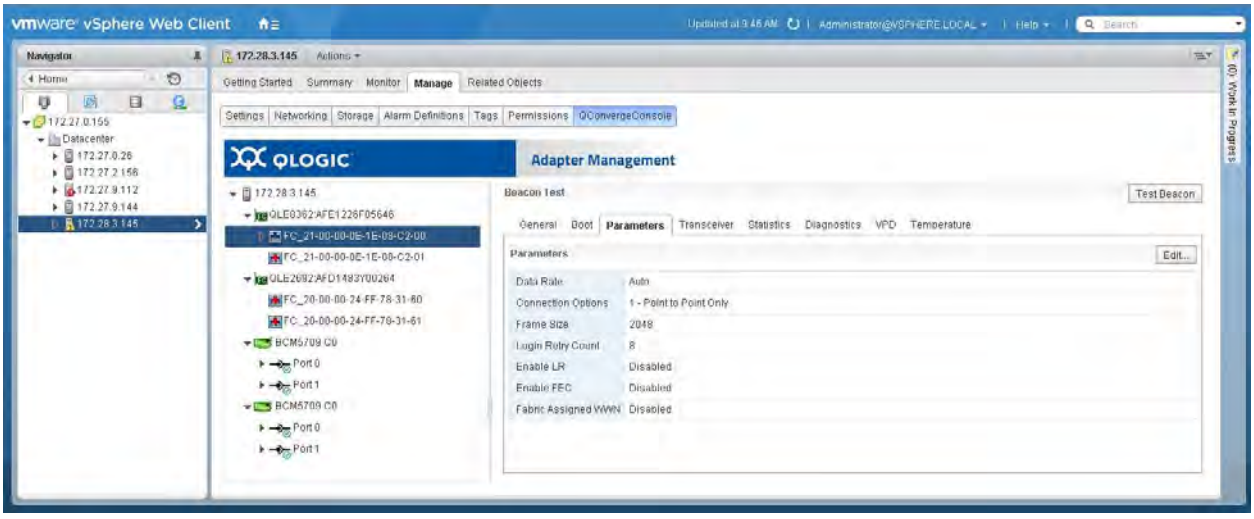

Figure 4-3. Accessing Port Parameters in the QCC Plug-in

5. On the Parameters page, click **Edit** to open the Fibre Channel Port Parameters dialog box.
6. In the Fibre Channel Port Parameters dialog box, enable FEC on this port by selecting the **Enable FEC** check box, and then click **OK**.

7. Reboot the server.
8. After the reboot, launch VMware's vSphere Web Client again and access the QConvergeConsole VMware vSphere Web Client Plug-in.
9. In the right pane, click the **Parameters** tab. The plug-in's Parameters page shows the **Enable FEC** parameter as **Enabled** on that port.
10. On the General page, click the **Parameters** tab.
11. Select the **Enable FEC Support** check box and reboot the server again.

    After the reboot, FEC is enabled as indicated by **(FEC)** following the adapter port name in the left pane of the QConvergeConsole VMware vSphere Web Client Plug-in.

A Troubleshooting

Troubleshooting FEC setup procedures include the following:

- Verify that TTS is Enabled on the Fibre Channel Switch
- Verify the Fibre Channel Switch OS Version
- Verify Adapter Firmware and Driver Versions
- Verify Connection Speed Between Switch and Adapter
- Observe FEC Detections on a Brocade FC Switch Port

A.1 Verify that TTS is Enabled on the Fibre Channel Switch

TTS must be enabled on the Fibre Channel switch port to communicate with the Marvell adapter. The following sections describe how to verify TTS on a Brocade and a Cisco Fibre Channel switch.

A.1.1 Verifying TTS on a Brocade Switch Port

To verify that TTS has been enabled on the Brocade switch port:

1. Log onto the Brocade switch.
2. Show the TTS status for the switch port (port 32 in this example) by issuing the following command:

```
DS_6510B-40155:admin> portcfgfec --show 32
Port: 32
FEC Capable: YES
FEC Configured: ON
FEC via TTS Configured: ON
FEC State: Inactive
```

TTS is enabled.

