



Storage Feature Guide



Modified: 2018-11-30

Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

Juniper Networks, the Juniper Networks logo, Juniper, and Junos are registered trademarks of Juniper Networks, Inc. in the United States and other countries. All other trademarks, service marks, registered marks, or registered service marks are the property of their respective owners.

Juniper Networks assumes no responsibility for any inaccuracies in this document. Juniper Networks reserves the right to change, modify, transfer, or otherwise revise this publication without notice.

Storage Feature Guide

Copyright © 2018 Juniper Networks, Inc. All rights reserved.

The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

The Juniper Networks product that is the subject of this technical documentation consists of (or is intended for use with) Juniper Networks software. Use of such software is subject to the terms and conditions of the End User License Agreement ("EULA") posted at <https://support.juniper.net/support/eula/>. By downloading, installing or using such software, you agree to the terms and conditions of that EULA.

Table of Contents

	About the Documentation	xix
	Documentation and Release Notes	xix
	Using the Examples in This Manual	xix
	Merging a Full Example	xx
	Merging a Snippet	xx
	Documentation Conventions	xxi
	Documentation Feedback	xxiii
	Requesting Technical Support	xxiii
	Self-Help Online Tools and Resources	xxiv
	Opening a Case with JTAC	xxiv
Chapter 1	Storage Overview	25
	Overview of Fibre Channel	26
	Fibre Channel Transport Protocol	27
	How FC Works on the Switch	27
	FCoE-FC Gateway	27
	FCoE Transit Switch	28
	FCoE VLANs	28
	Supported FC Features and Functions	30
	Lossless Transport Support	30
	Understanding Fibre Channel Terminology	31
	Overview of FIP	41
Part 1	Transit Switch, FCoE, and FIP Snooping	
Chapter 2	Using FCoE on a Transit Switch	45
	Understanding FCoE Transit Switch Functionality	46
	Understanding FCoE	51
	FCoE Devices	52
	FCoE Frames	53
	Virtual Links	54
	FCoE VLANs	54
	Understanding FCoE LAGs	57
	Why a Standard LAG Does Not Work for FCoE Traffic	58
	How an FCoE LAG Works	58
	Behavior on FCoE LAG Link Failure	59
	FIP Snooping Session Scaling on QFabric System Node Devices	59
	FCoE LAG Configuration on an FCoE Transit Switch	60

FCoE LAG Configuration and FIP Snooping Scaling on an FCoE-FC Gateway	60
Configuring an FCoE LAG on an FCoE-FC Gateway	60
FIP Snooping Session Scaling on an FCoE-FC Gateway	61
Summary of FCoE LAG and FIP Snooping Scaling on an FCoE-FC Gateway	61
FCoE Blade Switches	62
Limitations	62
Configuring an FCoE LAG	63
Example: Configuring an FCoE LAG on a Redundant Server Node Group	66
Understanding OxID Hash Control for FCoE Traffic Load Balancing on QFabric Systems	79
OxID Hash Control	80
Advantages and Disadvantages of OxID Hash Control	80
Disabling OxID Hash Control	81
Understanding OxID Hash Control for FCoE Traffic Load Balancing on Standalone Switches	81
Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on Standalone Switches	82
Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on QFabric Systems	83
Configuring VLANs for FCoE Traffic on an FCoE Transit Switch	85
Understanding FIP Snooping, FBF, and MVR Filter Scalability	91
VFP TCAM Architecture and Allocation	91
VFP TCAM Entry Consumption	92
FIP Snooping Filter VFP TCAM Consumption	92
FBF Filter VFP TCAM Consumption	93
MVR Filter VFP TCAM Consumption	94
VFP TCAM Consumption Summary Table	94
Rejected Filter Configurations (No Available VFP TCAM Space)	95
VFP TCAM Allocation and Consumption (Scaling) Examples	96
Example 1: Three Filter Types Consume Three Slices	96
Example 2: Three Filter Types Consume Four Slices	96
Example 3: Two Filter Types Consume Four Slices	97
Example 4: Three Filter Types Oversubscribe the VFP TCAM	97
Filter Configuration Recommendations	98
Configure and Maintain the Fewest Number of Filters Needed	98
Always Delete Rejected Filter Configurations	99
Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch	101
FC Network Security	102
VN2VF_Port FIP Snooping Functions	103
FIP Snooping Firewall Filters	103
FIP Snooping Session Scalability	103
VN2VF_Port FIP Snooping Implementation	104
ENode-Facing Interfaces	105
Network-Facing Interfaces	106
FC-MAP	106
T11 VN2VF_Port FIP Snooping Specification	107

Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch	108
Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch . . .	111
VN2VN_Port FIP Snooping and FIP Snooping Virtual Links	112
VN2VN_Port Communication Modes	112
Network Security	113
VN2VN_Port FIP Snooping Functions	113
Scalability	113
VN2VN_Port FIP Snooping Implementation	114
ENode-Facing Interfaces	114
Non-ELS Port Mode for FCoE Interfaces	115
ELS Interface Mode for FCoE Interfaces	115
Trusted and Untrusted FCoE Interfaces	115
Network-Facing Interfaces (Connecting to Another Transit Switch)	116
Beacon Period (VN2VN_Port FIP Snooping Link Maintenance)	116
QFabric System Differences in VN2VN_Port FIP Snooping Traffic Handling	116
Enabling VN2VN_Port FIP Snooping and Configuring the Beacon Period on an FCoE Transit Switch	118
Example: Configuring VN2VN_Port FIP Snooping (FCoE Hosts Directly Connected to the Same FCoE Transit Switch)	120
Example: Configuring VN2VN_Port FIP Snooping (FCoE Hosts Directly Connected to Different FCoE Transit Switches)	125
Example: Configuring VN2VN_Port FIP Snooping (FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch)	132
Disabling Enhanced FIP Snooping Scaling	142
Understanding MC-LAGs on an FCoE Transit Switch	143
Supported MC-LAG Topology	143
Transit Switches (Server Access)	145
MC-LAG Switches (FCoE Aggregation)	145
FIP Snooping and FCoE Trusted Ports	145
CoS and Data Center Bridging (DCB)	146
Example: Configuring CoS Using ELS for FCoE Transit Switch Traffic Across an MC-LAG	146
Understanding FCoE and FIP Session High Availability	174
High Availability for Fibre Channel Process Termination (FCoE-FC Gateway Mode, QFX3500 Only)	174
High Availability for FIP Snooping	174
Nonstop Software Upgrade (QFabric Systems)	175
Troubleshooting Dropped FIP Traffic	176
Troubleshooting Dropped FCoE Traffic	178
 Part 2	
 Chapter 3	
Fibre Channel and FCoE-FC Gateways	
Using Fibre Channel and FCoE-FC Gateways	185
Understanding Fibre Channel	186
FC Fabrics	186
FC Port Types	187
FC Switches	187

Adapters	188
N_Port ID Virtualization (NPIV)	188
FC Services	188
Understanding an FCoE-FC Gateway	190
Gateway FC Fabric	191
Fabric Services	192
FCoE-FC Gateway Traffic Switching	192
Understanding Fibre Channel Fabrics on the QFabric System	194
Configuring an FCoE-FC Gateway Fibre Channel Fabric	195
Understanding FCoE-FC Gateway Functions	196
Login and Logout	196
FCoE and FC Frame Handling	197
Data Center Bridging	197
Disabling the Fabric WWN Verification Check	197
Load Balancing	198
Disabling the Fabric WWN Verification Check	200
Understanding FCoE and FIP Session High Availability	201
High Availability for Fibre Channel Process Termination (FCoE-FC Gateway Mode, QFX3500 Only)	201
High Availability for FIP Snooping	201
Nonstop Software Upgrade (QFabric Systems)	202
Understanding FIP Functions	203
FIP VLAN Discovery	204
FIP Discovery	204
FIP FLOGI	205
FIP FDISC	206
FIP Maintenance (Keepalive Messages)	206
FIP LOGO	207
Understanding FIP Implementation on an FCoE-FC Gateway	208
FIP Basics	208
Fabric Login and FIP Login Overview	209
Proxy FIP Discovery	210
Proxy FIP Initialization	211
Proxy FIP Maintenance	212
Proxy FIP Logout	212
Understanding FIP Parameters on an FCoE-FC Gateway	212
FIP Keepalive Advertisement Period	213
Addressing Mode	213
FC-MAP	214
FCoE Trusted Fabric	214
Maximum Number of FCoE Sessions Per ENode	215
Priority	215
Configuring FIP on an FCoE-FC Gateway	216
Setting the Maximum Number of FIP Login Sessions per ENode	219
Setting the Maximum Number of FIP Login Sessions per FC Interface	220
Setting the Maximum Number of FIP Login Sessions per FC Fabric	221
Setting the Maximum Number of FIP Login Sessions per Node Device	222
Troubleshooting Dropped FIP Traffic	223
Understanding Fibre Channel Virtual Links	225

Understanding Interfaces on an FCoE-FC Gateway	226
Native FC Interfaces to the FC Switch	226
Port Mode	227
NPIV	227
Port Speed	228
FIP Login Session Limits	228
FCoE Trusted and Untrusted Interface Session Limits	229
Configuring Consistent Session Limits	230
Decreasing Session Limits	231
Increasing Session Limits	231
Effect of Deactivating and Then Reactivating the Configuration on Session Limits	231
Trusted and Untrusted Interfaces	232
Buffer-to-Buffer Credit Recovery	233
FCoE VLAN Interface to FCoE Devices	234
Port Mode	235
Disabling Storm Control on FCoE Interfaces	237
NPIV Support	238
VN2VF_Port FIP Snooping	238
Assigning Interfaces to a Fibre Channel Fabric	238
Deleting a Fibre Channel Interface	238
Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric	239
Configuring a Physical Fibre Channel Interface	254
Converting an Ethernet Interface To a Fibre Channel Interface	255
Configuring an FCoE VLAN Interface on an FCoE-FC Gateway	258
Assigning Interfaces to a Fibre Channel Fabric	262
Deleting a Fibre Channel Interface	263
Troubleshooting Fibre Channel Interface Deletion	264
Disabling VN2VF_Port FIP Snooping on an FCoE-FC Gateway Switch Interface	265
Disabling Storm Control on FCoE Interfaces on an FCoE-FC Gateway	266
Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric	267
Load-Balancing Algorithms	268
Simple Load Balancing	269
ENode-Based Load Balancing	270
FLOGI-Based Load Balancing	270
Load-Balancing Algorithm Comparison	271
Load-Rebalancing Methods	272
NP_Port Interface FIP Session Limit Effect on Load Balancing	273
Load-Balancing Triggers and Timing	273
Load-Balancing Triggers	273
Load-Balancing Timer	274
Load Rebalancing Behavior When a Link Goes Down	275
Interface Load Calculation Algorithm	276
Load-Balancing Scenarios	277
Simple Load-Balancing Algorithm Scenario	278
ENode-Based Load-Balancing Algorithm Scenarios	279
FLOGI-Based Load-Balancing Algorithm Scenarios	281

	Defining the Proxy Load-Balancing Algorithm	283
	Simulating On-Demand Fibre Channel Link Load Rebalancing (Dry Run Test)	285
	Example: Configuring Automated Fibre Channel Interface Load Rebalancing . .	285
Part 3	Data Center Bridging (DCBX, PFC)	
Chapter 4	Using Data Center Bridging (DCBX, PFC)	291
	Understanding DCB Features and Requirements	292
	Lossless Transport	292
	PFC	293
	Buffer Management	293
	Physical Interfaces	293
	ETS	293
	DCBX	294
	Understanding DCBX	295
	DCBX Basics	295
	DCBX Modes and Support	296
	DCBX Modes (Versions)	296
	Autonegotiation	298
	CNA Support for DCBX Modes	299
	Interface Support for DCBX	299
	DCBX Attribute Types	299
	Asymmetric Attributes	299
	Symmetric Attributes	300
	DCBX Application Protocol TLV Exchange	300
	Application Protocol TLV Exchange	300
	FCoE Application Protocol TLV Exchange	300
	Disabling Application Protocol TLV Exchange	301
	DCBX and PFC	301
	DCBX and ETS	302
	Default DCBX ETS Advertisement	302
	ETS Advertisement and Peer Configuration	302
	ETS Recommendation TLV	303
	Configuring the DCBX Mode	304
	Configuring DCBX Autonegotiation	305
	Disabling the ETS Recommendation TLV	308
	Understanding DCBX Application Protocol TLV Exchange	309
	Applications	309
	Application Maps	310
	Classifying and Prioritizing Application Traffic	311
	Enabling Interfaces to Exchange Application Protocol Information	312
	Disabling DCBX Application Protocol Exchange	312
	Defining an Application for DCBX Application Protocol TLV Exchange	313
	Configuring an Application Map for DCBX Application Protocol TLV Exchange	314
	Applying an Application Map to an Interface for DCBX Application Protocol TLV Exchange	315
	Example: Configuring DCBX Application Protocol TLV Exchange	316

	Understanding CoS Flow Control (Ethernet PAUSE and PFC)	327
	General Information about Ethernet PAUSE and PFC and When to Use	
	Them	328
	Ethernet PAUSE	328
	Symmetric Flow Control	330
	Asymmetric Flow Control	330
	PFC	333
	Lossless Transport Support Summary	337
	Example: Configuring CoS PFC for FCoE Traffic	339
Chapter 5	Learn About Technology	351
	Data Center Technology Overview Videos	351
	Learn About Video: Why Do We Need an IP Fabric?	351
	Learn About Video: What is the Best Control Plane Protocol to Use in a Data	
	Center IP Fabric?	351
	Learn About Video: Why Use an Overlay Network in a Data Center?	351
	Conceptual Documents That Contain Technology Overview Videos	352
Part 4	Configuration Statements and Operational Commands	
Chapter 6	Configuration Statements for Transit Switches, FCoE, and FIP	
	Snooping	355
	beacon-period	356
	examine-vn2vf	357
	examine-vn2vn	358
	family fcoe	359
	fc-map	360
	fcoe-lag	362
	fip-security	363
	fcoe-trusted	364
	interface (FIP Snooping)	365
	no-fcoe-lag	366
	no-fip-snooping-scaling	367
	node-group (OxID Hash Control)	368
	oxid	369
Chapter 7	Operational Commands for Transit Switches, FCoE, and FIP Snooping . .	371
	clear fip snooping enode	372
	clear fip snooping statistics	373
	clear fip snooping vlan	374
	clear fip vlan-discovery statistics	375
	show dcbx	376
	show fip snooping	377
	show fip snooping enode	383
	show fip snooping fcf	387
	show fip snooping interface	391
	show fip snooping statistics	394
	show fip snooping vlan	398
	show fip vlan-discovery	402
	show dcbx neighbors	404

Chapter 8	Configuration Statements for Fibre Channel and FCoE-FC Gateways . . .	433
	auto-load-rebalance	434
	bb-sc-n	435
	description (Fibre Channel Fabrics)	436
	fabric-id	437
	fabric-interfaces	438
	fabric-type	439
	fc2	439
	fc-fabrics	440
	fc-map	442
	fc-options	443
	fibre-channel (Family Interfaces)	444
	fibre-channel (Port)	445
	fibrechannel-options	446
	fip	447
	fka-adv-period	448
	interface (Fibre Channel Fabric)	449
	interface (FIP)	450
	load-balance-algorithm	451
	loopback (Fibre Channel Interface)	452
	max-login-sessions	453
	max-login-sessions-per-node	454
	max-sessions-per-enode	455
	no-fabric-wwn-verify	456
	no-fip-snooping-scaling	457
	port-mode (Fibre Channel Interfaces)	458
	port-range	459
	priority (FIP)	460
	protocols (FIP)	461
	proxy (Fibre Channel)	462
	speed (Fibre Channel Interfaces)	463
	traceoptions (FC-2 Fibre Channel)	464
	traceoptions (Fibre Channel)	466
	traceoptions (FIP Protocol Fibre Channel)	469
	traceoptions (Proxy Fibre Channel)	471
Chapter 9	Operational Commands for Fibre Channel and FCoE-FC Gateways	473
	Monitoring Fibre Channel Interface Load Balancing	474
	Monitoring the Interface Load-Balancing State	474
	Monitoring the Fabric Load-Balancing Algorithm	475
	clear fibre-channel fc2 statistics	480
	clear fibre-channel fip enode	481
	clear fibre-channel fip statistics	482
	clear fibre-channel fip vn-port	483
	clear fibre-channel flogi statistics	484
	clear fibre-channel proxy statistics	485
	clear fip vlan-discovery statistics	486
	request fibre-channel proxy load-rebalance	487
	restart	489

	show fibre-channel fabric	500
	show fibre-channel fc2 sessions	502
	show fibre-channel fc2 statistics	504
	show fibre-channel fip	506
	show fibre-channel fip enode	512
	show fibre-channel fip fabric	516
	show fibre-channel fip fcf	519
	show fibre-channel fip interface	522
	show fibre-channel fip statistics	526
	show fibre-channel flogi fport	530
	show fibre-channel flogi nport	532
	show fibre-channel flogi statistics	534
	show fibre-channel interfaces	537
	show fibre-channel next-hops	540
	show fibre-channel routes	542
	show fibre-channel proxy fabric-state	544
	show fibre-channel proxy login-table	548
	show fibre-channel proxy np-port	551
	show fibre-channel proxy statistics	555
	show fip vlan-discovery	558
	show route forwarding-table family fibre-channel	560
Chapter 10	Configuration Statements for Data Center Bridging and PFC	563
	application (Application Maps)	564
	application (Applications)	565
	application-map	566
	application-maps	567
	applications (Applications)	568
	applications (DCBX)	569
	code-points (Application Maps)	570
	dcbx	571
	dcbx-version	572
	destination-port (Applications)	573
	disable (DCBX)	574
	enhanced-transmission-selection	575
	ether-type	576
	interface (DCBX)	577
	no-recommendation-tlv	578
	policy-options	579
	priority-flow-control	580
	protocol (Applications)	581
	recommendation-tlv	582
Chapter 11	Operational Commands for Data Center Bridging	583
	show dcbx	584
	show dcbx neighbors	585

List of Figures

Part 1	Transit Switch, FCoE, and FIP Snooping	
Chapter 2	Using FCoE on a Transit Switch	45
	Figure 1: FCoE Transit Switch Connecting FCoE Devices to an FC Switch	49
	Figure 2: ENode Components	53
	Figure 3: FCoE LAG Example Topology	69
	Figure 4: FCoE Transit Switch Performs VN2VF_Port FIP Snooping	102
	Figure 5: VN2VN_Port Traffic Across a QFabric Interconnect Device	117
	Figure 6: VN2VN_Port FIP Snooping (FCoE Hosts Connected to Same Transit Switch) Topology	122
	Figure 7: VN2VN_Port FIP Snooping (FCoE Hosts Connected to Different Transit Switches) Topology	127
	Figure 8: VN2VN_Port FIP Snooping (FCoE Hosts Indirectly Connected) Topology	135
	Figure 9: Supported Topology for an MC-LAG on an FCoE Transit Switch	143
	Figure 10: Supported Topology for an MC-LAG on an FCoE Transit Switch	149
Part 2	Fibre Channel and FCoE-FC Gateways	
Chapter 3	Using Fibre Channel and FCoE-FC Gateways	185
	Figure 11: FCoE-FC Gateway Topology	190
	Figure 12: Traffic Switching Between FCoE Hosts Connected to the FC Network by an FCoE-FC Gateway	193
	Figure 13: FCoE-FC Gateway Fabric Login and FIP Login	209
	Figure 14: Fibre Channel Interface Configuration Topology	242
	Figure 15: Sample Load-Balancing Topology	278
Part 3	Data Center Bridging (DCBX, PFC)	
Chapter 4	Using Data Center Bridging (DCBX, PFC)	291
	Figure 16: PFC for FCoE Traffic Configuration Components Block Diagram	341

List of Tables

	About the Documentation	xix
	Table 1: Notice Icons	xxi
	Table 2: Text and Syntax Conventions	xxii
Chapter 1	Storage Overview	25
	Table 3: Fibre Channel Protocol Layers	27
	Table 4: Fibre Channel Terms	31
Part 1	Transit Switch, FCoE, and FIP Snooping	
Chapter 2	Using FCoE on a Transit Switch	45
	Table 5: Summary of FCoE LAG and FIP Snooping Scaling (FCoE-FC Gateway)	61
	Table 6: Components of the FCoE LAG Configuration Example	68
	Table 7: VFP TCAM Entry Consumption Summary	95
	Table 8: Components of the VN2VN_Port FIP Snooping Configuration Topology (FCoE Hosts Directly Connected to the Same FCoE Transit Switch)	122
	Table 9: Components of the VN2VN_Port FIP Snooping Configuration Topology (FCoE Hosts Directly Connected to Different FCoE Transit Switches)	126
	Table 10: Components of the VN2VN_Port FIP Snooping Configuration Topology (FCoE Hosts Indirectly Connected Across an Aggregation Layer FCoE Transit Switch)	134
	Table 11: Components of the CoS for FCoE Traffic Across an MC-LAG Configuration Topology	149
Part 2	Fibre Channel and FCoE-FC Gateways	
Chapter 3	Using Fibre Channel and FCoE-FC Gateways	185
	Table 12: Components of the Fibre Channel Interface Configuration Topology	241
	Table 13: Load-Balancing Algorithm Comparison	271
	Table 14: Load-Balancing Triggers and Actions	274
	Table 15: FC Interface Session-Based Load-Balancing Characteristics for Unequal Loads	276
	Table 16: FC Interface Session-Based Load-Balancing Characteristics for Equal Loads	277
Part 3	Data Center Bridging (DCBX, PFC)	
Chapter 4	Using Data Center Bridging (DCBX, PFC)	291
	Table 17: Summary of Differences Between IEEE DCBX and DCBX Version 1.01	297

Table 18: Default IEEE 802.1 Classifiers for Trunk Ports and Tagged-Access Ports (Default Trusted Classifier)	318
Table 19: Default IEEE 802.1 Unicast Classifiers for Access Ports (Default Untrusted Classifier)	318
Table 20: Components of DCBX Application Protocol Exchange Configuration Topology	319
Table 21: Asymmetric Ethernet PAUSE Flow Control Configuration	330
Table 22: Flow Control State Advertised to the Connected Peer (Autonegotiation)	331
Table 23: Asymmetric Ethernet PAUSE Behavior on Local and Peer Interfaces	333
Table 24: Default PFC Priority to Queue and Forwarding Class Mapping	335
Table 25: Components of the PFC for FCoE Traffic Configuration Topology	340

Part 4

Chapter 7

Configuration Statements and Operational Commands

Operational Commands for Transit Switches, FCoE, and FIP Snooping . . 371

Table 26: show dcbx output fields	376
Table 27: show fip snooping Output Fields	378
Table 28: show fip snooping enode Output Fields	384
Table 29: show fip snooping fcf Output Fields	388
Table 30: show fip snooping interface Output Fields	391
Table 31: show fip snooping statistics Output Fields	395
Table 32: show fip snooping vlan Output Fields	399
Table 33: show fip vlan-discovery Output Fields	402
Table 34: show dcbx neighbors Output Fields	405

Chapter 9

Operational Commands for Fibre Channel and FCoE-FC Gateways 473

Table 35: Summary of Key FC Interface Load-Balancing Output Fields	475
Table 36: show fibre-channel proxy fabric-state Output Fields	476
Table 37: request fibre-channel proxy load-rebalance dry-run Output Fields . . 488	
Table 38: show fibre-channel fabric Output Fields	500
Table 39: show fibre-channel fc2 sessions Output Fields	502
Table 40: show fibre-channel fc2 statistics Output Fields	504
Table 41: show fibre-channel fip Output Fields	506
Table 42: show fibre-channel fip enode Output Fields	512
Table 43: show fibre-channel fip fabric Output Fields	516
Table 44: show fibre-channel fip fcf Output Fields	519
Table 45: show fibre-channel fip interface Output Fields	523
Table 46: show fibre-channel fip statistics Output Fields	526
Table 47: show fibre-channel flogi fport Output Fields	530
Table 48: show fibre-channel flogi nport Output Fields	532
Table 49: show fibre-channel flogi statistics Output Fields	534
Table 50: show fibre-channel interfaces Output Fields	537
Table 51: show fibre-channel next-hops Output Fields	540
Table 52: show fibre-channel routes Output Fields	542
Table 53: show fibre-channel proxy fabric-state Output Fields	544
Table 54: show fibre-channel proxy login-table Output Fields	548
Table 55: show fibre-channel proxy np-port Output Fields	551
Table 56: show fibre-channel proxy statistics Output Fields	555

Chapter 11

Table 57: show fip vlan-discovery Output Fields	558
Table 58: show route forwarding-table family fibre-channel Output Fields	561
Operational Commands for Data Center Bridging	583
Table 59: show dcbx output fields	584
Table 60: show dcbx neighbors Output Fields	586

About the Documentation

- Documentation and Release Notes on page xix
- Using the Examples in This Manual on page xix
- Documentation Conventions on page xxi
- Documentation Feedback on page xxiii
- Requesting Technical Support on page xxiii

Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at <https://www.juniper.net/documentation/>.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

Juniper Networks Books publishes books by Juniper Networks engineers and subject matter experts. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration. The current list can be viewed at <https://www.juniper.net/books>.

Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

```
system {
  scripts {
    commit {
      file ex-script.xml;
    }
  }
}
interfaces {
  fxp0 {
    disable;
    unit 0 {
      family inet {
        address 10.0.0.1/24;
      }
    }
  }
}
```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

```
[edit]
user@host# load merge /var/tmp/ex-script.conf
load complete
```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

```
commit {
  file ex-script-snippet.xml; }
```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see [CLI Explorer](#).

Documentation Conventions

Table 1 on page xxi defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xxii defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the configure command: user@host> configure
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> show chassis alarms No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> Introduces or emphasizes important new terms. Identifies guide names. Identifies RFC and Internet draft titles. 	<ul style="list-style-type: none"> A policy <i>term</i> is a named structure that defines match conditions and actions. <i>Junos OS CLI User Guide</i> RFC 1997, <i>BGP Communities Attribute</i>
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# set system domain-name <i>domain-name</i>
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none"> To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level. The console port is labeled CONSOLE.
< > (angle brackets)	Encloses optional keywords or variables.	stub <default-metric <i>metric</i> >;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast (<i>string1</i> <i>string2</i> <i>string3</i>)
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	rsvp { # Required for dynamic MPLS only
[] (square brackets)	Encloses a variable for which you can substitute one or more values.	community name members [<i>community-ids</i>]
Indentation and braces ({ })	Identifies a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	

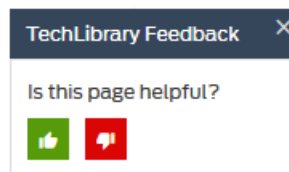
Table 2: Text and Syntax Conventions (continued)

Convention	Description	Examples
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none"> In the Logical Interfaces box, select All Interfaces. To cancel the configuration, click Cancel.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select Protocols>Ospf .

Documentation Feedback

We encourage you to provide feedback so that we can improve our documentation. You can use either of the following methods:

- Online feedback system—Click TechLibrary Feedback, on the lower right of any page on the [Juniper Networks TechLibrary](#) site, and do one of the following:



- Click the thumbs-up icon if the information on the page was helpful to you.
- Click the thumbs-down icon if the information on the page was not helpful to you or if you have suggestions for improvement, and use the pop-up form to provide feedback.
- E-mail—Send your comments to techpubs-comments@juniper.net. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or Partner Support Service support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at <https://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
- Product warranties—For product warranty information, visit <https://www.juniper.net/support/warranty/>.

- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: <https://www.juniper.net/customers/support/>
- Search for known bugs: <https://prsearch.juniper.net/>
- Find product documentation: <https://www.juniper.net/documentation/>
- Find solutions and answer questions using our Knowledge Base: <https://kb.juniper.net/>
- Download the latest versions of software and review release notes: <https://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications: <https://kb.juniper.net/InfoCenter/>
- Join and participate in the Juniper Networks Community Forum: <https://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <https://www.juniper.net/cm/>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: <https://entitlementsearch.juniper.net/entitlementsearch/>

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at <https://www.juniper.net/cm/>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see <https://www.juniper.net/support/requesting-support.html>.

CHAPTER 1

Storage Overview

- [Overview of Fibre Channel on page 26](#)
- [Understanding Fibre Channel Terminology on page 31](#)
- [Overview of FIP on page 41](#)

Overview of Fibre Channel

Fibre Channel (FC) is a high-speed network technology that interconnects network elements and allows them to communicate with one another. The International Committee for Information Technology Standards (INCITS) T11 Technical Committee sets FC standards.

FC networks provide high-performance characteristics such as lossless transport combined with flexible network topology. FC is primarily used in storage area networks (SANs) because it provides reliable, lossless, in-order frame transport between initiators and targets. FC components include initiators, targets, and FC-capable switches that interconnect FC devices and may also interconnect FC devices with Fibre Channel over Ethernet (FCoE) devices. Initiators originate I/O commands. Targets receive I/O commands. For example, a server can initiate an I/O request to a storage device target.

The Juniper Networks QFX3500 Switch has native FC ports as well as Ethernet access ports, and can function as an FCoE-FC gateway or as an FCoE transit switch. All other QFX Series switches and EX4600 switches have Ethernet access ports and can function as an FCoE transit switch.

FCoE transports native FC frames over an Ethernet network by encapsulating the unmodified frames in Ethernet. It also provides protocol extensions to discover FCoE devices through the Ethernet network. FCoE requires that the Ethernet network support data center bridging (DCB) extensions that ensure lossless transport and allow the Layer 2 Ethernet domain to meet the requirements of FC transport.

The FCoE-FC gateway functionality is a licensed feature on the QFX Series that is available only on QFX3500 switches. As an FCoE-FC gateway, the switch connects FCoE devices on an Ethernet network to a SAN FC switch.

You do not need a license to use the switch as an FCoE transit switch. As an FCoE transit switch, the switch:

- Is a Layer 2 data center bridging (DCB) switch that can transport FCoE frames.
- Implements FCoE Initialization Protocol (FIP) snooping.
- Connects multiple FCoE endpoints to the FC network.



NOTE: Standalone switches support FCoE. Virtual Chassis (VC) and mixed-mode Virtual Chassis Fabric (VCF) configurations do not support FCoE. Pure QFX5100 switch VCFs (consisting of only QFX5100 switches) support FCoE.

This topic describes:

- [Fibre Channel Transport Protocol on page 27](#)
- [How FC Works on the Switch on page 27](#)

- [Supported FC Features and Functions on page 30](#)
- [Lossless Transport Support on page 30](#)

Fibre Channel Transport Protocol

The Fibre Channel Protocol is a transport protocol that consists of five layers as shown in [Table 3 on page 27](#):

Table 3: Fibre Channel Protocol Layers

FC Protocol Layer	Description
FC-0	Physical (cabling, connectors, and so on)
FC-1	Data link layer
FC-2	Network layer (defines the main protocols)
FC-3	Common services
FC-4	Protocol mapping

The FC protocol layers are generally split into three groups:

- FC-0 and FC-1 are the physical layers.
- FC-2 is the protocol layer, similar to OSI Layer 3.
- FC-3 and FC-4 are the services layers.

The FCoE-FC gateway operates the physical layers and the protocol layer, and provides FIP and service redirection at the services layer.

How FC Works on the Switch

The switch connects devices that support FC and Ethernet (such as FCoE servers on an Ethernet network) to an FC SAN, thus converging the Ethernet and FC networks on a single physical network infrastructure. The switch provides the class-of-service (CoS) features needed to handle the different types of traffic appropriately.

To converge FC and Ethernet networks, you can configure the switch as an:

- [FCoE-FC Gateway on page 27](#)
- [FCoE Transit Switch on page 28](#)
- [FCoE VLANs on page 28](#)

FCoE-FC Gateway

When the switch functions as an FCoE-FC gateway, the switch aggregates FCoE traffic and performs the encapsulation and de-encapsulation of native FC frames in Ethernet as it transports the frames between FCoE devices in the Ethernet network and the FC switch. In effect, the switch translates Ethernet to FC and FC to Ethernet.

The gateway receives FC frames encapsulated in Ethernet from FCoE devices through an FCoE VLAN interface composed of one or more 10-Gigabit Ethernet interfaces. The gateway removes the Ethernet encapsulation from the FC frames, and then sends the native FC frames to the FC switch through a native FC interface.

The gateway receives native FC frames from the FC switch on the gateway's native FC interfaces. The gateway encapsulates the native FC frames in Ethernet, and then sends the encapsulated frames to the appropriate FCoE device through the FCoE VLAN interface.

To FCoE devices, the gateway behaves like an FC switch and can present multiple virtual F_Ports (VF_Ports) on a single interface. To an FC switch, the gateway behaves like an FC node that is doing N_Port ID virtualization (NPIV).

FCoE Transit Switch

When the switch functions as an FCoE transit switch, it forwards traffic (including FCoE traffic) based on Layer 2 media access control (MAC) forwarding and is a normal DCB-enabled Layer 2 switch that also performs FIP snooping. The switch aggregates FCoE traffic and passes it through to an FCF. The switch does not remove the Ethernet encapsulation from the FC frames, but it does preserve the class of service (CoS) required to transport FC frames.

The switch inspects (snoops) FIP information in order to create filters that permit only valid FCoE traffic to flow through the switch between FCoE devices and the FCF. The switch does not use native FC ports because the FC frames are encapsulated in Ethernet when they flow between the FCoE devices and the FCF. Virtual point-to-point links between each FCoE device and the FCF pass transparently through the switch, so the switch is not seen as a terminating point or an intermediate point by FCoE devices or by the FCF.

FCoE VLANs

All FCoE traffic must travel in a VLAN dedicated to transporting only FCoE traffic. Only FCoE interfaces should be members of an FCoE VLAN. Ethernet traffic that is not FCoE or FIP traffic must travel in a different VLAN.



NOTE: The same VLAN cannot be used in both transit switch mode and FCoE-FC gateway mode.



NOTE: FCoE VLANs (any VLAN that carries FCoE traffic) support only Spanning Tree Protocol (STP) and link aggregation group (LAG) Layer 2 features.

FCoE traffic cannot use a standard LAG because traffic might be hashed to different physical LAG links on different transmissions. This breaks the (virtual) point-to-point link that Fibre Channel traffic requires. If you configure a standard LAG interface for FCoE traffic, FCoE traffic might be rejected by the FC SAN.

QFabric systems support a special LAG called an FCoE LAG, which enables you to transport FCoE traffic and regular Ethernet traffic (traffic that is not FCoE traffic) across the same link aggregation bundle. Standard LAGs use a hashing algorithm to determine which physical link in the LAG is used for a transmission, so communication between two devices might use different physical links in the LAG for different transmissions. An FCoE LAG ensures that FCoE traffic uses the same physical link in the LAG for requests and replies in order to preserve the virtual point-to-point link between the FCoE device converged network adapter (CNA) and the FC SAN switch across the QFabric system Node device. An FCoE LAG does not provide load balancing or link redundancy for FCoE traffic. However, regular Ethernet traffic uses the standard hashing algorithm and receives the usual LAG benefits of load balancing and link redundancy in an FCoE LAG.



NOTE: IGMP snooping is enabled by default on all VLANs in all software versions before Junos OS R13.2. Disable IGMP snooping on FCoE VLANs if you are using software that is older than 13.2.

You can configure more than one FCoE VLAN, but any given virtual link must be in only one FCoE VLAN.



NOTE: All 10-Gigabit Ethernet interfaces that connect to FCoE devices must have a native VLAN configured in order to transport FIP traffic, because FIP VLAN discovery and notification frames are exchanged as untagged packets.



BEST PRACTICE: Only FCoE traffic is permitted on the FCoE VLAN. A native VLAN might need to carry untagged traffic of different types and protocols. Therefore, it is a good practice to keep the native VLAN separate from FCoE VLANs.

Supported FC Features and Functions

The following features and functionality are supported:

- As an FCoE-FC gateway:
 - DCB, including Data Center Bridging Capability Exchange protocol (DCBX), priority-based flow control (PFC), enhanced transmission service (ETS), and 10-Gigabit Ethernet interfaces
 - FCoE Initialization Protocol (FIP)
 - Proxy for FCoE devices when communicating with FC switches and acts as a proxy for FC switches when communicating with FCoE devices
 - Up to 12 native FC interfaces per QFX3500 switch (each interface can be configured as a 2-Gigabit, 4-Gigabit, or 8-Gigabit Ethernet interface)
- As an FCoE transit switch:
 - DCB functions
 - FIP snooping
 - Transparent Layer 2 MAC forwarding of FCoE frames

Lossless Transport Support

Up to six lossless forwarding classes are supported. For lossless transport, you must enable PFC on the IEEE 802.1p code point of lossless forwarding classes. The following limitations apply to support lossless transport:

- The external cable length from a standalone switch or QFabric system Node device to other devices cannot exceed 300 meters.
- The internal cable length from a QFabric system Node device to the QFabric system Interconnect device cannot exceed 150 meters.
- For FCoE traffic, the interface maximum transmission unit (MTU) must be at least 2180 bytes to accommodate the packet payload, headers, and checks.

Related Documentation

- [Understanding Fibre Channel on page 186](#)
- [Understanding an FCoE-FC Gateway on page 190](#)
- [Understanding FCoE Transit Switch Functionality on page 46](#)
- [Understanding FCoE on page 51](#)
- [Understanding DCB Features and Requirements on page 292](#)
- [Overview of FIP on page 41](#)
- [Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch on page 101](#)
- [Understanding CoS Flow Control \(Ethernet PAUSE and PFC\) on page 327](#)

- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Understanding FCoE LAGs on page 57](#)
- [Understanding Fibre Channel Terminology on page 31](#)

Understanding Fibre Channel Terminology

To understand the Fibre Channel (FC) and Fibre Channel over Ethernet (FCoE) capabilities of the QFX Series, you should become familiar with the terms defined in [Table 4 on page 31](#).



NOTE: Support for FC or FCoE depends on the Junos OS release in your installation.

Table 4: Fibre Channel Terms

Term	Definition
addressing mode	<p>Format for the locally unique MAC address the FC switch assigns to FCoE devices for FCoE transactions after FIP establishes a connection between an FCoE device and the FC switch. The two addressing modes are <i>fabric-provided MAC address (FPMA)</i> and <i>server-provided MAC address (SPMA)</i>. The QFX Series supports only FPMA.</p> <p>During FLOGI or FDISC, the ENode advertises the addressing modes it supports. If the FC switch supports an addressing mode that the ENode uses, the virtual link can be established, and the devices can communicate.</p> <p>See also <i>fabric-provided MAC address (FPMA)</i> and <i>server-provided MAC address (SPMA)</i>.</p>
ALL-ENode-MACs	<p>Well-known multicast MAC address to which all FCoE ENodes listen. FCFs send multicast <i>FIP discovery advertisement</i> messages and <i>FIP keepalive</i> messages to the ALL-ENode-MACs address so that ENodes can discover and maintain connections to FCFs. The hexadecimal format of the address is 01:10:18:01:00:01.</p> <p>See also <i>well-known address (WKA)</i>.</p>
ALL-FCF-MACs	<p>Well-known multicast MAC address to which all FCFs listen. ENodes send multicast <i>FIP discovery solicitation</i> messages to the ALL-FCF-MACs address to find out which FCFs can accept a login. The hexadecimal format of the address is 01:10:18:01:00:02.</p> <p>See also <i>well-known address (WKA)</i>.</p>
congestion notification	See <i>quantized congestion notification (QCN)</i> .

Table 4: Fibre Channel Terms (continued)

Term	Definition
converged network adapter (CNA)	<p>Physical adapter that combines the functions of a Fibre Channel <i>host bus adapter (HBA)</i> to process Fibre Channel frames and a <i>lossless Ethernet network interface card (NIC)</i> to process Ethernet frames. CNAs have one or more Ethernet ports. CNAs encapsulate Fibre Channel frames in Ethernet for FCoE transport and de-encapsulate Fibre Channel frames from FCoE to native Fibre Channel.</p> <p>See also <i>host bus adapter (HBA)</i>.</p>
data center bridging (DCB)	<p>Set of IEEE specifications that enhance the Ethernet standard to allow it to support converged Ethernet (LAN) and Fibre Channel (SAN) traffic on one Ethernet network. DCB features include <i>priority-based flow control (PFC)</i>, <i>enhanced transmission selection (ETS)</i>, <i>Data Center Bridging Capability Exchange protocol (DCBX)</i>, <i>quantized congestion notification (QCN)</i>, and full-duplex 10-Gigabit Ethernet ports.</p> <p>See also <i>priority-based flow control (PFC)</i>, <i>Ethernet PAUSE</i>, <i>enhanced transmission selection (ETS)</i>, <i>Data Center Bridging Capability Exchange protocol (DCBX)</i>, and <i>quantized congestion notification (QCN)</i>.</p>
expansion port (E_Port)	<p>An expansion port in an FC switch/FCF that connects the FC switch/FCF to the E_Port of another FC switch/FCF to form an <i>Interswitch Link (ISL)</i> in a common FC fabric.</p>
Data Center Bridging Capability Exchange protocol (DCBX)	<p>Discovery and exchange protocol for conveying configuration and capabilities among neighbors to ensure consistent configuration across the network. It is an extension of the Link Layer Data Protocol (LLDP, described in IEEE 802.1AB)</p> <p>See also <i>data center bridging (DCB)</i>.</p>
enhanced transmission selection (ETS)	<p>Mechanism that provides finer granularity of bandwidth management within a link.</p> <p>See also <i>data center bridging (DCB)</i>.</p>
ENode	See <i>FCoE Node (ENode)</i>
ENode MAC	<p><i>Lossless Ethernet MAC</i> paired with an <i>FCoE controller</i> in an ENode.</p> <p>See also <i>FCoE node (ENode)</i>.</p>
ENode MAC address	Globally unique address assigned to the CNA by the manufacturer and used to identify the node for FIP transactions.

Table 4: Fibre Channel Terms (continued)

Term	Definition
Ethernet PAUSE	<p>As defined in IEEE 802.3X, a flow control mechanism that temporarily stops the transmission of Ethernet frames on a link for a specified period. A receiving element sends an Ethernet PAUSE frame when a sender transmits data faster than the receiver can accept it. Ethernet PAUSE affects the entire link, not just an individual flow. An Ethernet PAUSE frame temporarily stops all traffic transmission on the link and allows the receiver's input buffer to empty sufficiently to restart traffic on the link. Ethernet PAUSE messages are sent to the previous hop and do not automatically propagate to the source of the congestion.</p> <p>See also <i>priority-based flow control (PFC)</i>.</p>
fabric	Interconnection of network nodes using one or more network switches.
fabric discovery (FDISC)	<p>Subsequent logins from the same ENode for different users, applications, or virtual machines after an ENode performs an initial FLOGI to log in to a switch.</p> <p>FC and FIP FDISC messages serve the same function in FC and FCoE networks, respectively. N_Ports send FC FDISC messages to the FC switch and VN_Ports send FIP FDISC messages to the FCF.</p> <p>After an N_Port acquires its initial N_Port ID through the FC FLOGI process, it can acquire additional N_Port IDs by sending an FC FDISC with a new worldwide port name and a source ID of 0x000000. The new port name and blank source ID tell the FC switch to assign a new N_Port ID to the N_Port. The different N_Port IDs allow multiple virtual machines or users on the N_Port to have separate, secure virtual links on the same physical N_Port. These additional ports are also referred to as VN_Ports.</p> <p>FIP FDISC works the same way, except the VN_Port logs in using a FIP FLOGI message.</p> <p>See also <i>fabric login (FLOGI)</i> and <i>N_Port ID</i>.</p>
fabric login (FLOGI)	<p>Creation of a logical connection to the FC switch and establishment of a node's operating environment.</p> <p>For FC devices, an N_Port logs in to the FC network by sending an FC FLOGI message to the F_Port of an FC switch.</p> <p>For FCoE devices, a VN_Port logs in to the FC network by sending a FIP FLOGI message to the VF_Port of an FC switch.</p>
fabric port (F_Port)	<p>FC port on an FC switch or an FCF that connects point-to-point to an FC node port (N_Port) on an FC host (server or storage device). An F_Port provides access to fabric services for FC devices.</p> <p>F_Ports are intermediate ports in a connection between FC device end-point N_Ports. For example, a connection between an FC host server and an FC storage device through an FC switch looks like this: FC server N_Port to FC switch ingress F_Port to FC switch egress F_Port to FC storage device N_Port.</p> <p>See also <i>node port (N_Port)</i>.</p>

Table 4: Fibre Channel Terms (continued)

Term	Definition
fabric-provided MAC address (FPMA)	<p>MAC address that an FCF assigns to a single ENode MAC through the FLOGI or FDISC process that is unique to the local fabric. The FPMA uniquely identifies a single VN_Port at that ENode MAC in FCoE transactions with the FCF.</p> <p>Because an ENode can have more than one ENode MAC, an FCF can assign multiple FPMAs to an ENode, one FPMA per ENode MAC.</p> <p>An FPMA is a 48-bit value that consists of two 24-bit values, the N_Port ID and the FC-MAP value. The N_Port ID uniquely identifies the VN_Port and the FC-MAP value identifies the FCF.</p> <p>See also <i>FCoE node (ENode)</i>, <i>N_Port ID</i>, and <i>FCoE mapped address prefix (FC-MAP)</i>.</p>
FCF-MAC	Lossless Ethernet MAC paired with an FCoE controller in an FCF. The FCF-MAC enables the FCF to handle FCoE traffic.
FCoE controller	<p>Instantiates and terminates VN_Port and VF_Port instances on an ENode. An ENode can have more than one FCoE controller. Each FCoE controller is paired with a lossless Ethernet MAC on the ENode.</p> <p>See also <i>lossless Ethernet MAC</i>.</p>
FC forwarder (FCF)	Alternative term and acronym to refer to an FC switch that has all physical Fibre Channel ports and the necessary set of services as defined in the T11 Organization <i>Fibre Channel Switched Fabric</i> (FC-SW) standards.
FCoE forwarder (FCF)	Defined by the <i>Fibre Channel Backbone - 5 (FC-BB-5) Rev 2.00</i> specification available at http://www.t11.org/ftp/t11/pub/fc/bb-5/09-056v5.pdf as a device that has the necessary set of services as defined in FC-SW and the FCoE capabilities to act as an FCoE-based FC switch.
FCoE Initialization Protocol (FIP)	<p>Layer 2 protocol for endpoint discovery, fabric login, and fabric association. FIP enables FCoE devices and FC switches to discover one another. Through FIP, FCoE nodes can log in to an FC switch, access the SAN FC fabric, and communicate with target FC devices. FIP messages also maintain the connection between the FCoE initiator and the FCF.</p> <p>FIP has its own EtherType (0x8914) to distinguish its traffic from payload-carrying FCoE traffic and other Ethernet traffic.</p>
FCoE link endpoint (LEP)	Virtual FC interface mapped onto a physical Ethernet interface to handle FC frame encapsulation and de-encapsulation and transmission and reception of FC frames encapsulated in Ethernet through a single virtual link.
FCoE mapped address prefix (FC-MAP)	<p>24-bit value that identifies the FC switch and is half of the 48-bit FPMA MAC address. The FC-MAP value can be configured on the FC switch and has a default value of 0EFC00h. The FC-MAP value was originally called the Fibre Channel Organizationally Unique Identifier (FC-OUI).</p> <p>See also <i>fabric-provided MAC address (FPMA)</i>.</p>

