BROCADE

FEATURE GUIDE

Forward Error Correction (FEC) for Gen 5

Supporting Fabric OS 7.3 and Later

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Contents

Preface

The scope of this document is to define the best practice for enabling and disabling Forward Error Correction (FEC) and FEC via Transmitter Training Signal (TTS) in Gen 5, 16G Fibre Channel (FC) products.

Overview

As Fibre Channel speeds increase, the ability to maintain an error-free cable plant is becoming increasingly difficult. FEC is designed to improve the reliability of optical signal transmission. Although FEC alleviates the need for pristine cable plants, good cable hygiene throughout the entire cable plant is still the recommended best practice.

This guide introduces concepts and guidelines to help you to enable FEC and FEC via TTS to avoid potential issues that can result from improper implementation. It covers the best way to use and implement the FEC feature across all Gen 5 switches and directors. The guidelines in this document do not apply to every environment but are designed to help guide you through the decisions that will need to be made for a successful implementation.

Audience

This guide is for technical IT architects and administrators who are directly or indirectly responsible for SAN design or administration.

Related Documents

For further information on FEC limitations and instruction on enablement and disablement, refer to the *Brocade Fabric OS Administrator's Guide* and the *Brocade Fabric OS Command Reference*, which contain additional information on configuring and using this feature.

About Brocade

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Innovative Ethernet and storage networking solutions for data center, campus, and service provider networks help reduce complexity and cost while enabling virtualization and cloud computing to increase business agility.

To help ensure a complete solution, Brocade partners with world-class IT companies and provides comprehensive education, support, and professional services offerings. (www.brocade.com).

Document History

Date	Part Number	Description
April 1, 2016	53-1004304-01	Initial version.

Definitions and Terminology

Forward Error Correction (FEC)

The Fibre Channel specification describes the behavior of FEC for Gen 5 and higher. FEC for optical links is optional for Gen 5, and Brocade supports this functionality for all Gen 5, 16GFC products.

FEC via Transmitter Training Signal (TTS)

FEC and FEC via TTS are part of the Gen 5 Fibre Channel technical specification for copper links. Brocade has implemented support for FEC and FEC via TTS on optical connections for all Gen 5 products. Since FEC is optional, TTS was extended to include a means to negotiate FEC capabilities.

FEC Active

FEC is negotiated in Gen 5. It is activated when both sides of the link have FEC enabled. The FEC active indicator in Fabric OS (FOS) indicates whether FEC was successfully negotiated.

How Forward Error Correction Works

FEC uses unused bits within the signaling protocol to generate an Error Correcting Code (ECC) and correct bits as needed. It is effectively equivalent to gaining as much as an additional 2.5 dB of link loss budget from a noise perspective.

Implementation Considerations

Device and Server Notes

All known devices that support FEC via TTS have it enabled by default; however, not all devices that support 16GFC support FEC via TTS. FEC is enabled by default on Brocade switches, but FEC via TTS is disabled by default.

FEC via TTS is negotiated during speed negotiation when a link comes up. Brocade Gen 5 switch ports support two modes of auto-negotiation.

With FEC via TTS Enabled	With FEC via TTS Disabled
16GFC with FEC via TTS	16GFC
8GFC	8GFC
4GFC	4GFC

This means that any HBA or device connection that supports 16GFC but not FEC via TTS will auto-negotiate to 8GFC. FEC via TTS, therefore, should be enabled only on switch ports intended for connections to HBAs and devices that support FEC via TTS.

DWDM Considerations

Since most DWDM interfaces understand Fibre Channel framing and only multiplex frames with other traffic, the FEC bits are not transported via Gen 5 DWDM ports. FEC, therefore, must be disabled. Some manufacturers of DWDM have a transparent mode. In this mode, all bits are transmitted. Check with your Brocade representative for support statements for FEC on DWDM in transparent mode.

Switch to Switch

The FEC protocol is designed into the Brocade Gen 5 ASIC. A Brocade-to-Brocade connection, ISL, therefore does not utilize TTS to enable FEC; consequently, FEC via TTS must be *disabled* on all E-Ports. When FEC via TTS is enabled on a port, that port will automatically be disabled when connected to another Brocade Gen 5 switch.

Mainframe Notes

Although supported with FOS 7.3.1c, FOS 7.4.1b should be used for mainframe environments.

The nondisruptive code path upgrade is: 7.2.1d --> 7.3.1c --> 7.4.1b

Enabling or disabling FEC via TTS momentarily disables the port. As with any switch action that disables a port, CHIPIDs connected to that port should be configured offline. Operators should quiesce all traffic or vary offline any link address associated with a port that will be disabled.

How to Enable/Disable FEC and FEC via TTS

Overview

The Element Manager in Brocade Network Advisor can be used to enable or disable FEC but not FEC via TTS. FEC via TTS can be enabled or disabled only using the CLI. The feature can be enabled on a port range on a fixed port switch or on a port range within a slot for directors.

FEC via TTS is a method to negotiate FEC when FEC is supported on Gen 5 links. FEC, therefore, must be enabled as well.

When enabling FEC via TTS, the port is momentarily disabled—a disruptive action. FEC is active only when both ends of the link have FEC enabled.

Important Considerations

Since 16GFC cannot be negotiated when FEC via TTS is enabled on the switch but is not supported on the attached node, some forethought should be given before enabling this feature. Setting the switch port to a fixed speed of 16GFC does not resolve this problem.

Some HBAs and devices support a 4-cycle method of speed negotiation: 16GFC with FEC via TTS, 16GFC without FEC, 8GFC, and 4GFC. In this case, 16GFC can be negotiated regardless of how FEC via TTS is configured on the switch port. Check with the manufacturer to determine what modes are supported.

The best practice is to always leave FEC enabled; however, a best practice regarding FEC via TTS depends on current and future plans regarding 16GFC attachments. If the only plans for 16GFC attachments are with HBAs and devices that will support FEC via TTS, then a data center may choose to establish a best practice to enable it during installation. Otherwise, FEC via TTS should be enabled only on ports intended for connections to HBAs and devices that also support FEC via TTS.

Because enabling FEC via TTS is disruptive, the use of this feature should be considered before putting the port into production.

FEC Command

The command to enable or disable FEC and to show the status of FEC and FEC via TTS is the **portcfgfec** command. For details, refer to the *Brocade Fabric OS Command Reference*.

Parameters for this command are:

--show	Displays the current state of FEC. A port or port range must also be specified. The FEC state is also displayed with the **portcfgshow** command.
--enable	Indicates that the FEC or TTS mode will be enabled, depending on what mode is specified.
--disable	Indicates that the FEC or TTS mode will be disabled, depending on what mode is specified.

-fec	Enables or disables the standard FEC feature.
-tts	Enables or disables the FEC via TTS feature.
-force or -f	Performs the enable or disable function without confirmation. If this option is not specified, the user will be warned that the port will go offline and be prompted to continue.
--help	Displays help for this command.

Examples

Before executing any commands, remember to set the CLI context to the fabric ID (FID) for the logical switch. For example, to set the context to FID 1:

```
setcontext 1
```

To enable FEC via TTS on all ports of a 32-port blade in slot 1 without confirmation:

```
portcfgfec --enable -tts -f 1/0-31
```

To enable FEC via TTS on port 0 of slot 1 with confirmation:

```
portcfgfec --enable -tts 1/0
```

To disable FEC via TTS on port 0 of slot 1 without confirmation:

```
portcfgfec --disable -tts -f 1/0
```

To disable FEC on port 0 of slot 1 without confirmation:

```
portcfgfec --disable -fec -f 1/0
```