A.1.2
Verifying TTS on a Cisco Switch Port

To verify that TTS has been enabled on the Cisco switch port:

1. Log onto the Cisco switch.
2. Show the TTS status for the switch port (port 16 in this example) by issuing the following command:

```
# sh int fc1/16
fc1/16 is up
    B2B State Change Number is 14
    Receive data field Size is 2112
    Beacon is turned off
    admin fec state is up
    oper fec state is up      TTS is enabled.
```

A.2
Verify the Fibre Channel Switch OS Version

Fibre Channel switch OS requirements for FEC are as follows:

- FOS 7.4.*x* or later for Brocade switches
- NX-OS 8.2.1 or later for Cisco switches.

The following sections describe how to verify OS versions for Brocade and Cisco Fibre Channel switches.

A.2.1
Verifying the Brocade Switch FOS Version

To verify that the Brocade switch FOS version is 7.4.*x* or later:

1. Log onto the Brocade switch.
2. Show the FOS version by issuing the following command:

```
DS_6510B-40166:admin> version
Kernel:     2.6.14.2
Fabric OS:  v7.4.0a
Made on:    Thu May 28 22:45:37 2015
Flash:      Thu Jun 11 23:54:04 2015
BootProm:   1.0.11
```

3. If the FOS version is earlier than 7.4.*x*:
   a. Go to www.brocade.com.
   b. Log in to your support account.
   c. Download and install the latest version of FOS onto the switch by following the directions provided by Brocade.

A.2.2
Verifying the Cisco Switch NX-OS Version

To verify that the Cisco switch NX-OS version is 8.2.1 or later:

1. Log onto the Cisco switch.
2. Show the NX-OS version by issuing the following command:

```
# sh version
Cisco Nexus Operating System (NX-OS) Software
TAC support: http://www.cisco.com/tac
Software
  kickstart: version 8.2.1
  system:    version 8.2.1
```

3. If the NX-OS version is earlier than 8.2.1:
   a. Go to www.cisco.com and point to **Support**.
   b. In the Downloads search field, type your switch model number, and then click **Find**.
   c. On the Select a Product page, select your switch model.
   d. On the Select Download page, select **NX-OS System Software**.
   e. Download and install the latest version of NX-OS onto the switch by following the directions provided by Cisco.

A.3
Verify Adapter Firmware and Driver Versions

Use either the QConvergeConsole GUI or CLI to verify that the Marvell adapter firmware and driver versions are current.

To verify the Marvell adapter's firmware and driver versions using QCC GUI:

1. To determine the latest firmware and drivers for your adapter and OS, go to the Downloads and Documentation page at https://www.marvell.com/support/downloads.html,

5. On the Port Info page, check the **Driver Version** and **Running Firmware Version** attributes for the selected port. Figure A-1 shows an example.

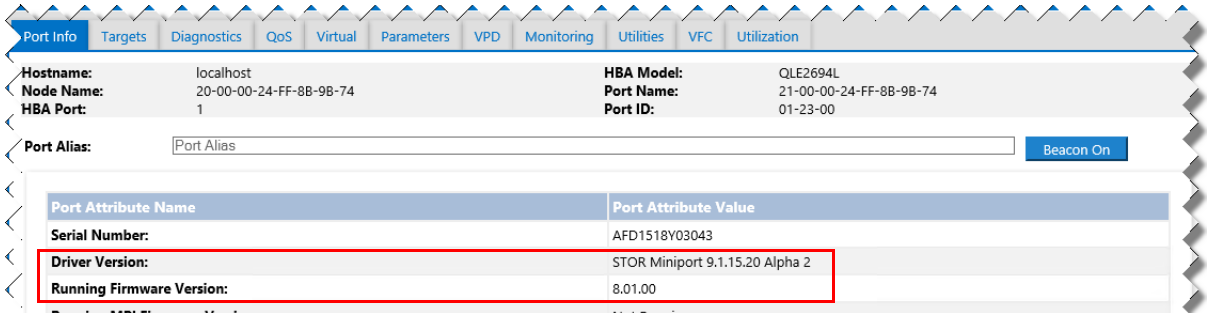

Figure A-1. Checking Driver and Firmware Versions in QCC GUI

6. Ensure that the versions are the same as those currently available from Marvell. Download and install firmware and drivers as needed.