Table 4: Fibre Channel Terms (continued)

Term	Definition
FCoE node (ENode)	<p>Fibre Channel node that has one or more lossless Ethernet MACs, each paired with an <i>FCoE Controller</i> in order to transmit FCoE frames. An ENode combines FCoE termination functions and the FC stack on a CNA. ENodes present virtual FC interfaces to FC switches or FCFs in the form of VN_Ports, which can establish FCoE virtual links with FC switch/FCF VF_Ports. ENodes perform FCoE related functions in a <i>converged network adapter (CNA)</i>.</p> <p>See also <i>converged network adapter (CNA)</i>.</p>
FCoE-FC gateway	A form of N_Port virtualizer in which the node-facing ports are FCoE ports and the FC switch-facing ports are FC ports.
FCoE-FCoE gateway	A form of N_Port virtualizer in which the node-facing ports are FCoE ports and the FC switch-facing ports are FCoE ports.
FC-FC gateway	A form of N_Port virtualizer in which the node-facing ports are FC ports and the FC switch-facing ports are FC ports.
FCoE transit switch (also known as a FIP snooping bridge)	<p>Switch with a minimum set of features designed to support FCoE Layer 2 forwarding and FCoE security. The switch can also have optional additional features.</p> <p>Minimum feature support is:</p> <ul style="list-style-type: none"> • Priority-based flow control (PFC) • Enhanced transmission selection (ETS) • Data Center Bridging Capability Exchange Protocol (DCBX), including the FCoE application TLV • FIP snooping (minimum support is FIP automated filter programming at the ENode edge) <p>Additional FIP snooping capabilities can include learning the virtual FC connection paths (VN2VF, VN2VN, or VE2VE) and monitoring the FIP keepalive mechanisms. Other optional capabilities can also enhance FCoE within the standards. FIP snooping is typically configurable on a per-VLAN basis.</p> <p>A transit switch has an FC stack even though it is not an FC switch or an FCF.</p>
FCoE VLAN	VLAN dedicated to carrying only FCoE traffic. FCoE traffic must travel in a VLAN. Only FCoE interfaces should be members of an FCoE VLAN. Ethernet traffic that is not FCoE traffic must travel in a different VLAN.
Fibre Channel	High-speed network technology used for storage area networks (SANs).
Fibre Channel fabric	<p>Network of Fibre Channel devices that allows communication among devices, device name lookup, security, and redundancy.</p> <p>Also a local fabric on a QFX3500 switch with FCoE interfaces connected to FCoE devices on the Ethernet network and native FC interfaces connected to an FC switch in a SAN.</p>

Table 4: Fibre Channel Terms (continued)

Term	Definition
Fibre Channel ID (FCID)	<p>24-bit value the FC switch assigns to the N_Port or VN_Port as a unique identifier within the local FC network. The FCID consists of an 8-bit domain value, an 8-bit area value, and an 8-bit port value. The FCID is sometimes called an N_Port ID.</p> <p>See also <i>N_Port ID</i>.</p>
Fibre Channel over Ethernet (FCoE)	<p>Standard for transporting FC frames over Ethernet networks. FCoE encapsulates Fibre Channel frames in Ethernet so that the same high-speed Ethernet physical infrastructure can transport both data and storage traffic while preserving the lossless CoS that FC requires. FCoE has its own EtherType (0x8906) to differentiate it from other Ethernet traffic.</p> <p>FCoE runs on a DCB network. FCoE servers connect to a switch that supports both FCoE and native FC protocols. This allows FCoE servers on the Ethernet network to access FC storage devices in the SAN fabric on one converged network.</p> <p>See also <i>data center bridging (DCB)</i>.</p>
Fibre Channel services	Functions required for establishing FC network connectivity among devices and for managing devices on the FC network, such as login servers, domain managers, name servers, and zone servers.
FC stack	<p>FC or FCoE protocol capability implemented on a device to support the FC or FCoE functionality. Having an FC stack does not imply consuming a domain ID.</p> <p>Each FC or FCoE enabled server or storage device has an FC stack. Similarly, an FC or FCoE switch, an FCF, an FCoE-FC gateway, and an FCoE transit switch have FC stacks.</p>
Fibre Channel switch	Network switch that implements the Fibre Channel protocol.
FIP discovery advertisement	<p>Multicast or unicast message that the FC switch (or FCF) transmits to ENodes to advertise the switch's presence on the network so that ENodes can discover the switch and request to log in to the FC fabric.</p> <p>The FC switch periodically sends multicast FIP discovery advertisements to the ALL-ENode-MACs address, a well-known address to which all ENodes listen. The multicast messages advertise the FC switch to all ENodes on the VLAN and serve as keepalive messages to maintain connectivity between the FC switch and ENodes.</p> <p>When an ENode sends a FIP discovery solicitation message to the FC switch, the FC switch responds with a unicast FIP discovery advertisement to that ENode.</p>

Table 4: Fibre Channel Terms (continued)

Term	Definition
FIP discovery solicitation	<p>Multicast or unicast message that an ENode transmits to FC switches (or FCFs) to find compatible switches in the network.</p> <p>When an ENode initializes, it sends a multicast FIP discovery solicitation to the ALL-FCF-MACs address, a well-known address to which all FC switches and FCFs listen. Compatible switches reply with a unicast FIP discovery advertisement.</p> <p>The ENode compiles a list of compatible switches, selects a switch, and logs in to that switch.</p>
FIP keepalive	Periodic multicast FIP discovery advertisement sent from the FC switch or FCF to all ENodes to maintain connectivity.
FIP snooping	<p>For VN_Port to VF_port (VN2VF) paths, FIP snooping is a security feature enabled for FCoE VLANs on an Ethernet switch that connects ENodes to FC switches or FCFs. FIP snooping inspects data in FIP frames and uses that data to create firewall filters. The filters permit only traffic from sources that perform a successful FLOGI to the FC switch. All other traffic on the VLAN is denied. FIP snooping filters are installed on the ports in the FCoE VLAN.</p> <p>FIP snooping also applies similarly for VN_Port to VN_Port (VN2VN) and VE_Port to VE_Port (VE2VE) paths.</p> <p>FIP snooping can also snoop to provide additional visibility of FCoE Layer 2 operation.</p> <p>See also <i>FCoE node (ENode)</i>.</p>
FIP snooping bridge	See <i>FCoE transit switch</i> and <i>FIP snooping</i> .
host bus adapter (HBA)	Physical mechanism that connects a host system to other FC network and storage devices. HBAs have a unique worldwide node name (WWNN) for the HBA node, which all of the ports on the HBA share, and each port on an HBA has a unique worldwide port name (WWPN).
initiator	System component that originates an I/O command over an I/O bus or network. An FCoE server sending a request to an FC storage device is an example of an initiator.
iSCSI transit switch	<p>Layer 2 Ethernet switch with a minimum set of best-practice Ethernet features to support iSCSI, along with optional enhancements. Minimum feature support is:</p> <ul style="list-style-type: none"> • IEEE 802.3X asymmetric and symmetric flow control on ports not running in DCB mode • Priority-based flow control (PFC) • Enhanced transmission selection (ETS) • Data Center Bridging Capability Exchange Protocol (DCBX), including the iSCSI application TLV <p>Other capabilities such as Internet storage name service (iSNS) are optional.</p>

Table 4: Fibre Channel Terms (continued)

Term	Definition
Interswitch link (ISL)	The link between the <i>E_Ports</i> of two FC switches in a common FC fabric. When two FCoE-based FC switches are connected together, there is a virtual ISL through Layer 2.
logout (LOGO)	<p>For FC devices, an <i>N_Port</i> logs out from the FC network by sending an FC LOGO message to the <i>F_Port</i> of an FC switch. The switch can also send a LOGO message to an <i>N_Port</i> to terminate its connection.</p> <p>For FCoE devices, a <i>VN_Port</i> logs out from the FC network by sending a FIP LOGO message to the <i>VF_Port</i> of an FC switch. The switch can also send a LOGO message to a <i>VN_Port</i> to terminate its connection.</p>
lossless Ethernet MAC	<p>Full-duplex Ethernet MAC that implements Ethernet extensions to avoid Ethernet frame loss due to congestion and supports at least 2.5-KB jumbo frames. Each lossless Ethernet MAC combines with an FCoE Controller to perform FCoE termination functions on an ENode.</p> <p>See also <i>priority-based flow control (PFC)</i>, <i>quantized congestion notification (QCN)</i>, <i>FCoE controller</i>, and <i>FCoE node (ENode)</i>.</p>
lossless Ethernet network	Ethernet network composed of only full-duplex links and lossless Ethernet MACs and with CoS and flow control to prevent dropping of frames.
lossless transport	In DCB networks, the ability to switch FCoE frames over an Ethernet network without dropping any frames. Lossless transports uses mechanisms such as priority-based flow control and quantized congestion notification to control traffic flows and avoid congestion.
<i>N_Port</i> ID	See <i>Fibre Channel ID (FCID)</i> .
<i>N_Port</i> ID virtualizer	<p>Presents itself as an FC or FCoE switch to external devices, but connects to an actual FC or FCoE switch in the other direction to provide the FC-SW services.</p> <p>An <i>N_Port</i> ID virtualizer logs in to the actual FC or FCoE switch in the same way as a normal node device and uses the NPIV mechanism to proxy incoming FLOGIs to FDISCs on the actual FC or FCoE switch.</p> <p>An <i>N_Port</i> ID virtualizes has an FC stack even though it is not an FC switch or an FCF.</p> <p>The acronym <i>NPV</i> is commonly used for <i>N_Port</i> ID virtualizer even though the acronym is not defined in the standards.</p>

Table 4: Fibre Channel Terms (continued)

Term	Definition
N_Port ID Virtualization (NPIV)	<p>NPIV enables a physical N_Port to acquire multiple N_Port IDs. Each N_Port ID maps to a different application (such as a virtual machine) or to a different user. This allows you to associate one F_Port with many N_Port IDs and create multiple discrete, secure virtual links over one physical point-to-point connection.</p> <p>NPIV increases resource and bandwidth utilization and allows the implementation of access control, zoning, and port security on a per-application or per-user basis.</p> <p>After an N_Port performs a FLOGI and receives its first N_Port ID, it can request more N_Port IDs by sending FDISC messages.</p> <p>See also <i>fabric login (FLOGI)</i>, <i>fabric discovery (FDISC)</i>, and <i>virtual link</i>.</p>
node port (N_Port)	<p>N_Ports can be in two modes:</p> <ul style="list-style-type: none"> • Fabric N_Port—Node port that is an FC host or storage device end port in a point-to-point link between the device and the F_Port of an FC switch. The point-to-point link can be virtual or physical. • Point-to-point N_Port—Node port that connects to another N_Port. The QFX3500 switch does not support this configuration. <p>N_Ports handle creation, detection, and flow of messages to and from the connected devices.</p>
node worldwide name (NWWN)	<p>WWN that is unique worldwide and is assigned to an FC node. An NWWN is valid for on multiple ports that are on that node (this identifies the ports as network interfaces of a particular node).</p>
port mode	<p>Role that the port plays in the FC fabric (endpoint device, FC switch connection to endpoint devices, interswitch link).</p> <p>See also <i>node port (N_Port)</i>, <i>virtual node port (VN_Port)</i>, <i>proxy node port (NP_Port)</i>, <i>fabric port (F_Port)</i>, and <i>virtual fabric port (VF_Port)</i>.</p>
port worldwide name (PWWN)	<p>WWN that is unique worldwide and is assigned to an FC port.</p>
priority-based flow control (PFC)	<p>Link-level flow control mechanism defined by IEEE 802.1Qbb that allows independent flow control for each class of service (as defined in the 3-bit CoS field of the Ethernet header by IEEE 802.1Q tags) to ensure that no frame loss from congestion occurs in DCB networks.</p> <p>PFC is an enhancement of the Ethernet PAUSE mechanism, but PFC controls classes of flows, whereas Ethernet PAUSE indiscriminately pauses all of the traffic on a link. With PFC, a receiving device can signal a transmitting device to pause transmission based on traffic class.</p> <p>PFC provides application-specific bandwidth reservations so you can ensure that time-critical protocols and applications such as FCoE receive the priority necessary to prevent frame loss. PFC allows the same physical link to carry FCoE traffic and provide lossless service while also carrying loss-tolerant Ethernet traffic.</p> <p>See also <i>Ethernet PAUSE</i>.</p>

Table 4: Fibre Channel Terms (continued)

Term	Definition
proxy gateway mode	Connects FCoE initiators to FC switches in a converged Ethernet and Fibre Channel network and acts as an intermediary for these devices. The FCoE-FC gateway represents and acts for the FCoE initiators in transactions from the FCoE initiators destined for an FC switch, including converting FIP and FCoE frames to FC frames. The gateway represents and acts for an FC switch in transactions from the FC switch destined for an FCoE initiator, including converting FC frames to FIP frames and encapsulating FC frames in Ethernet.
proxy node port (NP_Port)	N_Port on the QFX Series that performs proxy functions when it is configured as an FCoE-FC gateway. The NP_Port acts as a proxy for the FCoE device VN_Ports in transactions with the FC switch.
quantized congestion notification (QCN)	Mechanism defined by IEEE 802.1Qau that manages network congestion within a Layer 2 domain. When a queue reaches a configured threshold, QCN throttles traffic at the source of the congestion by transmitting messages that propagate back to the source and temporarily stop the source from transmitting. When the queue crosses the threshold that indicates the congestion has dissipated, QCN sends a message to allow the source to resume transmitting frames.
session	Fabric login (FLOGI) or fabric discovery (FDISC) login to the FC SAN fabric. Session does not refer to end-to-end server-to-storage sessions.
server-provided MAC address (SPMA)	<p>MAC address that an ENode assigns to one of its ENode MACs and is not assigned to any other ENode MAC in the same FCoE VLAN. An SPMA can be associated with more than one VN_Port at that ENode MAC.</p> <p>The QFX Series does not support SPMA.</p> <p>See also <i>ENode MAC</i> and <i>fabric-provided MAC address (FPMA)</i>.</p>
storage area network (SAN)	Network whose primary purpose is the transfer of data between computer systems and storage devices. This term is most commonly used in the context of any network that supports block storage, usually iSCSI, FC, and FCoE networks.
target	System component that receives an I/O command. An FC storage device that receives a request from a server is an example of a target.
VE_Port	Virtual ports created to form a connection (an <i>interswitch link</i>) between two FCoE-based FC switches as part of a common FC fabric.
VE2VE (VE_Port to VE_Port)	The <i>Fibre Channel Backbone - 5 (FC-BB-5) Rev 2.00</i> specification capability of FCFs to connect to each other as a single FCoE FC SAN.
VN2VF (VN_Port to VF_Port)	The <i>Fibre Channel Backbone - 5 (FC-BB-5) Rev 2.00</i> specification capability of an ENode to connect to an FCF or to an FCoE-enabled FC SAN.
VN2VN (VN_Port to VN_Port)	The <i>Fibre Channel Backbone - 6 (FC-BB-6)</i> specification capability of an ENode to connect directly over Layer 2 to another ENode without the need of any FC-related services. This capability is most often used in small-scale FCoE SANs.

Table 4: Fibre Channel Terms (continued)

Term	Definition
virtual fabric port (VF_Port)	<p>Data-forwarding component that emulates an F_Port. A VF_Port is dynamically instantiated on successful completion of a FIP FLOGI exchange and connects to one or more VN_Ports. The term <i>virtual</i> indicates the use of a non-FC link such as an FCoE link.</p> <p>See also <i>fabric port (F_Port)</i>.</p>
virtual link	<p>Logical link connecting two FCoE Link End Points (LEPs) over a lossless Ethernet network, for example, the link between a VF_Port and a VN_Port. The MAC addresses of the two LEPs identifies a virtual link.</p> <p>See also <i>FCoE link end point (LEP)</i> and <i>lossless Ethernet network</i>.</p>
virtual node port (VN_Port)	<p>Data-forwarding component that emulates an N_Port. With FCoE, a VN_Port is dynamically instantiated on successful completion of a FIP FLOGI exchange and connects to one or more VF_Ports. The term <i>virtual</i> indicates the use of a non-FC link such as an FCoE link.</p> <p>VN_Port is also used for the virtual N_Ports created in both FC and FCoE when additional NPIV-based logins occur over a previously created N_Port-to-VN_Port or N_Port-to-VF_Port connection.</p> <p>See also <i>node port (N_Port)</i>.</p>
well-known address (WKA)	<p>Address identifier used to access a service provided by an FC fabric. The service can be distributed in many elements throughout a fabric, or it can be centralized in one element. A WKA is always accessible, regardless of zoning. An example of a WKA is the <i>ALL-FCF-MACs</i> address to which all FCFs listen.</p>
worldwide name (WWN)	<p>64-bit identifier that is similar to a MAC address except that it is not used for forwarding. It uniquely identifies an FC device. The WWN is derived from the IEEE organizationally unique identifier (OUI) and vendor-supplied information. A WWN is unique worldwide.</p>
worldwide node name (WWNN)	<p>See <i>node worldwide name (NWWN)</i>.</p>
worldwide port name (WWPN)	<p>See <i>port worldwide name (PWWN)</i>.</p>

Related Documentation • [Overview of Fibre Channel on page 26](#)

Overview of FIP

Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) is a Layer 2 protocol that establishes and maintains Fibre Channel (FC) virtual links between pairs of FCoE devices such as server FCoE Nodes (ENodes) and FC switches. FIP can also establish and maintain virtual links between FCoE devices and an FCoE-FC gateway (such as the QFX3500 switch), where the gateway acts on behalf of the FC switch.

FIP enables FCoE devices to discover one another and to initialize and maintain virtual links over a physical Ethernet network. This allows FCoE devices in the Ethernet network to access storage devices in the FC storage area network (SAN).

FIP solves the problem presented by the FC requirement for point-to-point connections (FC does not permit point-to-multipoint connections) by creating a unique virtual link for each connection between an ENode VN_Port and an FC switch VF_Port. Multiple virtual links can use a single physical link and virtual links can traverse Ethernet transit (passthrough) switches while appearing to be direct point-to-point connections to the FC switch.

FIP has its own EtherType (0x8914) to distinguish its traffic from payload-carrying FCoE traffic and other Ethernet traffic. FIP operations occur on a per-VLAN basis.

For more details about FIP, see the Technical Committee T11 organization document *Fibre Channel Backbone - 5 (FC-BB-5) Rev 2.00* available at <http://www.t11.org/ftp/t11/pub/fc/bb-5/09-056v5.pdf>.

PART 1

Transit Switch, FCoE, and FIP Snooping

- [Using FCoE on a Transit Switch on page 45](#)

CHAPTER 2

Using FCoE on a Transit Switch

- [Understanding FCoE Transit Switch Functionality on page 46](#)
- [Understanding FCoE on page 51](#)
- [Understanding FCoE LAGs on page 57](#)
- [Configuring an FCoE LAG on page 63](#)
- [Example: Configuring an FCoE LAG on a Redundant Server Node Group on page 66](#)
- [Understanding OxID Hash Control for FCoE Traffic Load Balancing on QFabric Systems on page 79](#)
- [Understanding OxID Hash Control for FCoE Traffic Load Balancing on Standalone Switches on page 81](#)
- [Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on Standalone Switches on page 82](#)
- [Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on QFabric Systems on page 83](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)
- [Understanding FIP Snooping, FBF, and MVR Filter Scalability on page 91](#)
- [Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch on page 101](#)
- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch on page 111](#)
- [Enabling VN2VN_Port FIP Snooping and Configuring the Beacon Period on an FCoE Transit Switch on page 118](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to the Same FCoE Transit Switch\) on page 120](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to Different FCoE Transit Switches\) on page 125](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch\) on page 132](#)
- [Disabling Enhanced FIP Snooping Scaling on page 142](#)
- [Understanding MC-LAGs on an FCoE Transit Switch on page 143](#)

- [Example: Configuring CoS Using ELS for FCoE Transit Switch Traffic Across an MC-LAG on page 146](#)
- [Understanding FCoE and FIP Session High Availability on page 174](#)
- [Troubleshooting Dropped FIP Traffic on page 176](#)
- [Troubleshooting Dropped FCoE Traffic on page 178](#)

Understanding FCoE Transit Switch Functionality

You can use the switch as a Fibre Channel over Ethernet (FCoE) transit switch. An FCoE transit switch is a Layer 2 data center bridging (DCB) switch that can transport FCoE frames, and when used as an access switch for FCoE devices, implements FCoE Initialization Protocol (FIP) snooping. A DCB switch transports both FCoE and Ethernet LAN traffic over the same network infrastructure while preserving the class of service (CoS) treatment that Fibre Channel (FC) traffic requires.



NOTE: Juniper Networks QFX10000 switches do not support FIP snooping. (Aggregation devices do not need to enable FIP snooping because FIP snooping is performed at the FCoE access edge.)

An FCoE transit switch does not encapsulate or de-encapsulate FC frames in Ethernet. It is a switch that transports FC frames that have already been encapsulated in Ethernet between FCoE initiators such as servers and a storage area network (SAN) FC switch that supports both Ethernet and native FC traffic on its interfaces. The transit switch acts as a passthrough switch and is transparent to the FC switch, which detects each connection to an FCoE device as a direct point-to-point link.

When a switch acts as a transit switch, the VLANs you configure for FCoE traffic can use any of the switch ports because the traffic in both directions is standard Ethernet traffic, not native FC traffic.



NOTE: The Ethernet interfaces that connect to FCoE devices must include a native VLAN to transport FIP traffic, because FIP VLAN discovery and notification frames are exchanged as untagged packets. It is a good practice to keep the native VLAN separate from the VLANs that carry FCoE traffic. FCoE VLANs should carry only FCoE traffic, but other types of untagged traffic might use the native VLAN.

Switches and QFabric system Node devices that use the original CLI (not the Enhanced Layer 2 (ELS) software) only require that you configure the native VLAN on the FCoE interfaces that belong to the FCoE VLAN by including the `[set interfaces interface-name unit unit family ethernet-switching native-vlan-id native-vlan-id]` statement in the configuration.

Switches that use ELS software require that you include two statements in the configuration to configure a native VLAN on FCoE interfaces. Include the `[set interfaces interface-name native-vlan-id vlan-id]` statement in the configuration to configure the native VLAN on the interface, and also include the `[set interfaces interface-name unit unit family ethernet-switching native-vlan-id vlan-id]` statement in the configuration to configure the port as a member of the native VLAN.

FCoE traffic should use a VLAN dedicated only to FCoE traffic. Do not mix FCoE traffic with standard Ethernet traffic on the same VLAN.



NOTE: An FCoE VLAN (any VLAN that carries FCoE traffic) supports only Spanning Tree Protocol (STP) and link aggregation group (LAG) Layer 2 features.

FCoE traffic cannot use a standard LAG because traffic might be hashed to different physical LAG links on different transmissions. This breaks the (virtual) point-to-point link that Fibre Channel traffic requires. If you configure a standard LAG interface for FCoE traffic, FCoE traffic might be rejected by the FC SAN.

QFabric systems support a special LAG called an FCoE LAG, which enables you to transport FCoE traffic and regular Ethernet traffic (traffic that is not FCoE traffic) across the same link aggregation bundle. Standard LAGs use a hashing algorithm to determine which physical link in the LAG is used for a transmission, so communication between two devices might use different physical links in the LAG for different transmissions. An FCoE LAG ensures that FCoE traffic uses the same physical link in the LAG for requests and replies in order to preserve the virtual point-to-point link between the FCoE device converged network adapter (CNA) and the FC SAN switch across the QFabric system Node device. An FCoE LAG does not provide load balancing or link redundancy for FCoE traffic. However, regular Ethernet traffic uses the standard hashing algorithm and receives the usual LAG benefits of load balancing and link redundancy in an FCoE LAG.