To verify the Marvell adapter's firmware and driver versions using QCC CLI:

1. To determine the latest firmware and drivers for your adapter and OS, go to the Downloads and Documentation page at https://www.marvell.com/support/downloads.html

6. In the output, view the **Driver Version** and **Running Firmware Version** information. Figure A-2 shows an example.

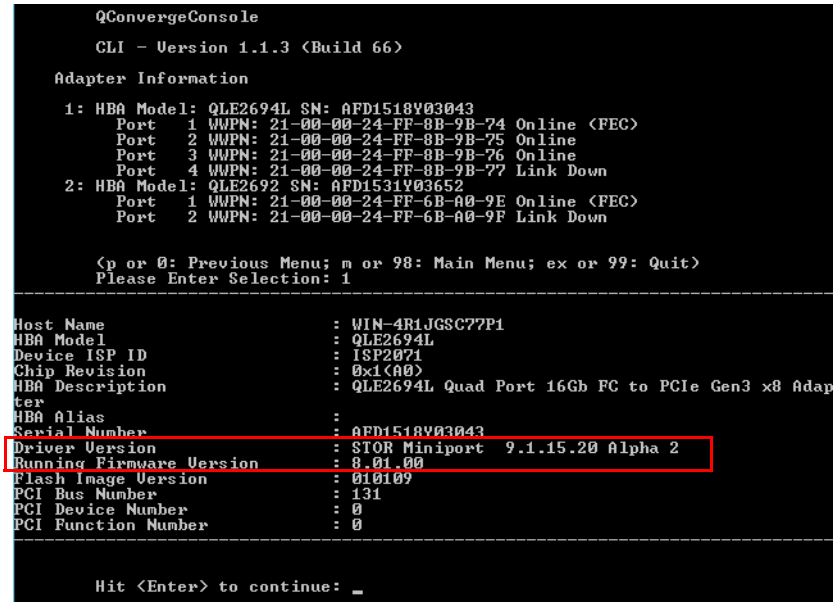

Figure A-2. Checking Driver and Firmware Versions in QCC CLI

7. Ensure that the versions are the same as those currently available from Marvell. Download and install firmware and drivers as needed.

A.4 Verify Connection Speed Between Switch and Adapter

The adapter-switch connection speed must be 16GFC; that is, the adapter port speed and the Fibre Channel switch port speed must be 16GFC. The following sections describe how to verify the connection speed on the adapter and the Brocade or Cisco switch.

NOTE

If either the adapter or switch port speed has been fixed at 8GFC, FEC will not operate, even if FEC has been enabled properly on both devices.

A.4.1
Verifying Brocade Switch-Adapter Connection Speed

To verify that the switch-adapter connection speed is 16GFC:

1. Log onto the Brocade switch.
2. Show the Brocade switch port speed (port 35 in this example) by issuing the following command:

```
DS_6510B-40155:admin> portshow 35
portIndex:  35
portName: port35
portHealth: HEALTHY
Authentication: None
portDisableReason: None
portCFlags: 0x1
portFlags: 0x24b03       PRESENT ACTIVE F_PORT G_PORT
LOGICAL_ONLINE LOGIN NOELP LED ACCEPT FLOGI
LocalSwcFlags: 0x0
portType:  24.0
POD Port: Port is licensed
portState: 1    Online
Protocol: FC
portPhys:  6    In_Sync         portScn:   32   F_Port
port generation number:    386
state transition count:    92
portId:    012300
portIfId:    43020020
portWwn:   20:23:00:05:33:76:3f:84
portWwn of device(s) connected:
        21:00:00:24:ff:8b:9b:74
Distance:  normal
portSpeed: N16Gbps          Switch port speed is 16GFC.
⋮
```

3. From QConvergeConsole GUI or QConvergeConsole CLI, show the adapter port speed.
   - ❑ In QCC GUI:
     a. Launch QConvergeConsole GUI.
     b. In the left pane, select an adapter port.
     c. In the right pane, click the **Port Info** tab.
     d. On the Port Info page, ensure that the **Actual Data Rate** attribute for the selected port shows **16 Gbps** (see Figure A-1 on page 12 for an example).