NOTE: IGMP snooping is enabled by default on all VLANs in all software versions before Junos OS Release 13.2. Disable IGMP snooping on FCoE VLANs if you are using software that is older than Junos OS Release 13.2.



NOTE: On a QFX3500 switch or on a QFabric system Node device, the same VLAN cannot be used in both transit switch mode and FCoE-FC gateway mode. (Only QFX3500 switches can be configured in FCoE-FC gateway mode.) If you configure both a transit switch and an FCoE-FC gateway on the same QFX3500 switch or QFabric system Node device, configure different FCoE VLANs for the transit switch and the FCoE-FC gateway.

To support FCoE traffic, transit switches require DCB configuration to implement the lossless transport of FCoE traffic across the Ethernet portion of the network, and transit switches on the access edge require enabling FIP snooping on the FCoE access ports.

With the exception of Virtual Chassis (VC) and mixed-mode Virtual Chassis Fabric (VCF) configurations, switches support the DCB standards for ensuring lossless transport and low latency, and provide 10-Gbps ports for FCoE traffic. VCF configurations that use only QFX5100 switches support DCB standards. For lossless transport to function correctly, you must use priority-based flow control (PFC, described in IEEE 802.1Qbb) to prevent FCoE packet loss during periods of congestion and ensure proper CoS for FCoE traffic.

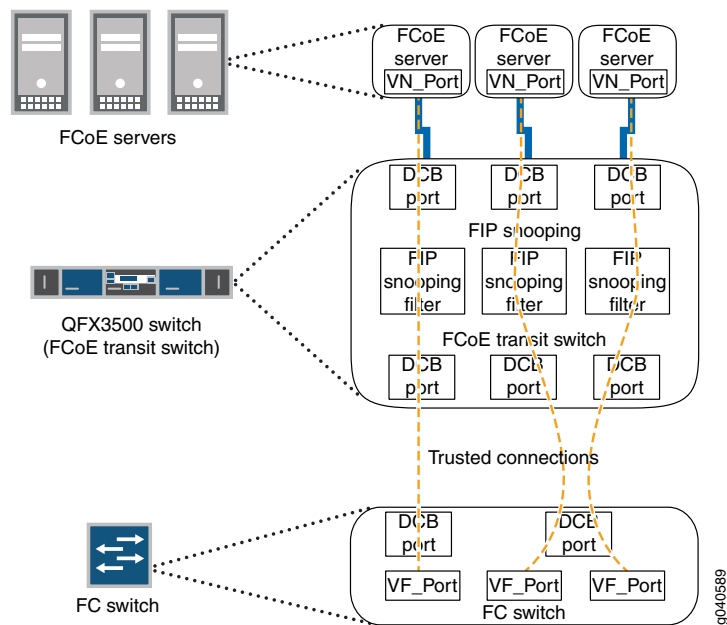
On the FCoE access edge, FIP snooping adds security by filtering access. Only traffic from servers that have successfully logged in to the FC network can pass through the transit switch and reach the FC network. The Technical Committee T11 organization specifications describe two types of FIP snooping:

- The FC-BB-5 specification describes VN_Port to VF_Port (VN2VF_Port) FIP snooping, which provides security for communication between FCoE device VN_Ports on the Ethernet network and FCF or FC switch VF_Ports.
- The FC-BB-6 specification describes VN_Port to VN_Port (VN2VN_Port) FIP snooping, which provides security for communication between FCoE device VN_Ports on the Ethernet network.

To accommodate the larger size of Ethernet-encapsulated frames, FCoE interfaces should be configured with a maximum transmission unit (MTU) size of at least 2180 bytes.

At the access edge, a transit switch transparently connects FCoE-capable devices such as servers in an Ethernet LAN to an FC switch or to a gateway switch (hereafter referred to as the FC switch), as shown in [Figure 1 on page 49](#). The transit switch acts as a transparent DCB access layer between FCoE servers and the FC switch.

Figure 1: FCoE Transit Switch Connecting FCoE Devices to an FC Switch



The transit switch performs FIP snooping at the ports connected to the FCoE devices. For VN2VF_Port FIP snooping, at the SAN edge, the FC switch must be able to convert the FCoE traffic to native FC traffic. (VN2VN_Port FIP snooping switches traffic between VN_Ports directly through the transit switch, without going through the FC switch, so no conversion of FCoE traffic to native FC traffic is needed.)

Encapsulated FCoE traffic flows through the transit switch to the FCoE ports on the FC switch. The FC switch removes the Ethernet encapsulation from the FCoE frames to restore the native FC frames. Native FC traffic travels out native FC ports to storage devices in the FC SAN.

Native FC traffic from storage devices flows to the FC switch FC ports, and the FC switch encapsulates that traffic in Ethernet as FCoE traffic. The FCoE traffic flows through the transit switch to the appropriate FCoE device.



NOTE: The FC switch and FC fabric apply appropriate zoning checks on traffic to and from each ENode and provide FC services (for example, name server, fabric login server, or event server).



NOTE: VN_Port to VN_Port FIP snooping is supported to allow FCoE initiators and targets to communicate directly through the switch without going through an FCoE forwarder (FCF) or an FC switch. An FCoE VLAN can support either VN2VF_Port FIP snooping (FC-BB-5) or VN2VN_Port FIP snooping (FC-BB-6), but not both. The same switch can have multiple FCoE VLANs configured, some FCoE VLANs for VN2VF FIP snooping traffic and others for VN2VN FIP snooping traffic.

Transit switches do not have to be FCoE access edge switches. Transit switches can be intermediate switches between a transit switch at the FCoE access edge and the FC switch. In this case, intermediate transit switches do not need to perform FIP snooping because only the access edge transit switch needs to filter traffic between the FCoE device and the FC network. Once that traffic has been processed by the FIP snooping filters, it does not need to be filtered again. However, intermediate transit switches must support DCB standards to preserve the lossless transport and other CoS characteristics required for FC traffic.

Release History Table

Release	Description
13.2	IGMP snooping is enabled by default on all VLANs in all software versions before Junos OS Release 13.2.

**Related
Documentation**

- [Understanding DCB Features and Requirements on page 292](#)
- [Understanding FCoE on page 51](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)

Understanding FCoE

Fibre Channel over Ethernet (FCoE) is a method of supporting converged Fibre Channel (FC) and Ethernet traffic on a data center bridging (DCB) network. FCoE encapsulates unmodified FC frames in Ethernet to transport the FC frames over a physical Ethernet network. The T11 Technical Committee, which is the International Committee for Information Technology Standards (INCITS) committee responsible for FC interfaces, developed the FCoE standard to provide a method for transporting FC frames over a DCB network. The T11 document *Fibre Channel Backbone - 5 (FC-BB-5) Rev 2.00* at <http://www.t11.org/ftp/t11/pub/fc/bb-5/09-056v5.pdf> provides details about the FCoE version 1 standard.



NOTE: The switch does not support T11 Annex F *FCoE Pre-FIP Virtual Link Instantiation Protocol*.

To the Ethernet network, an FCoE frame is the same as any other Ethernet frame because the Ethernet encapsulation provides the header information needed to forward the frames. However, to achieve the lossless behavior that FC transport requires, the Ethernet network must conform to DCB standards.

DCB standards create an environment over which FCoE can transport native FC traffic encapsulated in Ethernet while preserving the mandatory class of service (CoS) and other characteristics that FC traffic requires.

Supporting FCoE in a DCB network requires that the FCoE devices in the Ethernet network and the FC switches at the edge of the SAN network handle both Ethernet and native FC traffic. To handle Ethernet traffic, an FC switch does one of two things:

- Incorporates FCoE interfaces.
- Uses an FCoE-FC gateway such as a QFX3500 switch to de-encapsulate FCoE traffic from FCoE devices into native FC and to encapsulate native FC traffic from the FC switch into FCoE and forward it to FCoE devices through the Ethernet network.



NOTE: Standalone switches support FCoE. Virtual Chassis (VC) and mixed-mode Virtual Chassis Fabric (VCF) configurations do not support FCoE. Pure QFX5100 switch VCFs (consisting of only QFX5100 switches) support FCoE.

FCoE concepts include:

- [FCoE Devices on page 52](#)
- [FCoE Frames on page 53](#)
- [Virtual Links on page 54](#)
- [FCoE VLANs on page 54](#)

FCoE Devices

Each FCoE device has a converged network adapter (CNA) that combines the functions of an FC host bus adapter (HBA) and a lossless Ethernet network interface card (NIC) with 10-Gbps Ethernet ports. The portion of the CNA that handles FCoE traffic is called an FCoE Node (ENode). An ENode combines FCoE termination functions and the client part of the FC stack on the CNA.

ENodes present virtual FC interfaces to FC switches in the form of virtual N_Ports (VN_Ports). A VN_Port is an endpoint in a virtual point-to-point connection called a virtual link. The other endpoint of the virtual link is an FC switch (or FCF) port. A VN_Port emulates a native FC N_Port and performs similar functions: handling the creation, detection, and flow of messages to and from the FC switch. A single ENode can host multiple VN_Ports. Each VN_Port has a separate, unique virtual link with a FC switch.

ENodes contain at least one lossless Ethernet media access controller (MAC). Each Ethernet MAC is paired with an FCoE controller. The lossless Ethernet MAC is a full-duplex Ethernet MAC that implements Ethernet extensions to avoid frame loss due to congestion and supports frames of at least 2500 bytes. The FCoE controller instantiates and terminates VN_Port instances dynamically as they are needed for FCoE sessions. Each VN_Port instance has a unique virtual link to an FC switch.



NOTE: A *session* is a fabric login (FLOGI) or fabric discovery (FDISC) login to the FC SAN fabric. Session does not refer to end-to-end server-to-storage sessions.

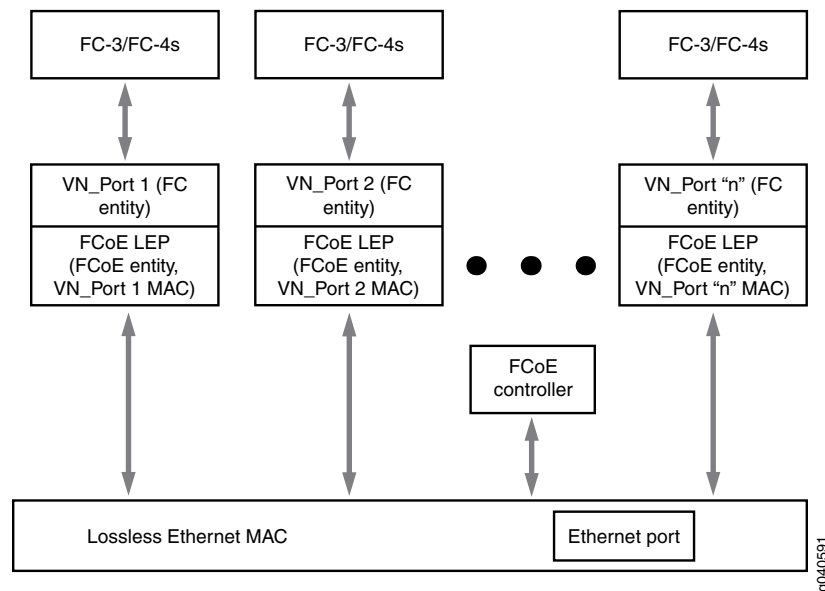
ENodes also contain one FCoE link end point (LEP) for each VN_Port connection. An FCoE LEP is a virtual FC interface mapped onto the physical Ethernet interface.

An FCoE LEP:

- Transmits and receives FCoE frames on the virtual link.
- Handles FC frame encapsulation for traffic going from the server to the FC switch.
- Performs frame de-encapsulation of traffic received from the FC switch.

Figure 2 on page 53 shows a block diagram of the major ENode components.

Figure 2: ENode Components



FCoE Frames

The FCoE protocol specification replaces the FC0 and FC1 layers of the FC stack with Ethernet, but retains the FC frame header. Retaining the FC frame header enables the FC frame to pass directly to a native FC SAN after de-encapsulation. The FCoE header carries the FC start of file (SOF) bits and end of file (EOF) bits in an encoded format. FCoE supports two frame types, control frames and data frames. FCoE Initialization Protocol (FIP) carries all of the discovery and fabric login frames.

FIP control frames handle FCoE device discovery, initializing communication, and maintaining communication. They do not carry a data payload. FIP has its own EtherType (0x8914) to distinguish FIP traffic from FCoE traffic and other Ethernet traffic. To establish communication, the ENode uses the globally unique MAC address assigned to it by the CNA manufacturer.

After FIP establishes a connection between FCoE devices, the FCoE data frames handle the transport of the FC frames encapsulated in Ethernet. FCoE also has its own EtherType (0x8906) to distinguish FCoE frames from other Ethernet traffic and ensure the in-order frame handling that FC requires. FCoE frames include:

- 2112 bytes FC payload
- 24 bytes FC header
- 14 bytes standard Ethernet header
- 14 bytes FCoE header
- 8 bytes cyclic redundancy check (CRC) plus EOF
- 4 bytes VLAN header
- 4 bytes frame check sequence (FCS)

The payload, headers, and checks add up to 2180 bytes. Therefore, interfaces that carry FCoE traffic should have a configured maximum transmission unit (MTU) of 2180 or larger. An MTU size of 2180 bytes is the minimum size; some network administrators prefer an MTU of 2240 or 2500 bytes.

Virtual Links

Native FC uses point-to-point physical links between FC devices. In FCoE, virtual links replace the physical links. A virtual link emulates a point-to-point link between two FCoE device endpoints, such as a server VN_Port and an FC switch (or FCF) VF_Port.

Each FCoE interface can support multiple virtual links. The MAC addresses of the FCoE endpoints (the VN_Port and the VF_Port) uniquely identify each virtual link and allow traffic for multiple virtual links to share the same physical link while maintaining data separation and security.

A virtual link exists in one FCoE VLAN and cannot belong to more than one VLAN. Although the FC switch and the FCoE device detect a virtual link as a point-to-point connection, virtual links do not need to be direct connections between a VF_Port and a VN_Port. A virtual link can traverse one or more transit switches, also known as passthrough switches. A transit switch can transparently aggregate virtual links while still appearing and functioning as a point-to-point connection to the FCoE devices. However, a virtual link must remain within a single Layer 2 domain.

FCoE VLANs

All FCoE traffic must travel in a VLAN dedicated to transporting only FCoE traffic. Only FCoE interfaces should be members of an FCoE VLAN. Ethernet traffic that is not FCoE or FIP traffic must travel in a different VLAN.



NOTE: On a standalone switch or QFabric system Node device, the same VLAN cannot be used in both transit switch mode and FCoE-FC gateway mode.



NOTE: FCoE VLANs (any VLAN that carries FCoE traffic) support only Spanning Tree Protocol (STP) and link aggregation group (LAG) Layer 2 features.

FCoE traffic cannot use a standard LAG because traffic might be hashed to different physical LAG links on different transmissions. This breaks the (virtual) point-to-point link that Fibre Channel traffic requires. If you configure a standard LAG interface for FCoE traffic, FCoE traffic might be rejected by the FC SAN.

QFabric systems support a special LAG called an FCoE LAG, which enables you to transport FCoE traffic and regular Ethernet traffic (traffic that is not FCoE traffic) across the same link aggregation bundle. Standard LAGs use a hashing algorithm to determine which physical link in the LAG is used for a transmission, so communication between two devices might use different physical links in the LAG for different transmissions. An FCoE LAG ensures that FCoE traffic uses the same physical link in the LAG for requests and replies in order to preserve the virtual point-to-point link between the FCoE device converged network adapter (CNA) and the FC SAN switch across the QFabric system Node device. An FCoE LAG does not provide load balancing or link redundancy for FCoE traffic. However, regular Ethernet traffic uses the standard hashing algorithm and receives the usual LAG benefits of load balancing and link redundancy in an FCoE LAG.



NOTE: IGMP snooping is enabled by default on all VLANs in all software versions before Junos OS R13.2. Disable IGMP snooping on FCoE VLANs if you are using software that is older than 13.2.

You can configure more than one FCoE VLAN, but any given virtual link must be in only one FCoE VLAN.



NOTE: All 10-Gigabit Ethernet interfaces that connect to FCoE devices must have a native VLAN configured in order to transport FIP traffic, because FIP VLAN discovery and notification frames are exchanged as untagged packets.

On switches that use the Enhanced Layer 2 Software (ELS) CLI, it is not sufficient only to configure the native VLAN on the interface, the interface must also be configured as a member of the native VLAN. (This is because the ELS CLI does not support tagged-access interface mode, so interfaces that are members of FCoE VLANs must use trunk mode, and trunk port interfaces must be explicitly included as members of a native VLAN.)

In addition, the VLAN ID must match the native VLAN ID that you configure on the physical interface. For example, to configure a native VLAN with an ID of 20 on interface xe-0/0/15 that is a member of an FCoE VLAN, you must include both of the following statements in the configuration:

1. Configure the native VLAN on the interface:

```
user@switch# set interfaces xe-0/0/15 native-vlan-id 20
```

(The equivalent configuration statement on a non-ELS device switch would be `set interfaces xe-0/0/15 unit 0 family ethernet-switching native-vlan-id 20`.)

2. Configure the port as a member of the native VLAN (this step is not required on switches that do not use the ELS software):

```
user@switch# set interfaces xe-0/0/15 unit 0 family ethernet-switching vlan members 20
```



BEST PRACTICE: Only FCoE traffic is permitted on the FCoE VLAN. A native VLAN might need to carry untagged traffic of different types and protocols. Therefore, it is a good practice to keep the native VLAN separate from FCoE VLANs.

Related Documentation

- [Understanding DCB Features and Requirements on page 292](#)
- [Understanding FCoE Transit Switch Functionality on page 46](#)
- [Understanding CoS Flow Control \(Ethernet PAUSE and PFC\) on page 327](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)
- [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)

Understanding FCoE LAGs

A Fibre Channel over Ethernet (FCoE) link aggregation group (LAG) is a special LAG that enables you to transport FCoE traffic and regular Ethernet traffic across the same link aggregation bundle. Fibre Channel (FC) storage area network (SAN) switches require a point-to-point connection (or a virtual point-to-point connection) to FCoE devices. This requirement means that communication between an FCoE device and a QFabric system Node device must use the same physical link in a LAG to maintain the virtual point-to-point connection.

However, a standard LAG can use any member link for any particular transmission, so a standard LAG cannot guarantee that the same link is used for requests and responses between an FCoE device and a QFabric system Node device. Using different LAG member links for communication breaks the virtual point-to-point connection, which results in dropped FCoE traffic.

Unlike a standard LAG, an FCoE LAG always uses the same member link to transmit FCoE traffic between an FCoE device and a QFabric system Node device. However, regular Ethernet traffic (traffic that is not FCoE traffic) on the LAG is distributed across member interfaces in the same way as on a standard LAG. The special treatment of FCoE traffic does not affect the way regular Ethernet traffic behaves on the LAG. FCoE traffic is treated properly in terms of maintaining a virtual point-to-point link, and regular Ethernet traffic enjoys the usual LAG benefits of load balancing and link redundancy.



NOTE: Configuring a LAG as an FCoE LAG does not provide link redundancy for FCoE traffic, and does not load balance FCoE traffic.

A LAG interface can be a member of both an FCoE VLAN and a regular Ethernet VLAN. An FCoE LAG allows FCoE and standard Ethernet traffic to coexist on the same LAG, and treats both types of traffic properly.

On QFabric systems, all of the member links of an FCoE LAG must belong to one Node group. The member links of an FCoE LAG cannot belong to different Node groups.

Like a standard LAG, an FCoE LAG can have up to 32 member interfaces. FCoE devices are usually servers with CNAs connected to a switch that performs FIP snooping, such as an FCoE transit switch or an FCoE-FC gateway switch that performs FIP snooping.

- [Why a Standard LAG Does Not Work for FCoE Traffic on page 58](#)
- [How an FCoE LAG Works on page 58](#)
- [Behavior on FCoE LAG Link Failure on page 59](#)
- [FIP Snooping Session Scaling on QFabric System Node Devices on page 59](#)
- [FCoE LAG Configuration on an FCoE Transit Switch on page 60](#)
- [FCoE LAG Configuration and FIP Snooping Scaling on an FCoE-FC Gateway on page 60](#)
- [FCoE Blade Switches on page 62](#)
- [Limitations on page 62](#)

Why a Standard LAG Does Not Work for FCoE Traffic

Each physical link that carries FCoE traffic connects to a CNA port on an FCoE device. The connection that the FIP process creates between the CNA and the FC SAN switch emulates a point-to-point connection between that CNA and the SAN switch through the QFabric system Node device. If a connection to an FCoE device is not on a point-to-point link, communication from the FC SAN switch to the FCoE device CNA might not reach the CNA.

In a LAG, two (or more) physical links connect to the same device. Standard LAGs use a hashing algorithm to determine which physical LAG link to use for each transmission. Because the hashing algorithm might choose any LAG link for a given transmission, there is no way a standard LAG can guarantee that a response from the FC SAN will use the same LAG link on a Node device as the request from the CNA.

To ensure that communication between the CNA and the FC SAN is successful, communication from the SAN to the CNA must use the same physical link. If the FCoE CNA sends a request to the FC SAN, the response from the FC SAN must come on the same link the FCoE device CNA used to send the request. For example, if a request from the CNA goes out on Node device LAG member interface RSNG1:xe-0/0/20, then the response from the FC SAN must be received on interface RSNG1:xe-0/0/20.

If the FC SAN switch response to the FCoE CNA uses a different physical link on the Node device LAG, the response arrives at a different CNA port than the CNA port on which the request was sent. This breaks the virtual point-to-point link and the SAN switch response does not reach the correct requestor, so the response is lost. This is why a standard LAG does not work for FCoE traffic.

How an FCoE LAG Works

For FIP and FCoE transactions with the FC SAN to work properly, a LAG for FIP and FCoE traffic must allow the FC SAN switch to respond to the FCoE CNA device on the same link that the CNA used to communicate with the FC SAN switch.

To accomplish this, an FCoE LAG selects the member interface that the CNA used to communicate with the FC SAN switch as the link for the SAN switch response to the CNA. This preserves the virtual point-to-point link across the LAG and ensures that traffic from the FC SAN reaches the correct CNA port.

In a standard LAG, other devices learn the MAC address of the LAG interface, not the MAC address of the physical member interface that actually carries the traffic. However, for FCoE communication, other devices need to learn and use the VN_Port MAC address that the SAN switch assigns to the virtual node port (VN_Port) on the FCoE device's CNA. The VN_Port MAC address uniquely identifies the CNA port used for FCoE transmission. (The VN_Port MAC address is based on the Fibre Channel ID and the FC-MAP value, which the FC SAN switch provides to the FCoE CNA as a unique port identifier.)

In an FCoE LAG, the Node device performs FIP snooping to learn the VN_Port MAC address of the CNA (in addition to other information). The Node device assigns the VN_Port MAC address to the particular interface that was used to connect to the CNA. For FCoE traffic, this replaces the normal LAG hashing logic, so instead of using an arbitrary LAG interface

on the Node device for FCoE communication between the SAN switch and the CNA, an FCoE LAG uses the same physical LAG link for all FCoE transactions based on the VN_Port MAC address.

VLAN discovery traffic is untagged, so it must use a native VLAN. When you configure an FCoE LAG, VLAN discovery traffic on a native VLAN in the LAG also automatically uses the same physical link, preserving the virtual point-to-point link.

For multicast packets such as multicast discovery advertisements (MDAs), the advertisement is forwarded on all member links of the FCoE LAG. This ensures that multicast advertisements reach all of the FCoE devices attached to FCoE LAG member interfaces.

Behavior on FCoE LAG Link Failure

If an FCoE LAG link goes down, FCoE traffic and regular Ethernet traffic are treated differently.

If an FCoE LAG link goes down, the FCoE sessions on that link also go down. The Node device cannot simply move a session to another LAG link because that breaks the virtual point-to-point link. FCoE LAGs do not provide link redundancy for FCoE traffic.