- ❑ In QCC CLI:
  a. Launch QConvergeConsole CLI.
  b. From the Main Menu, select option 1, **Adapter Information**.
  c. From the FC Adapter Information menu, select option 2, **FC Port Information**.
  d. Select the option number that specifies the FEC-enabled adapter port for which you want to determine the port speed.
  e. In the port information output, verify that the **Actual Data Rate** is **16 Gbps**. Figure A-3 shows an example.

Figure A-3. Verifying the Port Speed in QCC CLI

A.4.2

Verifying the Cisco Switch-Adapter Connection Speed

To verify that the switch-adapter connection speed is 16GFC:

1. Log onto the Cisco switch.
2. Show the switch port properties (port 16 in this example) by issuing the following command.

```
Cisco# sh interface fc1/16
fc1/16 is up
    Hardware is Fibre Channel, SFP is short wave laser w/o OFC
(SN)
    Port WWN is 20:10:00:de:fb:ab:43:80
    Admin port mode is auto, trunk mode is on
    snmp link state traps are enabled
    Port mode is F, FCID is 0xbc0021
    Port vsan is 15
    Admin Speed is 16 Gbps
    Operating Speed is 16 Gbps      Switch port speed is 16GFC.
    Rate mode is dedicated
    Port flow-control is R_RDY
    ⋮
```

3. To show the adapter port speed using QConvergeConsole GUI or QConvergeConsole CLI, see Step 3 on page 14.

A.5

Observe FEC Detections on a Brocade FC Switch Port

To observer FEC detections that have occurred on a Brocade switch port:

1. Log onto the Brocade switch.
2. Show the Brocade switch port statistics (port 32 in this example) by issuing the following command:

   ```
   DS_6510B-40155:admin> portstatsshow 32
   ```

3. In the command output, check the `fec_cor_detected` and `fec_uncor_detected` fields to determine how many FEC corrected and uncorrected blocks were detected. For example:

```
DS_6510B-40155:admin> portstatsshow 32
stat_wtx                2564924401  4-byte words transmitted
stat_wrx                3300703007  4-byte words received
stat_ftx                2220105151  Frames transmitted
stat_frx                1780804040  Frames received
stat_c2_frx             0           Class 2 frames received
stat_c3_frx             1694259484  Class 3 frames received
stat_lc_rx              0           Link control frames received
stat_mc_rx              0           Multicast frames received
stat_mc_to              0           Multicast timeouts
stat_mc_tx              0           Multicast frames transmitted
tim_rdy_pri             0           Time R_RDY high priority
tim_txcrd_z             442580338   Time TX Credit Zero (2.5Us ticks)
tim_txcrd_z_vc  0- 3:   0           0           442580338   0
tim_txcrd_z_vc  4- 7:   0           0           0           0
tim_txcrd_z_vc  8-11:   0           0           0           0
tim_txcrd_z_vc 12-15:   0           0           0           0
tim_latency_vc  0- 3:   1           1           1           1
tim_latency_vc  4- 7:   1           1           1           1
tim_latency_vc  8-11:   1           1           1           1
tim_latency_vc 12-15:   1           1           1           1
fec_cor_detected        0           Count of blocks that were corrected by FEC
fec_uncor_detected      0           Count of blocks that were left uncorrected by FEC
er_enc_in               0           Encoding errors inside of frames
er_crc                  0           Frames with CRC errors
```

⋮

Document Revision History	
Revision A, August 24, 2015	
Revision B, September 16, 2015	
Revision C, February 29, 2016	
Revision D, May 15, 2018	
Changes	
Removed QLE2694U from the table of applicable products.	"Applicable Products" on page 1
Added support for Cisco Fibre Channel switches	Throughout
Updated Marvell URLs and downloading instructions to reflect the new Marvell Web Site	Throughout

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