As on a normal LAG, an FCoE LAG provides link redundancy for regular Ethernet traffic. Regular Ethernet sessions on the down FCoE LAG link are moved to other member links of the FCoE LAG (assuming that other member links are up).

FIP Snooping Session Scaling on QFabric System Node Devices

When the switch is on the FCoE access edge, you must enable FIP snooping on the FCoE VLAN to provide secure access when connecting to the FC SAN. (You can also enable FIP snooping on FCoE VLANs on switches that are not at the access edge if you want to collect FIP snooping statistics on the switch or if you are not confident that the edge switch is properly snooping traffic.)

FIP snooping VLANs support scaling up to 2,500 sessions by default, which is called enhanced FIP snooping scaling mode. Software releases before Junos OS Release 12.3 limited VN2VF_Port FIP snooping session scaling to 376 sessions on untrusted interfaces and untrusted FC fabrics, but scaled to 2,500 sessions on trusted interfaces and trusted FC fabrics. Starting with Junos OS Release 12.3, by default, all VN2VF_Port FIP snooping VLANs used enhanced FIP snooping scaling (2,500 sessions) for both trusted and untrusted interfaces and FC fabrics. The old limit of 376 sessions for untrusted interfaces and untrusted FC fabrics was deprecated and could not be configured.

The FCoE LAG feature introduces the ability to disable FIP snooping session scaling so that only 376 sessions are supported instead of the default 2,500 sessions. The reason for reintroducing FIP snooping session scaling limits is that when a Node device is configured as an FCoE-FC gateway that has one or more untrusted gateway Fibre Channel fabric (fc-fabric), placing FCoE traffic in a LAG forces the TCAM to store additional session data to ensure that the virtual point-to-point link between the FCoE device and the FC SAN is maintained. This case is described later in this document.

FCoE LAG Configuration on an FCoE Transit Switch

To create an FCoE LAG on an FCoE transit switch, you include the **fcoe-lag** option in the **[edit interfaces *interface-name* aggregated-ether-options]** hierarchy.

In addition to creating the FCoE LAG, you also need to:

- Add interfaces to the FCoE LAG.
- Configure at least one dedicated VLAN for FCoE traffic (an FCoE VLAN).
- Configure a native VLAN to carry untagged FIP traffic.
- Configure the FCoE LAG interfaces as a member of both the FCoE VLAN and the native VLAN.
- Enable FIP snooping on the FCoE VLAN.

FCoE LAG Configuration and FIP Snooping Scaling on an FCoE-FC Gateway

There are differences in the way you configure an FCoE LAG on an FCoE-FC gateway compared to configuring an FCoE LAG on an FCoE transit switch.

- [Configuring an FCoE LAG on an FCoE-FC Gateway on page 60](#)
- [FIP Snooping Session Scaling on an FCoE-FC Gateway on page 61](#)
- [Summary of FCoE LAG and FIP Snooping Scaling on an FCoE-FC Gateway on page 61](#)

Configuring an FCoE LAG on an FCoE-FC Gateway

To create an FCoE LAG on an FCoE-FC gateway, you include the **fcoe-lag** option in the **[edit interfaces *interface-name* aggregated-ether-options]** hierarchy.

In addition to creating the FCoE LAG, you also need to:

- Add interfaces to the FCoE LAG.
- Configure at least one dedicated VLAN for FCoE traffic (an FCoE VLAN).
- Configure a native VLAN to carry untagged FIP traffic.
- Configure the FCoE LAG interfaces as a member of both the FCoE VLAN and the native VLAN.
- Configure an FCoE VLAN interface (a Layer 3 routed VLAN interface that is configured as a virtual F_Port) for the FCoE traffic. This enables the FCoE VLAN (and the member FCoE LAG interfaces) to interface with the native Fibre Channel ports in the FCoE-FC gateway switch Fibre Channel fabric (fc-fabric).
- Add the FCoE VLAN interface to the fc-fabric.
- Enable FIP snooping on the FCoE VLAN.
- Configure FIP snooping session scaling as described in the next section. The FIP snooping scaling mode depends on whether the fc-fabric is trusted or untrusted.

FIP Snooping Session Scaling on an FCoE-FC Gateway

FIP snooping session scaling on an FCoE-FC gateway depends on whether or not the gateway has an untrusted fc-fabric:

- If the FCoE-FC gateway fc-fabric is FCoE trusted, then you can use enhanced FIP snooping scaling (2,500 sessions), and you do not have to do any additional configuration even if two or more FCFs in an FCoE VLAN have the same FC-MAP value.
- If the FCoE-FC gateway fc-fabric is FCoE untrusted, then you must disable enhanced FIP snooping scaling (reduce the number of supported sessions to 376 sessions) by including the **no-fip-snooping-scaling** statement in the **[edit fc-options]** hierarchy.



NOTE: On an FCoE-FC gateway, disabling enhanced FIP snooping scaling is global.

Gateway fc-fabrics are untrusted by default. FCoE-FC gateways do not support FCoE LAGs on untrusted fc-fabrics when enhanced FIP snooping scaling is enabled.

Summary of FCoE LAG and FIP Snooping Scaling on an FCoE-FC Gateway

Table 5 on page 61 summarizes FCoE LAG and FIP snooping scaling on an FCoE-FC gateway.

Table 5: Summary of FCoE LAG and FIP Snooping Scaling (FCoE-FC Gateway)

FCoE Fabric Trusted or Untrusted	FCoE LAG Configured	FIP Snooping Session Scaling	Configuration Notes
Trusted	Yes (fcoe-lag option included in the [edit interfaces <i>interface-name</i> aggregated-ether-options] hierarchy)	2,500 sessions (enhanced FIP snooping scaling)	Configure the fc-fabric as an FCoE trusted fabric by including the fcoe-trusted option in the [edit fc-fabrics <i>fc-fabric-name</i> protocols fip fcoe-trusted] hierarchy.
Untrusted	Yes (fcoe-lag option included in the [edit interfaces <i>interface-name</i> aggregated-ether-options] hierarchy)	376 sessions (no FIP snooping scaling)	Disable FIP snooping scaling by including the no-fip-snooping-scaling option in the [edit fc-options] hierarchy. This disables FIP snooping scaling globally on the gateway.
Untrusted	No (fcoe-lag option not included in LAG configuration)	2,500 sessions (enhanced FIP snooping scaling)	FCoE LAGs with enhanced FIP snooping scaling enabled are not supported on untrusted FCoE-FC gateway fc-fabrics. To configure an FCoE LAG on an untrusted fc-fabric, FIP snooping scaling must be disabled.

FCoE Blade Switches

If you are using an FCoE blade switch, you need to configure an FCoE LAG only if the blade switch uses a passthrough module instead of an integrated switch.

Limitations

There are several limitations to configuring FCoE LAGs:

1. All FCoE LAG member links must belong to the same QFabric system Node group.
2. On an FCoE-FC gateway, you must disable FIP snooping scaling on untrusted fc-fabrics. Disabling FIP snooping scaling is global to the gateway Node device. If all of the fc-fabrics on an FCoE-FC gateway are trusted fabrics, you do not need to disable FIP snooping scaling.
3. FCoE LAGs with enhanced FIP snooping scaling enabled are not supported on untrusted FCoE-FC gateway fc-fabrics.

Related Documentation

- [Understanding Aggregated Ethernet Interfaces and LACP for Switches](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Configuring an FCoE LAG on page 63](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)
- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Example: Configuring an FCoE LAG on a Redundant Server Node Group on page 66](#)

Configuring an FCoE LAG

A Fibre Channel over Ethernet (FCoE) link aggregation group (LAG) is a special LAG that enables you to transport FCoE traffic and regular Ethernet traffic across the same link aggregation bundle. Standard LAGs use a hashing algorithm to determine which physical link in the LAG is used for a transmission, so a series of communications between two devices might use different physical links in the LAG for different transmissions.

However, FCoE traffic requires a point-to-point link (or a virtual point-to-point link) between the FCoE device and the Fibre Channel (FC) storage area network (SAN) switch. This requirement means that communication between an FCoE device and a QFabric system Node device must use the same physical link in a LAG to maintain the virtual point-to-point connection.

An FCoE LAG solves the problem by ensuring that the same LAG link is used for communication between an FC SAN switch and a given FCoE device across a QFabric system Node device, preserving point-to-point link emulation. At the same time, regular Ethernet traffic (traffic that is not FCoE traffic) on the LAG is distributed across member interfaces in the same way as on a standard LAG. FCoE traffic is treated properly in terms of maintaining a virtual point-to-point link with the FC SAN, and regular Ethernet traffic enjoys the usual LAG benefits of load balancing and link redundancy.



NOTE: Configuring a LAG as an FCoE LAG does not provide link redundancy for FCoE traffic, and does not load balance FCoE traffic.

On FCoE-FC gateway untrusted Fibre Channel fabrics (fc-fabrics), if you configure an FCoE LAG, you must also disable enhanced FIP snooping scaling (scaling up to 2,500 sessions), which reduces the number of supported FIP snooping sessions to 376 sessions. On an FCoE-FC gateway, disabling enhanced FIP snooping scaling is global to the Node device. Trusted fc-fabrics on an FCoE-FC gateway support enhanced FIP snooping scaling.

This example shows how to configure an FCoE LAG with enhanced FIP snooping scaling enabled and also with enhanced FIP snooping scaling disabled.

The steps required to create the FCoE LAG are:

- Configuring an FCoE LAG interface.
- Assigning the Ethernet interfaces connected to the FCoE device to the FCoE LAG.
- Configuring FIP snooping.

In addition to configuring the FCoE LAG and FIP snooping scaling, you also need to configure:

- Configure a dedicated FCoE VLAN for the FCoE traffic.
- Configure a native VLAN for the untagged FIP traffic.
- Enable FIP snooping on the FCoE VLAN.

- Configure the FCoE LAG interface membership in the FCoE VLAN and the native VLAN.
- For FCoE-FC gateway switches, configure a Layer 3 FCoE VLAN interface, and add the FCoE VLAN interface to the Fibre Channel fabric.
- For FCoE-FC gateway switches, configure the fc-fabric as an FCoE trusted fabric if you are using enhanced FIP snooping scaling (and if the FCoE traffic is trusted).

[“Example: Configuring an FCoE LAG on a Redundant Server Node Group” on page 66](#) includes an example of this configuration.

Configuring an FCoE LAG When Enhanced FIP Snooping Scaling is Enabled

This example shows how to configure an FCoE LAG when you can use enhanced FIP snooping scaling, such as when the FCoE-FC gateway fabrics are trusted, or on an FCoE transit switch.

1. Specify the number of LAGs (Ethernet devices) the QFabric system Node group will support:

```
admin@qfabric# set chassis node-group node-group-name aggregated-devices ethernet device-count device-count
```

For example, to configure the Node group **RSNG1** to allow up to ten LAGs:

```
admin@qfabric# set chassis node-group RSNG1 aggregated-devices ethernet device-count 10
```

2. Configure the LAG interface on the RSNG:

```
admin@qfabric# set interfaces lag-interface-name unit unit family ethernet-switching port-mode trunk
```

For example, to configure a LAG interface named **ae3** on Node group **RSNG1**:

```
admin@qfabric# set interfaces RSNG1:ae3 unit 0 family ethernet-switching port-mode trunk
```

3. Configure the LAG interface as an FCoE LAG:

```
admin@qfabric# set interfaces lag-interface-name aggregated-ether-options fcoe-lag
```

For example, to configure LAG **ae3** on a Node group named **RSNG1** as an FCoE LAG:

```
admin@qfabric# set interfaces RSNG1:ae3 aggregated-ether-options fcoe-lag
```

4. Enable LACP on the FCoE LAG:

```
admin@qfabric# set interfaces fcoe-lag-interface-name aggregated-ether-options lacp active
```


For example, to configure LACP on FCoE LAG **RSNG1:ae3**:

```
admin@qfabric# set interfaces RSNG1:ae3 aggregated-ether-options lacp active
```

5. Assign the Ethernet interfaces connected to the FCoE device converged network adapter (CNA) to the FCoE LAG:

```
admin@qfabric# set interfaces interface-name ether-options 802.3ad fcoe-lag-name
```

For example, to assign interfaces **xe-0/0/20** and **xe-0/0/21** on Node device **row1-rack1** (which is part of the Node group **RSNG1**) to the FCoE LAG **ae3** (on Node group **RSNG1**):

```
admin@qfabric# set interfaces row1-rack1:xe-0/0/20 ether-options 802.3ad RSNG1:ae3
admin@qfabric# set interfaces row1-rack1:xe-0/0/21 ether-options 802.3ad RSNG1:ae3
```



NOTE: On QFabric system Node groups that have two or more member nodes, you can assign interfaces from any Node in the Node group to the FCoE LAG. Adding to the example, if Node device **row2-rack1** is part of Node group **RSNG1**, then you can add interfaces from **row2-rack1** to the FCoE LAG. For example, **set interfaces row2-rack1:xe-0/0/20 ether-options 802.3ad RSNG1:ae3** adds an interface on a second Node device to the FCoE LAG.

6. Enable FIP snooping on the FCoE VLAN:

```
admin@qfabric# set ethernet-switching-options secure-access-port vlan fcoe-vlan-name
examine-fip
```

For example, to enable FIP snooping on an FCoE VLAN named **fcoe-vlan-blue**:

```
admin@qfabric# set ethernet-switching-options secure-access-port vlan fcoe-vlan-blue
examine-fip
```

7. On an FCoE-FC gateway only, enable FCoE trusted mode on the fc-fabric:

```
admin@qfabric# set fc-fabrics fc-fabric-name protocols fip fcoe-trusted
```

For example, to configure an fc-fabric named **sanfab1** as an FCoE trusted fabric:

```
admin@qfabric# set fc-fabrics sanfab1 protocols fip fcoe-trusted
```

Configuring an FCoE
LAG When Enhanced
FIP Snooping Scaling
Must be Disabled

This example shows how to configure an FCoE LAG when you need to disable enhanced FIP snooping scaling, for example, when an FCoE-FC gateway fabric is untrusted.

Follow steps 1-6 of the preceding example to configure the FCoE LAG and enable FIP snooping on the FCoE VLAN. Next, disable enhanced FIP snooping scaling:

1. On an FCoE-FC gateway switch, disable FIP snooping scaling on all FCoE LAGs in the Fibre Channel fabric options configuration:

```
admin@qfabric# set fc-options no-fip-snooping-scaling
```

This global statement disables FIP snooping scaling on all FCoE LAGs associated with all FC fabrics on the switch.

**Related
Documentation**

- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)
- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Example: Configuring an FCoE LAG on a Redundant Server Node Group on page 66](#)
- [Understanding FCoE LAGs on page 57](#)

Example: Configuring an FCoE LAG on a Redundant Server Node Group

This example shows how to configure a Fibre Channel over Ethernet (FCoE) link aggregation group (LAG) on a redundant server Node group (RSNG) to transport FCoE traffic and regular Ethernet traffic across the same link aggregation bundle. The FCoE servers have converged network adapters (CNAs) and communicate with the Fibre Channel (FC) storage area network (SAN). FCoE servers are usually connected to a switch that performs FIP snooping, such as an FCoE transit switch or an FCoE-FC gateway switch that performs FIP snooping. This example provides a common FCoE LAG configuration for an FCoE transit switch and an FCoE-FC gateway, and shows how to disable FIP snooping scaling on an FCoE untrusted FCoE-FC gateway fabric (fc-fabric).

- [Requirements on page 66](#)
- [Overview on page 67](#)
- [Configuration on page 69](#)
- [Verification on page 74](#)

Requirements

This example uses the following hardware and software components:

- Two Juniper Networks QFabric System Node devices configured as an RSNG. The Node devices can be configured as FCoE transit switches or as FCoE-FC gateways. (A configuration with one Node device as an FCoE transit switch and the other Node device as an FCoE-FC gateway is possible providing that the transit switch and the FCoE-FC gateway use different FCoE VLANs.)
- Junos OS Release 13.2X52-D10 or later for the QFX Series

- One FCoE server with two CNA ports

Overview

Standard LAGs use a hashing algorithm to determine which physical link in the LAG is used for a transmission, so a series of communications between two devices might use different physical links in the LAG for different transmissions. However, FCoE traffic requires a point-to-point link (or a virtual point-to-point link) between the FCoE device and the Fibre Channel (FC) storage area network (SAN) switch.

An FCoE LAG solves this problem by ensuring that the same LAG link is used for communication between a given FCoE device and the QFabric system Node device, preserving point-to-point link emulation. At the same time, regular Ethernet traffic (traffic that is not FCoE traffic) on the LAG is distributed across member interfaces in the same way as on a standard LAG. FCoE traffic is treated properly in terms of maintaining a virtual point-to-point link with the FC SAN, and regular Ethernet traffic enjoys the usual LAG benefits of load balancing and link redundancy.



NOTE: Configuring a LAG as an FCoE LAG does not provide link redundancy for FCoE traffic, and does not load balance FCoE traffic.

On FCoE-FC gateway untrusted Fibre Channel fabrics (fc-fabrics), if you configure an FCoE LAG, you must also disable enhanced FIP snooping scaling (scaling up to 2,500 sessions), which reduces the number of supported FIP snooping sessions to 376 sessions. On an FCoE-FC gateway, disabling enhanced FIP snooping scaling is global to the Node device. Trusted fc-fabrics on an FCoE-FC gateway support enhanced FIP snooping scaling.

This example shows you how to:

- Configure the RSNG and its Node devices
- Configure the FCoE LAG on the RSNG
- Configure a dedicated VLAN for FCoE traffic (an FCoE VLAN) and a native VLAN for untagged FCoE initialization protocol (FIP) traffic
- Enable VN2VF_Port FIP snooping on the FCoE VLAN
- Disable FIP snooping scaling on an untrusted FCoE-FC gateway fabric



NOTE: FCoE traffic requires lossless transport across the Ethernet network to comply with the requirements for transporting storage traffic. This example describes how to configure an FCoE LAG to provide redundancy for FCoE traffic. See [“Example: Configuring CoS PFC for FCoE Traffic” on page 339](#) for how to configure lossless transport for FCoE traffic.



NOTE: On a Node device that is configured as an FCoE-FC gateway, you must create a Fibre Channel fabric, configure native FC interfaces, configure an FCoE VLAN interface (a Layer 3 RVI) for the FCoE VLAN (which includes the FCoE LAG as a member interface), and add the native FC interfaces and FCoE VLAN interface to the FC fabric. For an example of FCoE-FC gateway interface configuration, see [“Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric”](#) on page 239.

Topology

Table 6 on page 68 shows the configuration components for this example.

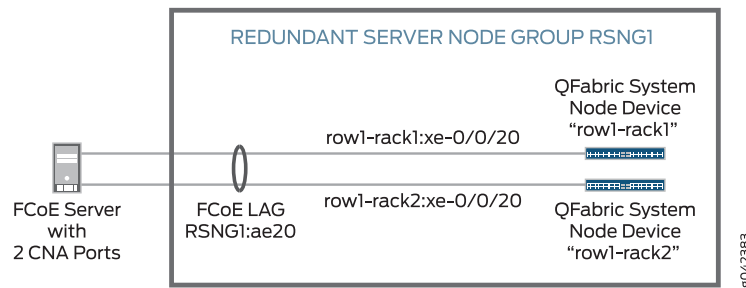
Table 6: Components of the FCoE LAG Configuration Example

Component	Settings
Hardware	<p>Two QFabric system Node devices configured as an RSNG (the Node devices can be configured as FCoE transit switches or as FCoE-FC gateways; this example is valid for both modes):</p> <ul style="list-style-type: none"> • RSNG name—RSNG1 • First Node device—Serial number ABCD1234, alias name row1-rack1 • Second Node device—Serial number ABCD1235, alias name row1-rack2 <p>NOTE: The alias names chosen for this example indicate the physical locations of the Node devices. You can use any aliasing system you want to make identifying Node devices easier, or you can use the default Node device names (the Node device serial numbers).</p> <p>One FCoE server with two CNA ports.</p>
LAG configuration	<p>RSNG device count—48</p> <p>FCoE LAG name—RSNG1:ae20</p> <p>FCoE LAG member interfaces—row1rack1:xe-0/0/20 and row1rack2:xe-0/0/20</p> <p>FCoE LAG LACP—active</p> <p>FCoE LAG port mode—trunk</p> <p>MTU—2180</p> <p>FCoE LAG VLAN memberships—FCoE VLAN (fcoe-vlan1) and native VLAN</p>
FCoE VLAN	<p>Name—fcoe-vlan1</p> <p>VLAN ID—2000</p> <p>Member interfaces—RSNG1:ae20</p>
Native VLAN	<p>Name—native</p> <p>VLAN ID—1</p> <p>Member interfaces—RSNG1:ae20</p>

Table 6: Components of the FCoE LAG Configuration Example (continued)

Component	Settings
VN2VF_Port FIP snooping	Enabled on the FCoE VLAN (fcoe-vlan1)
FIP snooping scaling	Enabled for FCoE transit switch portion of the example. Disabled for the FCoE-FC gateway portion of the example (gateway FC fabric is FCoE untrusted).

Figure 3 on page 69 shows the network topology for this example.

Figure 3: FCoE LAG Example Topology

Configuration

To configure an FCoE LAG between an FCoE server with two CNA ports and the two Node device members of an RSNG, perform these tasks:

- [Configuring an FCoE LAG on an RSNG \(FCoE Transit Switch or FCoE-FC Gateway\) on page 71](#)
- [Disabling Enhanced FIP Snooping Scaling on an FCoE-FC Gateway on page 72](#)
- [Results on page 73](#)

CLI Quick Configuration

In this example, the enhanced FIP snooping scaling is disabled (376 sessions) on the FCoE-FC gateway because the gateway fabric is an untrusted fc-fabric.

Most of the FCoE LAG configuration is common to both the FCoE transit switch and FCoE-FC gateway modes of operation. The CLI Quick Configuration shows the common configuration statements first, followed by the additional configuration statement that disables FIP snooping scaling on the FCoE-FC gateway. Disabling FIP snooping scaling on an FCoE-FC gateway is a global configuration that affects all of the fc-fabrics on the gateway. (On an FCoE transit switch, you can disable FIP snooping scaling on an individual FCoE VLAN without affecting other FCoE VLANs.)



NOTE: This example does not include configuring the FC fabric, the native FC fabric ports, and the Layer 3 FCoE VLAN interface.

Common Configuration

To quickly configure an FCoE LAG, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the [edit] hierarchy level.

```
set fabric aliases node-device ABCD1234 row1-rack1
set fabric aliases node-device ABCD1235 row1-rack2
set fabric resources node-group RSNG1 node-device row1-rack1
set fabric resources node-group RSNG1 node-device row1-rack2
set chassis node-group RSNG1 aggregated-devices ethernet device-count 48
set interfaces RSNG1:ae20 unit 0 family ethernet-switching port-mode trunk vlan members
  fcoe-vlan1
set interfaces RSNG1:ae20 unit 0 family ethernet-switching native-vlan-id 1
set interfaces RSNG1:ae20 mtu 2180
set interfaces RSNG1:ae20 aggregated-ether-options fcoe-lag
set interfaces RSNG1:ae20 aggregated-ether-options lacp active
set interfaces row1-rack1:xe-0/0/20 ether-options 802.3ad RSNG1:ae20
set interfaces row1-rack2:xe-0/0/20 ether-options 802.3ad RSNG1:ae20
set vlans fcoe-vlan1 vlan-id 2000
set vlans native vlan-id 1
set vlans fcoe-vlan1 interface RSNG1:ae20
set ethernet-switching-options secure-access-port vlan fcoe-vlan1 examine-fip
```



NOTE: If you want to configure an FCoE-FC gateway fabric as a trusted fabric so that you can leave enhanced FIP snooping scaling enabled on the gateway, add the following statement to the configuration, replacing the variable *fc-fabric-name* with the name of the FC fabric (if you do this, do not disable FIP snooping scaling as shown in the FCoE-FC Gateway Additional Configuration):

```
set fc-fabrics fc-fabric-name protocols fip fcoe-trusted
```

FCoE-FC Gateway Additional Configuration (Untrusted FC Fabric)

To disable enhanced FIP snooping scaling on an FCoE-FC gateway untrusted FC fabric, copy the following command, paste it in a text file, remove line breaks, and then copy and paste the command into the CLI at the [edit] hierarchy level.

```
set fc-options no-fip-snooping-scaling
```

Configuring an FCoE LAG on an RSNG (FCoE Transit Switch or FCoE-FC Gateway)

- Step-by-Step Procedure** To configure the RSNG member Node devices, the FCoE LAG, the FCoE VLAN, and VN2VF_Port FIP snooping on an FCoE transit switch or an FCoE-FC gateway:
1. Define aliases for the two Node devices that will be in the RSNG (aliases are easier to remember and more descriptive than the Node device serial number). Name the Node device with serial number **ABCD1234** as **row1-rack1** and the Node device with the serial number **ABCD1235** as **row1-rack2**:


```
admin@qfabric# set fabric aliases node-device ABCD1234 row1-rack1
admin@qfabric# set fabric aliases node-device ABCD1235 row1-rack2
```
 2. Configure the Node device membership for **row1-rack1** and **row1-rack2** in the RSNG **RSNG1**:


```
admin@qfabric# set fabric resources node-group RSNG1 node-device row1-rack1
admin@qfabric# set fabric resources node-group RSNG1 node-device row1-rack2
```
 3. Configure the number of LAG interfaces that RSNG **RSNG1** can support. (Each Node device in the RSNG has 48 server-facing ports. If we used one port from each Node device to provide Node device redundancy for each LAG, we might need to support a maximum of 48 LAGs, so we set the device count to **48** LAGs.)


```
admin@qfabric# set chassis node-group RSNG1 aggregated-devices ethernet device-count 48
```
 4. Configure the LAG interface (**ae20**) on RSNG1 and set the port mode to **trunk** mode. In the same statement, configure the LAG interface membership in the dedicated FCoE VLAN **fcoe-vlan1**:


```
admin@qfabric# set interfaces RSNG1:ae20 unit 0 family ethernet-switching port-mode trunk
vlan members fcoe-vlan1
```
 5. Configure the LAG interface membership in the native VLAN:


```
admin@qfabric# set interfaces RSNG1:ae20 unit 0 family ethernet-switching native-vlan-id 1
```
 6. Configure the LAG interface with an MTU of **2180** to accommodate the size of the FCoE frame and headers.


```
admin@qfabric# set interfaces RSNG1:ae20 mtu 2180
```
 7. Configure the LAG **RSNG1:ae20** as an FCoE LAG:


```
admin@qfabric# set interfaces RSNG1:ae20 aggregated-ether-options fcoe-lag
```

8. Enable LACP on the FCoE LAG:

```
admin@qfabric# set interfaces RSNG1:ae20 aggregated-ether-options lacp active
```

9. Assign one Ethernet interface on each RSNG Node device to the FCoE LAG:

```
admin@qfabric# set interfaces row1-rack1:xe-0/0/20 ether-options 802.3ad RSNG1:ae20
admin@qfabric# set interfaces row1-rack2:xe-0/0/20 ether-options 802.3ad RSNG1:ae20
```

10. Configure a dedicated VLAN for FCoE traffic (an FCoE VLAN) named **fcoe-vlan1** with the VLAN ID **2000**:

```
admin@qfabric# set vlans fcoe-vlan1 vlan-id 2000
```

11. Configure a native VLAN with the VLAN ID 1 to carry untagged FIP traffic:

```
admin@qfabric# set vlans native vlan-id 1
```

12. Assign the FCoE LAG interface to the FCoE VLAN:

```
admin@qfabric# set vlans fcoe-vlan1 interface RSNG:ae20
```

13. Assign the FCoE LAG interface to the native VLAN:

```
admin@qfabric# set vlans native interface RSNG:ae20
```

14. Enable VN2VF_Port FIP snooping on the FCoE VLAN:

```
admin@qfabric# set ethernet-switching-options secure-access-port vlan fcoe-vlan1
examine-fip
```

Disabling Enhanced FIP Snooping Scaling on an FCoE-FC Gateway

Step-by-Step Procedure

To disable enhanced FIP snooping scaling on an FCoE-FC gateway:

1. Disable FIP snooping scaling on the gateway fabrics. Disabling FIP snooping scaling on an FCoE-FC gateway is global to the gateway, so every FC fabric on the gateway reverts to supporting 376 sessions (instead of 2,500 sessions as with FIP snooping scaling enabled).

```
admin@qfabric# set fc-options no-fip-snooping-scaling
```


Results

Display the results of the configuration. The results below show the configuration on an FCoE transit switch and have been edited to include only the components configured in the example:

```
admin@qfabric> show configuration
root@qfabric> fabric {
  resources {
    node-group RSNG1 {
      node-device row1-rack1;
      node-device row1-rack2;
    }
  }
  aliases {
    node-device ABCD1234 {
      row1-rack1;
    }
    node-device ABCD1235 {
      row1-rack2;
    }
  }
}
chassis {
  node-group RSNG1 {
    aggregated-devices {
      ethernet {
        device-count 48;
      }
    }
  }
}
interfaces {
  RSNG1:ae20 {
    aggregated-ether-options {
      fcoe-lag;
      lacp {
        active;
      }
    }
  }
  unit 0 {
    family ethernet-switching {
      port-mode trunk;
      vlan {
        members fcoe-vlan1;
      }
      native-vlan-id 1;
    }
  }
}
row1-rack1:xe-0/0/20 {
  ether-options {
    802.3ad RSNG1:ae20;
  }
}
row1-rack2:xe-0/0/20 {
  ether-options {
    802.3ad RSNG1:ae20;
  }
}
```

```
    }  
  }  
}  
ethernet-switching-options {  
  secure-access-port {  
    vlan fcoe-vlan1 {  
      examine-fip;  
    }  
  }  
}  
vlangs {  
  fcoe-vlan1 {  
    vlan-id 2000;  
    interface {  
      RSNG1:ae20.0;  
    }  
  }  
  native {  
    vlan-id 1;  
    interface {  
      RSNG1:ae20.0;  
    }  
  }  
}
```

Verification

To verify the configuration of the QFabric system Node device resources, FCoE LAG, FCoE VLAN, native VLAN, and FIP snooping, perform these tasks:

- [Verifying the Node Device Aliases \(Names\) on page 74](#)
- [Verifying the Node device Assignment to the Node Group on page 75](#)
- [Verifying the Number of Aggregated Ethernet Logical Devices \(LAG Interfaces\) That the Node Group Can Support on page 75](#)
- [Verifying the FCoE LAG Interface Configuration on page 76](#)
- [Verifying the FCoE VLAN and Native VLAN Configuration on page 78](#)
- [Verifying the FIP Snooping Configuration on page 78](#)

Verifying the Node Device Aliases (Names)

Purpose Verify that the Node device alias names are configured.

Action List the Node device inventory on the QFabric system using the **show fabric administration inventory node-devices** command:

```
admin@qfabric> show fabric administration inventory node-devices
```

```
root@qfabric> show fabric administration inventory node-devices
```

Item	Identifier	Connection	Model
Node device			
row1-rack1	ABCD1234	Connected	qfx3500
row1-rack2	ABCD1235	Connected	qfx3500

Meaning The **show fabric administration inventory node-devices** command lists the Node device names in the *Node device* column and lists the Node device serial numbers in the *Identifier* column. The *Connection* column shows if the Director device has detected the Node device, and the *Model* column lists QFX switch model type.

The command output shows that Node device **ABCD1234** is configured with the name (alias) **row1-rack1**, and the Node device **ABCD1235** is configured with the name **row1-rack2**.

Verifying the Node device Assignment to the Node Group

Purpose Verify that the redundant server Node group includes the two Node devices.

Action Verify that the QFabric system Node group **RSNG1** is configured with the correct Node devices using the **show configuration fabric resources** command:

```
admin@qfabric> show configuration fabric resources
```

```
root@qfabric> show configuration fabric resources
```

```
node-group RSNG1 {
  node-device row1-rack1;
  node-device row1-rack2;
}
```

Meaning The **show configuration fabric resources** command lists the Node groups and the Node devices in the Node groups. The command output shows that Node group **RSNG1** consists of the Node devices **row1-rack1** and **row1-rack2**.

Verifying the Number of Aggregated Ethernet Logical Devices (LAG Interfaces) That the Node Group Can Support

Purpose Verify the number of LAG interfaces that the redundant server node group supports.

Action List the LAG interface device count using the **show configuration chassis** command:

```
admin@qfabric> show configuration chassis
```

```
node-group RSNG1 {  
    aggregated-devices {  
        ethernet {  
            device-count 48;  
        }  
    }  
}
```

Meaning The **show configuration chassis** command displays the Ethernet device count (the number of LAG interfaces supported) as **48** devices.

Verifying the FCoE LAG Interface Configuration

Purpose Verify that the FCoE LAG interface, port mode, interface VLAN membership, and Node device interface membership in the FCoE LAG are correctly configured.

Action List the FCoE LAG interface and Node device interface information using the **show configuration interfaces** command:

```
admin@qfabric> show configuration interfaces
```

```
RSNG1:ae20 {
  aggregated-ether-options {
    fcoe-lag;
    lacp {
      active;
    }
  }
  unit 0 {
    family ethernet-switching {
      port-mode trunk;
      vlan {
        members fcoe-vlan1;
      }
      native-vlan-id 1;
    }
  }
}
row1-rack1:xe-0/0/20 {
  ether-options {
    802.3ad RSNG1:ae20;
  }
}
row1-rack2:xe-0/0/20 {
  ether-options {
    802.3ad RSNG1:ae20;
  }
}
```

Meaning The **show configuration interfaces** command lists both the LAG interfaces and the individual Node device interfaces, and their configuration.

The command output shows a lot of information about the interfaces:

- The LAG interface name is **RSNG1:ae20**
- **fcoe-lag** confirms the LAG is an FCoE LAG
- **lacp** is configured in **active** mode
- Port mode is **trunk**
- The LAG has membership in the **fcoe-vlan1** VLAN and in the native VLAN with the VLAN ID 1.
- Interface **row1-rack1:xe-0/0/20** is a member of FCoE LAG **RSNG1:ae20**
- Interface **row1-rack2:xe-0/0/20** is a member of FCoE LAG **RSNG1:ae20**

Verifying the FCoE VLAN and Native VLAN Configuration

Purpose Verify that the FCoE VLAN **fcoe-vlan1** and the native VLAN **native** are configured with the correct VLAN tags (**2000** and **1**, respectively) and that the FCoE LAG interface **RSNG1:ae20** is assigned to the VLANs.

Action List the VLAN information using the **show configuration vlans** command:

```
admin@qfabric> show configuration vlans
```

```
fcoe-vlan1 {  
    vlan-id 2000;  
    interface {  
        RSNG1:ae20.0;  
    }  
}  
native {  
    vlan-id 1;  
    interface {  
        RSNG1:ae20.0;  
    }  
}
```

Meaning The **show configuration vlans** command lists the configured VLANs, their VLAN IDs, and the interfaces assigned to the VLANs.

The command output shows that the FCoE VLAN **fcoe-vlan1** is configured with the VLAN ID **2000** and is assigned to the FCoE LAG interface **RSNG1:ae20**.

The command output also shows that the native VLAN **native** is configured with the VLAN ID **1** and is assigned to the FCoE LAG interface **RSNG1:ae20**.

Verifying the FIP Snooping Configuration

Purpose Verify that VN2VF_Port FIP snooping is enabled on the FCoE VLAN (**fcoe-vlan1**).

Action List the FIP snooping information using the **show configuration ethernet-switching-options** command:

```
admin@qfabric> show configuration ethernet-switching-options

secure-access-port {
    vlan fcoe-vlan1 {
        examine-fip;
    }
}
```

Meaning The **show configuration ethernet-switching-options** command lists the security options configured on VLANs. The command output shows that on VLAN **fcoe-vlan1**, VN2VF_Port FIP snooping is enabled (**examine-fip** output).

Related Documentation

- [Configuring an FCoE LAG on page 63](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)
- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
- [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)
- [Example: Configuring CoS Hierarchical Port Scheduling \(ETS\)](#)
- [Understanding FCoE LAGs on page 57](#)
- [Understanding CoS Flow Control \(Ethernet PAUSE and PFC\) on page 327](#)

Understanding OxID Hash Control for FCoE Traffic Load Balancing on QFabric Systems

The originator exchange identifier (OxID) field is one of several fields used in the hash function computation for FCoE traffic load balancing over multiple outgoing links in an Ethernet link aggregation group (LAG) on ports that face an FCoE forwarder (FCF). The QFabric system Node device ports can be 10-Gigabit Ethernet ports or 40-Gigabit fabric ports. (The 40-Gigabit fabric ports that connect a QFabric system Node device to QFabric system Interconnect devices function as a LAG even though they are not explicitly configured as a LAG.)

The OxID field is a unique identifier used to identify an exchange between a target and an initiator. The OxID value can be different for different exchanges between the same target and initiator.

- [OxID Hash Control on page 80](#)
- [Advantages and Disadvantages of OxID Hash Control on page 80](#)
- [Disabling OxID Hash Control on page 81](#)

OxID Hash Control

When FCoE traffic has multiple paths to an FCF (crosses a LAG that faces an FCF), packets can take different links between the source and destination endpoints. For each packet, the network bases the LAG link selection on the cost of the path (for example, link bandwidth or the number of hops). Using multiple paths distributes the FCoE traffic across the FCF-facing links, thus balancing the link load. The switch creates a hash value from some of the packet header fields, and uses the hash value to assign each packet to one of the LAG links. The switch always uses the following five packet header fields to compute the hash value:

- Source ID (SID)
- Destination ID (DID)
- Fabric ID (FID)
- Source Port ID (SPID)
- Source Module ID (SMID)

In addition, the QFabric system includes the OxID field by default in the FCoE load-balancing hash computation. However, if you do not want to use the OxID field in the FCoE load-balancing hash computation, you can remove it from the computation.

Advantages and Disadvantages of OxID Hash Control

The advantage of including the OxID field in the load-balancing hash computation is that OxID hash control allows different exchanges between a pair of Fibre Channel (FC) endpoints (such as an FCoE host and an FC storage device) to take different paths across the network, thus improving the aggregate network throughput and balancing the link load.

However, if communication between two FC endpoints uses different links, frames might not be delivered in the order that they are sent because of variance in the time each path takes to process and transmit frames. If your network is not experiencing out-of-order delivery of FCoE frames, then you can leave OxID hash control enabled and enjoy the benefits of load balancing. However, if your network experiences out-of-order delivery of FCoE frames, you can disable OxID hash control to force FCoE traffic to use the same path to the FCF and ensure in-order delivery of FCoE frames.

For example, when OxID hash control is enabled on a QFabric system, a Node device that is connected by 40-Gigabit fabric ports to four QFabric system Interconnect devices can send FCoE traffic across any of the four Interconnect devices to the FCF. (The connections to the four Interconnect devices function as a fabric LAG, even though they are not explicitly configured as a LAG.) Different Interconnect devices might not forward the FCoE frames at the same rate, so the frames might not be delivered in the order they were sent.

If FCoE frames are delivered out-of-order, you can disable OxID hash control to prevent the FCoE traffic from using different fabric links that connect to different Interconnect

devices. Because disabling OxID hash control forces the frames to be delivered over the same link, the frames traverse the same Interconnect device and are delivered in order.

The same scenario is true when FCoE traffic traverses an FCF-facing LAG composed of 10-Gigabit interfaces. When OxID hash control is enabled, FCoE traffic can use any LAG link, which could result in out-of-order frame delivery. If your network experiences out-of-order FCoE frame delivery, disabling OxID hash control ensures that the FCoE traffic uses the same LAG link for every transaction, so the FCoE frames are delivered in order.

Disabling OxID Hash Control

You can disable OxID hash control on the 40-Gigabit fabric interfaces and on the 10-Gigabit Ethernet interfaces of a QFabric system Node group. Disabling OxID hash control affects all of the fabric or Ethernet interfaces of a Node group. For example, you cannot disable OxID hash control on some fabric interfaces in a Node group and leave OxID hash control enabled on other fabric interfaces of the same Node group.

Related Documentation

- [Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on QFabric Systems on page 83](#)
- [Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on Standalone Switches on page 82](#)
- [Understanding OxID Hash Control for FCoE Traffic Load Balancing on Standalone Switches on page 81](#)
- *Understanding CoS IEEE 802.1p Priorities for Lossless Traffic Flows*

Understanding OxID Hash Control for FCoE Traffic Load Balancing on Standalone Switches

The originator exchange identifier (OxID) field is one of several fields that the switch can use in its hash function computation for FCoE traffic load balancing over multiple outgoing links in an Ethernet link aggregation group (LAG) on ports that face an FCoE forwarder (FCF). The originator of an exchange between a pair of Fibre Channel (FC) endpoints (such as an FCoE host and an FC storage device) uses the OxID field as an identifier for that exchange. The originator also uses the OxID field to track the progress of the series of sequences that comprise the exchange.

When FCoE traffic traverses a LAG that faces an FCF, it can take multiple different links between the source and destination endpoints. The idea is to distribute the FCoE traffic across the FCF-facing LAG links, thus balancing the link load. The switch creates a hash value from some of the packet header fields, and uses the hash value to assign each packet to one of the LAG links. The switch always uses five packet header fields to compute the hash value:

- Source ID (SID)
- Destination ID (DID)
- Fabric ID (FID)

- Source Port ID (SPID)
- Source Module ID (SMID)

In addition, the OxID field is included by default in the FCoE load-balancing hash computation. However, if you do not want to use the OxID field in the FCoE load-balancing hash computation, you can remove it from the computation by using the **set forwarding-options hash-key family fcoe oxid disable** command.

Including the OxID field in the load-balancing hash computation allows different exchanges between a pair of Fibre Channel (FC) endpoints (such as an FCoE host and an FC storage device) to take different paths across the network, thus improving the aggregate network throughput.

However, if the paths between different sets of FC endpoints have common links, congestion on one set of FC endpoints can affect the other set of endpoints. Such congestion can happen if the FCoE traffic on the two sets of endpoints uses the same priority (IEEE 802.1p code point). It is common for networks to use priority 3 (IEEE 802.1p code point 011) for FCoE traffic. However, you can assign different IEEE priorities to different lossless FCoE flows as described in *Understanding CoS IEEE 802.1p Priorities for Lossless Traffic Flows* to further separate the traffic flows.

**Related
Documentation**

- [Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on Standalone Switches on page 82](#)

Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on Standalone Switches

The originator exchange identifier (OxID) field is one of several fields that the switch can use in its hash function computation for FCoE traffic load balancing over multiple outgoing links in an Ethernet link aggregation group (LAG) on ports that face an FCoE forwarder (FCF). You can configure whether or not the switch uses the OxID in the hash computation.

Including the OxID field in the load-balancing hash computation allows different exchanges between a pair of Fibre Channel (FC) endpoints (such as an FCoE host and an FC storage device) to take different paths across the network, thus improving the aggregate network throughput.

However, if the paths between different sets of FC endpoints have common links, congestion on one set of FC endpoints can affect the other set of endpoints. Such congestion can happen if the FCoE traffic on the two sets of endpoints uses the same priority (IEEE 802.1p code point). It is common for networks to use priority 3 (IEEE 802.1p code point 011) for FCoE traffic. However, you can assign different IEEE priorities to different lossless FCoE flows as described in *Understanding CoS IEEE 802.1p Priorities for Lossless Traffic Flows* to further separate the traffic flows.

OxID hash control is enabled by default.

- To enable OxID hash control field for FCoE traffic load balancing:

```
[edit forwarding-options hash-key]  
user@switch# set family fcoe oxid enable
```

- To disable OxID hash control field for FCoE traffic load balancing:

```
[edit forwarding-options hash-key]
user@switch# set family fcoe oxid disable
```

**Related
Documentation**

- [Understanding OxID Hash Control for FCoE Traffic Load Balancing on Standalone Switches on page 81](#)

Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on QFabric Systems

The originator exchange identifier (OxID) field is one of several fields used in the hash function computation for FCoE traffic load balancing over multiple outgoing links in an Ethernet link aggregation group (LAG) on ports that face an FCoE forwarder (FCF). The QFabric system Node device ports can be 10-Gigabit Ethernet ports or 40-Gigabit fabric ports. (The 40-Gigabit fabric ports that connect a QFabric system Node device to QFabric system Interconnect devices function as a LAG even though they are not explicitly configured as a LAG.)

The originator of an exchange between a pair of Fibre Channel (FC) endpoints (such as an FCoE host and an FC storage device) uses the OxID field as an identifier for that exchange. The originator also uses the OxID field to track the progress of the series of sequences that comprise the exchange.

OxID hash control is enabled by default.

You can enable or disable OxID hash control on the 10-Gigabit Ethernet interfaces and on the 40-Gigabit fabric interfaces of a QFabric system Node group. OxID hash control is either enabled or disabled on all of the fabric or Ethernet interfaces of a Node group. For example, you cannot disable OxID hash control on some fabric interfaces in a Node group and leave OxID hash control enabled on other fabric interfaces of the same Node group.

1. To enable or disable OxID hash control on all of the 10-Gigabit Ethernet interfaces of a specified Node group or on all Node groups:

```
[edit forwarding-options hash-key]
admin@qfabric# set family fcoe ethernet-interfaces node-group [node-group-name | all]
oxid [enable | disable]
```

For example, to disable OxID hash control on all of the 10-Gigabit Ethernet interfaces of a Node group named **RSNG1**:

```
admin@qfabric# set family fcoe ethernet-interfaces node-group RSNG1 oxid disable
```

2. To enable or disable OxID hash control on all of the 40-Gigabit fabric interfaces of a specified Node group or on all Node groups:

```
[edit forwarding-options hash-key]
admin@qfabric# set family fcoe fabric-interfaces node-group [node-group-name | all] oxid
[enable | disable]
```

For example, to disable OxID hash control on the fabric interfaces of all Node groups:

```
admin@qfabric# set family fcoe fabric-interfaces node-group all oxid disable
```

**Related
Documentation**

- [Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on Standalone Switches on page 82](#)
- [Understanding OxID Hash Control for FCoE Traffic Load Balancing on QFabric Systems on page 79](#)
- [Understanding OxID Hash Control for FCoE Traffic Load Balancing on Standalone Switches on page 81](#)

Configuring VLANs for FCoE Traffic on an FCoE Transit Switch

When you configure a switch as a Fibre Channel over Ethernet (FCoE) transit switch, you must configure a VLAN that transports only FCoE traffic. FCoE traffic requires a dedicated VLAN and cannot share a VLAN with any other type of traffic. Because FCoE traffic is tagged traffic, the port (or interface) mode cannot be access mode, it must be either tagged-access port-mode (for switches that run the original CLI) or trunk interface-mode (for switches that run the Enhanced Layer 2 Software (ELS) CLI).

However, each interface that belongs to an FCoE VLAN must not only transport the tagged FCoE traffic, it must also transport the untagged FCoE Initialization Protocol (FIP) traffic. FIP communicates with the storage area network (SAN) Fibre Channel (FC) switch to set up the FCoE session for the FCoE client.

To transport untagged traffic on a tagged-access or trunk mode interface, the interface must have a native VLAN configured on it. Therefore, each interface that belongs to an FCoE VLAN must also have a native VLAN on it.

There are slight differences in the way you configure a native VLAN on an interface, depending on whether the switch uses the ELS CLI or the original CLI. This topic describes both methods.



NOTE: FCoE VLANs (any VLAN that carries FCoE traffic) support only Spanning Tree Protocol (STP) and link aggregation group (LAG) Layer 2 features.

FCoE traffic cannot use a standard LAG because traffic might be hashed to different physical LAG links on different transmissions. This breaks the (virtual) point-to-point link that Fibre Channel traffic requires. If you configure a standard LAG interface for FCoE traffic, FCoE traffic might be rejected by the FC SAN.

QFabric systems support a special LAG called an FCoE LAG, which enables you to transport FCoE traffic and regular Ethernet traffic (traffic that is not FCoE traffic) across the same link aggregation bundle. Standard LAGs use a hashing algorithm to determine which physical link in the LAG is used for a transmission, so communication between two devices might use different physical links in the LAG for different transmissions. An FCoE LAG ensures that FCoE traffic uses the same physical link in the LAG for requests and replies in order to preserve the virtual point-to-point link between the FCoE device converged network adapter (CNA) and the FC SAN switch across the QFabric system Node device. An FCoE LAG does not provide load balancing or link redundancy for FCoE traffic. However, regular Ethernet traffic uses the standard hashing algorithm and receives the usual LAG benefits of load balancing and link redundancy in an FCoE LAG.



NOTE: To configure an FCoE VLAN on a QFX3500 switch that you are using as an FCoE-FC gateway, you must also configure an FCoE VLAN interface as described in [“Configuring an FCoE VLAN Interface on an FCoE-FC Gateway”](#)

[on page 258](#). (Only the QFX3500 switch supports FCoE-FC gateway configuration.)

.....

FCoE VLAN configuration includes:

- Configuring a VLAN to use as a dedicated FCoE VLAN
- Configuring the interface members of the FCoE VLAN.
- Configuring a native VLAN for FIP traffic.

This topic includes two configuration procedures, one for switches that run the original CLI, and one for switches that run the ELS CLI.

**Original CLI
Configuration**

To configure an FCoE VLAN on a non-ELS switch:

1. Configure a dedicated FCoE VLAN:

```
[edit vlans]
user@switch# set vlan-name vlan-id vlan-id
```

For example, to configure a VLAN named **fcoe_vlan** with a VLAN ID of **100** as the FCoE VLAN:

```
[edit vlans]
user@switch# set fcoe_vlan vlan-id 100
```

2. Configure the FCoE VLAN on the interface (use **ethernet-switching** as the family and **tagged-access** as the port mode):

```
[edit interfaces]
user@switch# set interface-name unit unit family family port-mode mode vlan members
vlan-name
```

For example, to configure the interface **xe-0/0/10** as a member of the FCoE VLAN **fcoe_vlan**:

```
[edit interfaces]
user@switch# set xe-0/0/10 unit 0 family ethernet-switching port-mode tagged-access vlan
members fcoe_vlan
```

3. Configure the Ethernet interface membership in the FCoE VLAN:

```
[edit vlans]
user@switch# set vlan-name interface interface-name
```

For example, to assign the interface **xe-0/0/10.0** to the FCoE VLAN named **fcoe_vlan**:

```
[edit vlans]
user@switch# set fcoe_vlan interface xe-0/0/10.0
```

4. Configure a native VLAN for the untagged FIP traffic:

```
[edit vlans]
user@switch# set native vlan-id vlan-id
```

For example, to configure the native VLAN with a VLAN ID of **1**:

```
[edit vlans]
user@switch# set native vlan-id 1
```

5. Assign member interfaces to the native VLAN:


```
[edit interfaces]
user@switch# set interface-name unit unit family family native-vlan-id vlan-id
```

For example, to configure the interface **xe-0/0/10** as a member of the native VLAN with the native VLAN ID 1:

```
[edit interfaces]
user@switch# set xe-0/0/10 unit 0 family ethernet-switching native-vlan-id 1
```

ELS CLI Configuration

To configure an FCoE VLAN on a switch running ELS:

1. Configure a dedicated FCoE VLAN:

```
[edit vlans]
user@switch# set vlan-name vlan-id vlan-id
```

For example, to configure a VLAN named **fcoe_vlan** with a VLAN ID of **100** as the FCoE VLAN:

```
[edit vlans]
user@switch# set fcoe_vlan vlan-id 100
```

2. Configure the FCoE VLAN on the interface (use **ethernet-switching** as the family and **trunk** as the interface mode):

```
[edit interfaces]
user@switch# set interface-name unit unit family family interface-mode mode vlan members vlan-name
```

For example, to configure the interface **xe-0/0/10** as a member of the FCoE VLAN **fcoe_vlan**:

```
[edit interfaces]
user@switch# set xe-0/0/10 unit 0 family ethernet-switching interface-mode trunk vlan members fcoe_vlan
```

3. Configure the Ethernet interface membership in the FCoE VLAN:

```
[edit vlans]
user@switch# set vlan-name interface interface-name
```

For example, to assign the interface **xe-0/0/10.0** to the FCoE VLAN named **fcoe_vlan**:

```
[edit vlans]
user@switch# set fcoe_vlan interface xe-0/0/10.0
```

4. Configure a native VLAN on the physical Ethernet interface for the untagged FIP traffic:

```
[edit interfaces]
user@switch# set interface-name native-vlan-id vlan-id
```

For example, to configure the native VLAN on interface **xe-0/0/10** with a VLAN ID of 1:

```
[edit interfaces]
user@switch# set xe-0/0/10 native-vlan-id 1
```

5. Configure the Ethernet interface as a member of the native VLAN:

```
[edit interfaces]
user@switch# set interface-name unit unit family family vlan members native-vlan-id
```



NOTE: The *native-vlan-id* number must be the same as the native VLAN ID number that you configured on the physical Ethernet interface (see [step 4](#)).

For example, to configure the interface **xe-0/0/10** as a member of the native VLAN with the native VLAN ID 1:

```
[edit interfaces]
user@switch# set xe-0/0/10 unit 0 family ethernet-switching vlan members 1
```

**Related
Documentation**

- [Understanding FCoE on page 51](#)
- [Understanding FCoE Transit Switch Functionality on page 46](#)
- [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)

Understanding FIP Snooping, FBF, and MVR Filter Scalability

The VLAN filter processor (VFP) ternary content addressable memory (TCAM) stores the VLAN filter configuration for three filter types:

- Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) snooping—FIP snooping filters prevent an FCoE device from gaining unauthorized access to a Fibre Channel (FC) storage device or to another FCoE device. VN2VF_Port FIP snooping filters prevent an FCoE device from gaining unauthorized access to devices on an FC network. VN2VN_Port FIP snooping filters prevent an FCoE device from gaining unauthorized access to another FCoE device directly through the standalone switch or QFabric system, without traversing the FC network.

The VFP TCAM stores the VN2VF_Port and VN2VN_Port FIP snooping filters that the switch automatically creates when you enable FIP snooping on a VLAN that carries FCoE traffic. See [“Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch” on page 101](#) and [“Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch” on page 111](#) for more information.

- Filter-based forwarding (FBF)—FBF enables you to use firewall filters to direct packets to virtual routing instances. The switch then forwards the matching packets based on the configuration of the routing instances. The VFP TCAM stores the terms you configure for FBF filters. See *Understanding Filter-Based Forwarding* for more information.
- Multicast VLAN registration (MVR)—MVR enables you to configure a multicast source VLAN (MVLAN) that is shared across a Layer 2 network. An MVLAN distributes IPTV multicast streams across different VLANs without having to create a separate multicast stream for each VLAN, and without compromising the security and separation of traffic in the different VLANs. The VFP TCAM stores the MVR rules you configure for MVLANS. See *Understanding Multicast VLAN Registration* for more information.

FIP snooping filters, FBF filters, and MVR rules share the VFP TCAM memory space. In most use cases, the VFP TCAM memory is sufficient to store filter terms and information for all three applications.

- [VFP TCAM Architecture and Allocation on page 91](#)
- [VFP TCAM Entry Consumption on page 92](#)
- [Rejected Filter Configurations \(No Available VFP TCAM Space\) on page 95](#)
- [VFP TCAM Allocation and Consumption \(Scaling\) Examples on page 96](#)
- [Filter Configuration Recommendations on page 98](#)

VFP TCAM Architecture and Allocation

When packets arrive at an ingress interface, the VFP TCAM is the first TCAM in the packet pipeline. The VFP TCAM stores a total of 1024 entries. The 1024 entries are partitioned into four equal *slices* of 256 entries.

The VFP TCAM allocates entries to three filter types (FIP snooping filters, FBF filter terms, and MVR rules) in 256-entry slices. The VFP TCAM dynamically allocates the minimum number of memory slices required to store the filters for a particular filter type, as needed.

The TCAM does not allocate partial slices to a filter type, and slices cannot be shared among filter types. At any given time, each slice contains entries for one and only one filter type.

For example, if you configure one MVR rule, the system allocates a whole slice to MVR rules, even if the MVR rule consumes only one TCAM entry. The remaining 256 entries in the slice allocated to MVR rules can store subsequently configured MVR rules, but not FIP snooping or FBF filters. Similarly, if FIP snooping filters consume 50 entries of a 256-entry slice, the remaining 206 entries in the FIP snooping slice are available only to store more FIP snooping filters, not to store FBF filter terms or MVR rules.

The VFP TCAM allocates slices to a filter type only if there is at least one configured filter or rule for that filter type. If no filters exist for a filter type, then the VFP TCAM does not allocate a slice to that filter type.



NOTE: The VFP TCAM rejects partial filters. For example, if an FBF filter contains six terms, but there is only space in the TCAM for four of those terms, the whole filter is not committed.

Each filter type can use from zero slices to all four slices of VFP TCAM space. However, if one filter type uses three slices, then only one slice remains, so only one other filter type can use the remaining slice. In that situation, if you configure filters for all three filter types, the last filter type that you configure receives no TCAM space for its filter entries. Filters that receive no TCAM entry space are not implemented.

VFP TCAM Entry Consumption

FIP snooping filters, FBF filters, and MVR rules consume VFP TCAM entry space in different ways:

- [FIP Snooping Filter VFP TCAM Consumption on page 92](#)
- [FBF Filter VFP TCAM Consumption on page 93](#)
- [MVR Filter VFP TCAM Consumption on page 94](#)
- [VFP TCAM Consumption Summary Table on page 94](#)

FIP Snooping Filter VFP TCAM Consumption

VN2VF_Port FIP snooping filters consume VFP TCAM entry space differently than VN2VN_Port FIP snooping filters:

- [VN2VF_Port FIP Snooping Filter VFP TCAM Consumption on page 93](#)
- [VN2VN_Port FIP Snooping Filter VFP TCAM Consumption on page 93](#)



NOTE: One FCoE VLAN cannot support both VN2VF_Port traffic and VN2VN_Port traffic. Configure separate FCoE VLANs for VN2VF_Port traffic and for VN2VN_Port traffic.

VN2VF_Port FIP Snooping Filter VFP TCAM Consumption

The switch uses an algorithm that allows one 256-entry slice of the VFP TCAM to store the maximum possible number of VN2VF_Port FIP snooping filters (2500 filters). VN2VF_Port FIP snooping filters never consume more than one slice of the VFP TCAM.

Regardless of whether there is one VN2VF_Port FIP snooping session or there are 2500 VN2VF_Port FIP snooping sessions, VN2VF_Port FIP snooping filters consume one slice of the VFP TCAM. (If there are no VN2VF_Port or VN2VN_Port FIP snooping sessions, the TCAM does not allocate a slice for FIP snooping filters.)

VN2VN_Port FIP Snooping Filter VFP TCAM Consumption

VN2VN_Port FIP snooping filters consume one VFP TCAM entry for each VN2VN_Port session. The maximum number of VN2VN_Port FIP snooping sessions is 376 sessions per switch. (If you configure an interface that carries VN2VN_Port FIP snooping traffic as a trusted interface, the switch does not apply filters on the trusted interface.)

Because the switch can have up to 376 VN2VN_Port sessions running simultaneously, with each session consuming one entry, VN2VN_Port FIP snooping filters consume VFP TCAM space as follows:

- 1–256 filters consume one slice
- 257–376 filters consume two slices

FBF Filter VFP TCAM Consumption

Each FBF filter term is double-wide, so each FBF filter term consumes two entries in the VFP TCAM. One 256-entry slice can contain up to 128 FBF filter terms. FBF filters consume VFP TCAM space as follows:

- 1–128 entries consume one slice
- 129–256 entries consume two slices
- 257–384 entries consume three slices
- 385–512 entries consume four slices



NOTE: In practice, FBF filters can consume only three slices of the VFP TCAM because FBF filters are also stored simultaneously in the ingress filter processor (IFP) TCAM, and the IFP TCAM can store only 384 FBF filter terms (768 entries, or 3 TCAM slices).

For example, if you configure FBF filters that contain 200 terms, then the FBF filters require 400 VFP TCAM entries and consume 2 slices.

FBF filter entries are simultaneously stored in the VFP TCAM and the IFP TCAM. The IFP TCAM can only contain up to 768 entries—256 fewer entries (1 slice) than the VFP TCAM. As with the VFP TCAM, FBF filters consume two IFP TCAM entries per filter term. In addition to FBF filter terms, the IFP TCAM stores filter entries for firewall filters.



CAUTION: There must be enough space in the VFP TCAM *and* the IFP TCAM for the FBF filter entries. If both TCAMs do not have enough space for the FBF filters, the switch rejects the portion of the configuration that it cannot store and sends a syslog message to notify you.

For example, if you configure FBF filters that have 400 terms, even though the VFP TCAM has enough space to store the resulting 800 entries, the switch rejects a portion of the configuration because the IFP TCAM can store a maximum of only 768 entries. If the IFP TCAM stores no other filter entries, the switch rejects 32 FBF filter entries.

In another example, if you configure firewall filters that have a total of 200 terms, which consume 200 entries in the IFP TCAM, and you then configure FBF filters that have a total of 300 terms, the switch rejects a portion of the configuration because the FBF filters require 600 entries. Combined with the 200 entries required for the firewall filters, the total number of 800 entries exceeds the maximum of 768 entries that the IFP TCAM can store. In this case, the switch accepts the first 768 entries and rejects the rest of the filter entries. The switch installs the filter entries in the order that they are committed; the rejected entries are the last entries the switch attempts to commit after the TCAM space is exhausted.

The IFP TCAM limit of 768 entries means that the true maximum number of FBF filter terms is 384 terms, even though the VFP TCAM can store up to 512 FBF terms.

MVR Filter VFP TCAM Consumption

Each MVR rule consumes one entry in the VFP TCAM, so MVR rules consume VFP TCAM space as follows:

- 1–256 rules consume one slice
- 257–512 rules consume two slices
- 513–758 rules consume three slices
- 759–1024 rules consume four slices

VFP TCAM Consumption Summary Table

Table 7 on page 95 summarizes VFP TCAM consumption.



NOTE: FBF filters are simultaneously stored in the VFP TCAM and in the IFP TCAM. Due to the IFP TCAM limit of 768 entries (384 FBF filters), which is 256 entries fewer than the VFP TCAM, the effective VFP TCAM consumption limit for FBF filters is lower than the total amount of VFP TCAM entry space, even when no other filters consume VFP TCAM space.

Table 7: VFP TCAM Entry Consumption Summary

Filter Type	VFP TCAM Entry Consumption	Maximum VFP TCAM Slices Consumed	Other Limitations
VN2VF_Port FIP snooping filters	Never consumes more than one slice	One slice (regardless of number of sessions)	2500 session maximum
VN2VN_Port FIP snooping filters	One entry per session	Two	376 session maximum
FBF filters	Two entries per filter	Three (due to IFP TCAM limitation)	384 filters (due to IFP TCAM limitation)
MVR rules	One entry per rule	Four	1024 rule maximum

Rejected Filter Configurations (No Available VFP TCAM Space)

If there is not enough space available in the VFP TCAM to store the FIP snooping filters, the configured FBF filters, and the MVR rules, the switch rejects only the portion of the configuration that it cannot store. Any portion of the filter configuration that the TCAM can store, is stored. In most cases, even if the switch rejects part of the configuration, part of the configuration is also stored.

If the switch rejects any portion of a configuration, the switch sends a syslog message to notify you of the failure. The switch does not generate a commit error, and the rejected portion of the configuration remains on the switch, even though the rejected configuration does not function. (The accepted portions of the configuration function as expected.) The syslog message shows you the filter configuration that the switch rejected.

We strongly recommend that you always delete rejected filter configurations from the switch. It is important to delete rejected filter configurations because:

- Even though the rejected configuration remains on the switch, it does not function.
- After a reboot, there is no guarantee that the same filters will be rejected. The previously rejected filters might be accepted, and other filters that had previously been accepted might be rejected. Therefore, the functioning filter configuration could be changed inadvertently and unexpectedly.
- Even if a VFP TCAM slice becomes available, the switch does not automatically allocate the available slice to the rejected configuration. To use the available slice, you must delete and reconfigure the rejected configuration.

For example, you configure FBF filters and MVR rules on a switch, and that switch also transports FCoE traffic with VN2VF_Port FIP snooping (never consumes more than one slice) enabled on FCoE access interfaces. After you commit the configuration, you check the syslog. You find that the VN2VF_Port FIP snooping and FBF filters consume all four slices of the VFP TCAM, and the MVR configuration was rejected. Instead of deleting the MVR configuration, you leave it on the switch. Subsequently, all VN2VF_Port FIP snooping sessions end, the FIP snooping filters time out and are removed from the VFP TCAM, so the slice that was allocated to VN2VF_Port FIP snooping filters becomes free. However, the MVR rules do *not* automatically receive the free slice.

To force the switch to allocate the free slice to the MVR rules, you should delete the MVR rules from the configuration and then reconfigure the MVR rules. When you commit the new configuration, check the syslog messages to ensure that the MVR rule configuration was accepted.

In this example, you could also choose to free a VFP TCAM slice for MVR rule storage by deleting some of the FBF filters. To do this, you delete both the unneeded FBF filters and the MVR rule configuration. Then you reconfigure the MVR rules, and check the syslog to ensure that the configuration was successful.

VFP TCAM Allocation and Consumption (Scaling) Examples

The following examples illustrate how FIP snooping entries, FBF filter entries, and MVR rule entries consume VFP TCAM slices:

- [Example 1: Three Filter Types Consume Three Slices on page 96](#)
- [Example 2: Three Filter Types Consume Four Slices on page 96](#)
- [Example 3: Two Filter Types Consume Four Slices on page 97](#)
- [Example 4: Three Filter Types Oversubscribe the VFP TCAM on page 97](#)

Example 1: Three Filter Types Consume Three Slices

Filters and rules are configured in the following sequence:

- 100 VN2VN_Port FIP snooping filters (1 slice)
- 2 MVR rules (1 slice, 2 entries)
- 60 FBF filter terms (1 slice, 120 entries)

One slice remains free. The slice allocated to VN2VN_Port FIP snooping filters can store 156 more filters before another slice is required. The slice allocated to MVR rules can store 254 more rules before another slice is required. The slice allocated to FBF filters can store 68 more filter terms (136 entries) before another slice is required. Providing that the IFP TCAM has space for the FBF filter terms, the switch accepts this configuration and rejects no filters.

Example 2: Three Filter Types Consume Four Slices

Filters and rules are configured in the following sequence:

- 2000 VN2VF_Port FIP snooping filters (always 1 slice)
- 18 MVR rules (1 slice, 18 entries)
- 150 FBF filter terms (2 slices, 300 entries)

All four slices are allocated to filter types. The slice allocated to MVR rules can store 238 more rules before it is full. The slice allocated to FBF filters can store 106 more filter terms (212 entries) before it is full. Providing that the IFP TCAM has space for the FBF filter terms, the switch accepts this configuration and rejects no filters.



NOTE: If you configure more MVR rules or FBF filters than entry space remaining in the slices, the switch rejects those rules and filters because no slice is available. The switch installs filters in the order that they were configured, so if filters are rejected, the filters configured last are rejected.

Example 3: Two Filter Types Consume Four Slices

Filters and rules are configured in the following sequence:

- 50 VN2VF_Port FIP snooping filters (always 1 slice)
- 300 FBF filter terms (3 slices, 600 entries)

All four slices are allocated to filter types. No slices are available for MVR rules. The third slice allocated to FBF filters can store 84 more filter terms (168 entries) before it consumes all of its entry space. Providing that the IFP TCAM has space for the FBF filter terms, the switch accepts this configuration and rejects no filters.



NOTE: If you configure MVR rules or if you configure more than 84 more FBF filters, the switch rejects those rules and filters because no slice is available for the MVR rules, and the FBF filter slice has entry space for only 84 more filter terms.

Example 4: Three Filter Types Oversubscribe the VFP TCAM

Filters and rules are configured in the following sequence:

- 1750 VN2VF_Port FIP snooping filters (always 1 slice)
- 10 MVR rules (1 slice, 10 entries)
- 275 FBF filter terms (2 slices, 512 accepted entries, 38 rejected entries)

All four slices are allocated to filter types. The slice allocated to MVR rules can store 246 more rules before it is full, but the number of FBF filter terms exceeds the amount of available VFP TCAM storage space. (The 275 FBF filter terms consume 550 VFP TCAM entries. However, there are only two available slices, for a total of 512 available entry spaces, so only 256 FBF filter terms can be stored, leaving 19 rejected FBF filter terms.)

The switch accepts the VN2VF_Port FIP snooping filters, the MVR rules, and 256 FBF filter terms. The switch retains the excess FBF filters in the configuration, but does not install those filters in the VFP TCAM. In this case, you delete the rejected FBF filter terms from the configuration. Alternatively, you could delete the MVR rules from the configuration to free a slice of the TCAM, and then delete and reconfigure the rejected FBF filters so that the system allocates the freed slice to the FBF filters.



NOTE: The sequence of configuration makes a difference; if there is not enough VFP TCAM space for a given filter type, the switch installs the filters that fit in the order they are configured. For example, if you configure the FBF filters before you configure the MVR rules, the VFP TCAM allocates one slice to FIP snooping filters, three slices to FBF filters (assuming the IFP TCAM has available space), and no slices to MVR rules, because all four slices are allocated before the switch attempts to install the MVR rules in the VFP TCAM.

Filter Configuration Recommendations

To utilize the VFP TCAM space most efficiently:

- [Configure and Maintain the Fewest Number of Filters Needed on page 98](#)
- [Always Delete Rejected Filter Configurations on page 99](#)

Configure and Maintain the Fewest Number of Filters Needed

To conserve VFP TCAM entry space, and because FBF filter storage also depends on the availability of IFP TCAM space, we recommend that you configure as few FBF filters and MVR rules as is practical to serve your network needs. The more filters you configure, the greater the possibility of exceeding TCAM storage capacity.

Several factors determine VFP TCAM consumption:

- **Type of filters configured**—Different filter types consume different amounts of VFP TCAM space. VN2VF_Port FIP snooping filters never consume more than one slice. MVR rules and VN2VN_Port FIP snooping filters consume entries in a slice at a rate of one entry per MVR rule or VN2VN_Port session. FBF filter terms consume entries in a slice at a rate of two entries per FBF filter term.
- **Number of filters configured**—Although the number of filters does not affect the number of slices allocated to the VN2VF_Port FIP snooping filter type (it is always one slice for one or more VN2VF_Port FIP snooping filters and no slice for no FIP snooping filters), the number of VN2VN_Port FIP snooping filters, MVR rules, and FBF filter terms that you configure determine how many VFP TCAM slices are required for each filter type.

For example, if you configure 257 MVR rules, the MVR rule entries consume 2 slices. One slice stores 256 MVR rules (entries), and one slice stores 1 MVR rule (entry). In this case, if you can eliminate one MVR rule, you can free a slice to allocate to other filter types.

- **Sequence of filter configuration**—If you configure too many filters for the VFP TCAM to store, the last filters you configure are not stored in the TCAM.

Always check the syslog after you configure FBF filters or MVR rules to ensure that the configuration was not rejected. If you enable FIP snooping on access ports, check the syslog to ensure that the configuration was not rejected due to lack of VFP TCAM space.

If you check the syslog and a filter configuration has been rejected, delete the filters that were rejected from the configuration.



TIP: If you no longer need an FBF filter or an MVR rule, delete it from the configuration to conserve VFP TCAM space. Enable VN2VF_Port or VN2VN_Port FIP snooping on access ports only if the switch port is directly connected to FCoE devices. (FIP snooping should be performed at the access edge. FIP snooping should not be performed on traffic that has already been snooped and filtered at the access edge. If another switch that is physically between the transit switch (or QFabric system) and the FCoE devices already performs FIP snooping, you do not have to enable FIP snooping on the transit switch or QFabric system, but you can.)

Always Delete Rejected Filter Configurations

The switch does not return a commit error if it rejects any portion of a configuration. Instead, the switch sends a syslog message to report the rejected portion of the configuration. The rejected portion of the configuration remains on the switch, but does not function.

After you configure FBF filters or MVR rules, or enable FIP snooping, check the syslog messages to ensure that the switch accepted the configuration. If the switch rejected any portion of the configuration, delete that portion of the configuration. (You do not need to delete the portion of the configuration that was accepted, unless you want to reconfigure those filters or rules.)



CAUTION: If you do not delete rejected filter configurations, and if you reboot the system, you cannot predict which filters the system installs after the reboot. For example, a switch with the following configuration has more configured filters than the VFP TCAM can support:

- VN2VF_Port FIP snooping sessions (always consumes one slice)
- 20 MVR rules (consume one slice)
- 300 FBF filters (attempt to consume three slices, but because only two slices are available, 256 filters consume two slices, and the remaining 44 filters are rejected)

If you do not delete the 44 rejected FBF filters, then if the switch reboots, the 44 FBF filters that were rejected might be accepted, and 44 different FBF filters might be rejected. This unpredictable behavior is the reason that you should check the syslog messages after you configure filters, and if any filters were rejected, you should always delete the rejected filters from the configuration.

**Related
Documentation**

- [Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch on page 101](#)
- [Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch on page 111](#)
- *Understanding Filter-Based Forwarding*
- *Understanding Multicast VLAN Registration*
- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to the Same FCoE Transit Switch\) on page 120](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to Different FCoE Transit Switches\) on page 125](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch\) on page 132](#)
- *Example: Using Filter-Based Forwarding to Route Application Traffic to a Security Device*
- *Configuring Multicast VLAN Registration on EX Series Switches (CLI Procedure)*

Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch

Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) snooping is a security mechanism that is designed to prevent unauthorized access and data transmission to a Fibre Channel (FC) network. It works by filtering traffic to permit only servers that have logged in to an FC network to access that network.

You explicitly enable VN_Port to VF_Port (VN2VF_Port) FIP snooping (FC-BB-5) on FCoE VLANs when the switch is an FCoE transit switch at the access edge that connects FCoE devices on the Ethernet network to FC switches or gateways at the FC storage area network (SAN) edge. The transit switch applies FIP snooping filters at the ports associated with the FCoE VLANs on which you enable VN2VF_Port FIP snooping. An FCoE transit switch is a data center bridging (DCB) switch with FIP snooping capability.

An FCoE device that has a converged network adapter (CNA) uses the FIP process to log in to the FC network as an FCoE Node (ENode). The login process establishes a dedicated virtual link between a virtual N_Port (VN_Port) on the ENode and a virtual F_Port (VF_Port) on the FC switch. This dedicated virtual link emulates a point-to-point connection. The emulated connection is called a virtual link.

Virtual links pass transparently through the transit switch. The ENode VN_Port and the FC switch VF_Port do not detect the transit switch, and virtual links appear to be direct point-to-point links.

The switch applies VN2VF_Port FIP snooping firewall filters at the FCoE-network facing ports associated with the FCoE VLANs on which you enable VN2VF_Port FIP snooping. FIP snooping provides security for virtual links by creating firewall filters based on information gathered (snooped) about FC devices during FIP transactions.

The switch also supports VN_Port to VN_Port (VN2VN_Port) FIP snooping (FC-BB-6) to allow FCoE initiators and targets to communicate directly through the switch without going through an FCoE forwarder (FCF) or an FC switch, as described in [“Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch” on page 111](#).



NOTE: An FCoE VLAN can support either VN2VF_Port FIP snooping (FC-BB-5) or VN2VN_Port FIP snooping (FC-BB-6), but not both. The same switch can have multiple FCoE VLANs configured, some for VN2VF_Port FIP snooping traffic and others for VN2VN_Port FIP snooping traffic. On FCoE VLANs that are configured as VN2VN_Port snooping VLANs, VN2VF_Port FIP snooping traffic is dropped.

When you enable VN2VF_Port FIP snooping on an FCoE VLAN, the system snoops VN_Port to VF_Port packets and enforces security only on VN2VF_Port virtual links.

When you enable VN2VN_Port FIP snooping on an FCoE VLAN, the system snoops VN_Port to VN_Port packets and enforces security only on VN2VN_Port virtual links.

This topic describes:

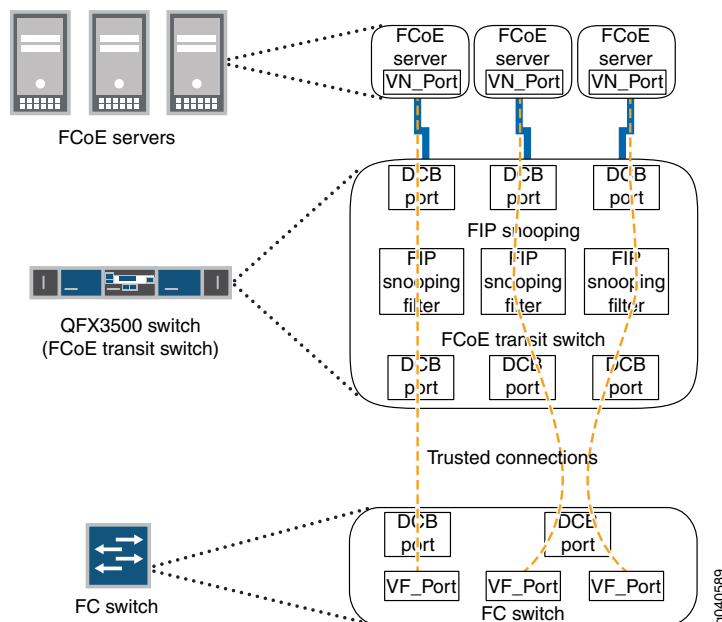
- [FC Network Security on page 102](#)
- [VN2VF_Port FIP Snooping Functions on page 103](#)
- [FIP Snooping Firewall Filters on page 103](#)
- [FIP Snooping Session Scalability on page 103](#)
- [VN2VF_Port FIP Snooping Implementation on page 104](#)
- [T11 VN2VF_Port FIP Snooping Specification on page 107](#)

FC Network Security

In traditional FC networks, the FC switch is usually a trusted entity, and server ENodes connect directly to its VF_Ports. After an ENode gains access to the network through the fabric login (FLOGI) process, the FC switch enforces zoning configurations, ensures that the ENode uses valid addresses, monitors the connection, and performs other security functions to prevent unauthorized access.

However, FCoE exposes FC frames to Ethernet networks, which do not have the same level of security as native FC networks. VN2VF_Port FIP snooping firewall filters emulate the native FC network security functions by preventing unauthorized access to the FC switch through the transit switch and by ensuring the security of the virtual link between each ENode and the FC switch, as shown in [Figure 4 on page 102](#). VN2VF_Port FIP snooping also prevents man-in-the-middle attacks.

Figure 4: FCoE Transit Switch Performs VN2VF_Port FIP Snooping



The transit switch performs VN2VF_Port FIP snooping at the ports connected to the FCoE devices. At the SAN edge, the FC switch must be able to convert the FCoE traffic to native FC traffic.

VN2VF_Port FIP Snooping Functions

When VN2VF_Port FIP snooping is enabled, the transit switch sets and applies filters to block all FCoE traffic by default. The transit switch monitors FIP logins, solicitations, and advertisements that pass through it and gathers information about the ENode address and the address of the port on the FC switch. The transit switch uses the information to construct firewall filters that permit access only to logged-in ENodes. All other traffic on the VLAN is denied.

For example, when an ENode on an FCoE VLAN performs a successful login to an FC switch port, the transit switch snoops the FIP information and constructs a firewall filter that provides access for the ENode to that port on the FC switch.

The firewall filters enable FCoE frames to pass through the transit switch only on a virtual link established between an FCoE device ENode VN_Port and the FC switch VF_Port to which it has logged in. The firewall filters ensure that ENodes can only connect to the FC switches they have successfully logged in to and that only valid FCoE traffic along valid paths is transmitted. VN2VF_Port FIP snooping maintains the filters by tracking FCoE sessions (ENode to FCF sessions).

FIP Snooping Firewall Filters

The effect of the firewall filters is to protect the FCoE ports. VN2VF_Port FIP snooping performs the following actions and checks to ensure that FCoE traffic is valid:

- Denies ENodes that use the FC switch media access control (MAC) address as the source address.
- Enables ENodes to transmit FIP and FCoE frames to the FC switch address.
- Ensures that the FCoE source address the FC switch assigns or accepts is only used for FCoE traffic.
- Ensures that FCoE frames are only addressed to the accepting FC switch.

FIP Snooping Session Scalability

Enhanced FIP snooping session scaling, which supports up to 2,500 sessions, is enabled by default. On QFabric systems, if you want to disable enhanced FIP snooping scaling (which reduces the number of supported sessions to 376 sessions), you can do so as described in [“Disabling Enhanced FIP Snooping Scaling” on page 142](#).

By default, up to 2500 total FIP snooping sessions are supported on an interface, an FCoE-FC gateway fabric (only supported on QFX3500 switches configured as standalone switches or as QFabric system Node devices), a switch, a QFabric Node device, or a QFabric Node group. For example, you can:

- Place all 2500 sessions on one FCoE interface.
- Split the 2500 sessions among multiple FCoE interfaces on one FCoE VLAN.
- Split the 2500 sessions among multiple FCoE interfaces on multiple FCoE VLANs.

- Split the 2500 sessions among the FCoE interfaces on multiple gateway FC fabrics on a switch.
- Split the 2500 sessions among the FCoE interfaces on multiple gateway FC fabrics on multiple Node devices in a QFabric Node group.

Regardless of how you allocate the sessions among interfaces and local FC fabrics on a switch or on a QFabric system Node device or Node group, the combined FIP session limit is a maximum of 2500 sessions.



NOTE: The total number of sessions the system can support is the combined number of VN2VF_Port sessions and VN2VN_Port sessions. If VN2VN_Port sessions are active, the total number of available VN2VF_Port sessions is reduced.

VN2VF_Port FIP Snooping Implementation

You enable VN2VF_Port FIP snooping on a per-VLAN basis on VLANs that carry FCoE traffic. The switch snoops FIP frames at the ports associated with FCoE VLANs enabled for VN2VF_Port FIP snooping. The switch then installs the resulting firewall filters on the ports to ensure that all VN2VF_Port FIP snooping occurs on the switch network edge.

VN2VF_Port FIP snooping FCoE VLANs must meet the following criteria:

- An FCoE VLAN should be dedicated to FCoE traffic only.
- An FCoE VLAN cannot support both VN2VF_Port FIP snooping and VN2VN_Port FIP snooping simultaneously. You must configure separate FCoE VLANs for VN2VF_Port FIP snooping traffic and for VN2VN_Port FIP snooping traffic.



NOTE: Changing an FCoE VLAN from VN2VF_Port FIP snooping mode to VN2VN_Port snooping mode terminates the existing virtual links on the VLAN. The transit switch removes the existing FIP snooping filters, creates the new FIP snooping filters, and applies them to the FIP snooping ports. If you downgrade the software to Junos OS Release 12.1 or earlier, VLANs configured for VN2VN_Port FIP snooping revert to VN2VF_Port FIP snooping VLANs.

-
- For systems that use software that does not support Enhanced Layer 2 Software (ELS) CLI, configure all access ports that belong to an FCoE VLAN (ports connected to a converged network adapter [CNA] in an FCoE device) in **tagged-access** port mode. Access ports associated with an FCoE VLAN should not be configured as access ports or trunk ports on these platforms, although trunk port configuration is supported.

However, on switches that use the ELS CLI, configure access ports that belong to an FCoE VLAN in **trunk** interface mode.

- All ports connected to an FC switch (or FCoE forwarder) must be configured in **trunk** port mode. Ports connected to an FC switch must be configured as trusted ports.

- FIP traffic uses the native VLAN (FIP VLAN discovery and notification frames are exchanged as untagged packets).
- All FCoE VLAN traffic must be tagged and cannot belong to the native VLAN.
- FCoE VLAN traffic cannot be untagged or priority-tagged.

When you enable VN2VF_Port FIP snooping, the switch inspects FIP frames.

The VN2VF_Port FIP snooping implementation includes these considerations:

- [ENode-Facing Interfaces on page 105](#)
- [Network-Facing Interfaces on page 106](#)
- [FC-MAP on page 106](#)

ENode-Facing Interfaces

When the interfaces that belong to an FCoE VLAN connect directly to FCoE devices (there is no other transit switch between the FCoE devices and the switch), we recommend that you enable VN2VF_Port FIP snooping on all FCoE VLANs that connect VN_Ports to VF_Ports. Enabling FIP snooping ensures secure connections between server ENodes and FC switches. (Enabling VN2VN_Port FIP snooping ensures secure connections on FCoE VLANs that connect VN_Ports to other VN_Ports). FIP snooping should always be enabled at the access edge.

Systems that run Enhanced Layer 2 Software (ELS) support a slightly different configuration on ENode-facing interfaces than systems that do not run ELS. This section describes:

- [Non-ELS Port Mode for FCoE Interfaces on page 105](#)
- [ELS Interface Mode for FCoE Interfaces on page 106](#)
- [Trusted and Untrusted FCoE Interfaces on page 106](#)

Non-ELS Port Mode for FCoE Interfaces

The interfaces that belong to FCoE VLANs (interfaces that connect to CNAs in FCoE devices) on systems that do not support ELS should be configured in **tagged-access** port mode. After you enable VN2VF_Port FIP snooping on an FCoE VLAN, the transit switch denies FCoE traffic from any ENode on that VLAN until the ENode performs a valid fabric login with an FC switch.

The **tagged-access** port mode was not available in Junos OS Release 11.3 and prior releases. In Release 11.3 and earlier, **trunk** port mode was used for Ethernet interfaces that connected to FCoE access devices. Because **tagged-access** mode is now available, using **trunk** mode for interfaces connected to FCoE CNAs is not recommended.

If an existing configuration uses **trunk** mode for ports connected to FCoE CNAs, you can change the port mode to **tagged-access** without disrupting traffic. Although we recommend changing the port mode of these ports from **trunk** to **tagged-access** as a best practice, it is not mandatory. New configurations should use **tagged-access** mode for interfaces that connect to FCoE devices.

ELS Interface Mode for FCoE Interfaces

The interfaces that belong to FCoE VLANs (interfaces that connect to CNAs in FCoE devices) on systems that support ELS should be configured in **trunk** interface mode. After you enable VN2VF_Port FIP snooping on an FCoE VLAN, the transit switch denies FCoE traffic from any ENode on that VLAN until the ENode performs a valid fabric login with an FC switch.

Trusted and Untrusted FCoE Interfaces

Do not configure ENode-facing interfaces as FCoE trusted interfaces when VN2VF_Port FIP snooping is enabled on those interfaces. If you enable VN2VF_Port FIP snooping on an FCoE VLAN and you configure ENode-facing interfaces that are members of the FIP snooping VLAN as **fcoe-trusted**, then FCoE devices might not be able to log in to the FC network.

Changing ports from untrusted to trusted removes any existing VN2VF_Port FIP snooping filters from the ports and terminates the existing sessions. Changing the fabric ports from trusted to untrusted forces all of the FCoE sessions on those ports to log out so that when the ENodes and VN_Ports log in again, the switch can build the appropriate VN2VF_Port FIP snooping filters.

Network-Facing Interfaces

When the switch acts as an FCoE transit switch, you must configure any interface that is connected to a switch as an FCoE trusted interface in **trunk** port mode and as a 10-Gigabit Ethernet interface.

Switch-facing Ethernet interfaces have the following requirements and behaviors:

- You must explicitly configure switch-facing trunk ports on an FCoE transit switch as FCoE trusted interfaces.
- After you configure an FC switch-facing trunk port as a trusted interface, the FCoE transit switch always processes FC switch frames because they come from a source on a trusted interface.
- All ports in an FCoE VLAN must be configured as tagged access or trunk ports.

FC-MAP

When the switch acts as an FCoE transit switch and you enable VN2VF_Port FIP snooping on an FCoE VLAN, you can optionally specify a 24-bit FCoE mapped address prefix (FC-MAP) value. On a given VLAN, the transit switch learns only those FC switches that have a matching FC-MAP value. If the transit switch FCoE VLAN FC-MAP value does not match the FC switch FC-MAP value, the transit switch does not discover the FC switch on that VLAN, and the ENodes on that VLAN cannot access the FC switch. An FCoE VLAN can have one and only one FC-MAP value.

The FC-MAP value is a MAC address prefix unique to an FC switch in the FC SAN fabric that the FC switch uses to identify FCoE traffic for a given FC fabric (traffic on a particular FCoE VLAN). The FC switch combines the FC-MAP value with a unique 24-bit FCID value for the ENode VN_Port during the login process. This creates a 48-bit identifier that is

unique to the fabric. The FC switch assigns this 48-bit value to the ENode VN_Port as its MAC address and unique identifier for the session. Each VN_Port session the ENode establishes with the FC switch receives a unique FCID from the FC switch, so an FCoE device can host multiple virtual links (one for each VN_Port) to an FC switch, each with a 48-bit MAC address that is unique to the fabric.

The VN2VF_Port FIP snooping filter compares the configured FC-MAP value with the FC-MAP value in the header of frames coming from the ENode VN_Port. If the values do not match, the transit switch denies access.



NOTE: Changing the FC-MAP value causes all logins to be dropped and forces ENodes to log in again.



NOTE: Do not configure static MAC addresses with the FC-MAP value as a prefix (the first 24 bits of the MAC address). If you configure a static MAC address that uses the FC-MAP value as a prefix, the system deletes the static MAC address automatically after you enable FIP snooping. The static MAC address configuration is not restored even if you disable FIP snooping later. (The system considers a static MAC address with the FC-MAP value as the prefix to be a misconfiguration.) Do not use a MAC address with the FC-MAP value as the prefix for any traffic other than the FIP snooping traffic when the switch is acting as a transit switch.

T11 VN2VF_Port FIP Snooping Specification

For more details about VN2VF_Port FIP snooping, see <http://www.t11.org/ftp/t11/pub/fc/bb-5/08-264v3.pdf> for the Technical Committee T11 organization document *Increasing FCoE Robustness using FIP Snooping*.

Related Documentation

- [Overview of Fibre Channel on page 26](#)
- [Understanding DCB Features and Requirements on page 292](#)
- [Understanding FCoE Transit Switch Functionality on page 46](#)
- [Understanding an FCoE-FC Gateway on page 190](#)
- [Overview of FIP on page 41](#)
- [Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch on page 111](#)
- [Understanding FCoE LAGs on page 57](#)
- [Understanding FIP Snooping, FBF, and MVR Filter Scalability on page 91](#)
- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Disabling VN2VF_Port FIP Snooping on an FCoE-FC Gateway Switch Interface on page 265](#)

- [Disabling Enhanced FIP Snooping Scaling on page 142](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)
- [Configuring an FCoE LAG on page 63](#)
- [Understanding Fibre Channel Terminology on page 31](#)

Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch

VN_Port to VF_Port (VN2VF_Port) Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) snooping uses information gathered during FIP discovery and login to create firewall filters that provide security against unauthorized access to the FC switch or FCoE forwarder (FCF) through the switch when the switch is acting as an FCoE transit switch. The firewall filters allow only FCoE devices that successfully log in to the FC fabric to access the FCF through the transit switch. VN2VF_Port FIP snooping provides security for the point-to-point virtual links that connect host FCoE Nodes (ENodes) and FCFs in the FCoE VLAN by denying access to any device that does not successfully log in to the FCF.

VN2VF_Port FIP snooping is disabled by default. You enable VN2VF_Port FIP snooping on a per-VLAN basis for VLANs that carry FCoE traffic. Ensure that a VLAN that carries FCoE traffic carries only FCoE traffic, because enabling VN2VF_Port FIP snooping denies access for all other Ethernet traffic.



NOTE: All of the transit switch ports are untrusted by default. If an ENode on an FCoE device logs in to an FCF before you enable VN2VF_Port FIP snooping on the VLAN and you then enable VN2VF_Port FIP snooping, the transit switch denies traffic from the ENode because the transit switch has not snooped (learned) the ENode state. The following process automatically logs the ENode back in to the FCF to reestablish the connection:

1. VN2VF_Port FIP snooping is enabled on an FCoE VLAN on the switch.
2. The switch denies existing connections between servers and the FCF on the FCoE VLAN by filtering the FCoE traffic and FIP traffic, so no keepalive messages from the ENodes reach the FCF.
3. The FCF port timer for each ENode and for each VN_Port on each ENode expires.
4. The FCF sends each ENode whose port timer has expired a Clear Virtual Links (CVL) message.
5. The CVL message causes the ENode to log in again.

Because the FCF is a trusted source, you configure interfaces that connect to the FCF as FCoE trusted interfaces. FCoE trusted interfaces do not filter traffic (FIP snooping filtering should occur only at the FCoE access edge), but VN2VF_Port FIP snooping continues to run on trusted interfaces so that the switch learns the FCF state.



NOTE: Do not configure ENode-facing interfaces both with FIP snooping enabled and as trusted interfaces. FCoE VLANs with interfaces that are directly connected to FCoE hosts should be configured with FIP snooping enabled and the interfaces should *not* be trusted interfaces. Ethernet interfaces that are connected to an FCF should be configured as trusted interfaces and should not have FIP snooping enabled. Interfaces that are connected to a transit switch that is performing FIP snooping can be configured as trusted interfaces if the FCoE VLAN is not enabled for FIP snooping.

Optionally, you can specify an FC-MAP value for each FCoE VLAN. On a given FCoE VLAN, the switch learns only FCFs that have a matching FC-MAP value. The default FC-MAP value is 0EFC00h for all FC devices. (Enter hexadecimal values for FC-MAP preceded by the hexadecimal indicator “0x”—for example, 0x0EFC00.) If you change the FC-MAP value of an FCF, change the FC-MAP value for the FCoE VLAN it belongs to on the switch and on the servers you want to communicate with the FCF. An FCoE VLAN can have one and only one FC-MAP value.



NOTE: The default enhanced FIP snooping scaling supports 2,500 sessions. On QFabric systems, starting with Junos OS Release 13.2X52, you can disable enhanced FIP snooping scaling on a per-VLAN basis if you want to do so, but only 376 sessions are supported if you disable enhanced FIP snooping scaling.

There are differences in the way you configure FIP snooping and FCoE trusted interfaces on a switch that depend on whether the switch uses the original CLI or the Enhanced Layer 2 Software (ELS) CLI. This topic includes two configuration procedures, one for switches that run the original CLI, and one for switches that run the ELS CLI.

Original CLI Configuration

To enable VN2VF_Port FIP snooping:

- To enable VN2VF_Port FIP snooping on a single VLAN and specify the optional FC-MAP value:

```
[edit ethernet-switching-options secure-access-port]
user@switch# set vlan vlan-name examine-fip fc-map fc-map-value
```

For example, to enable VN2VF_Port FIP snooping on a VLAN named **san1_vlan** and change the FC-MAP value to **0x0EFC03**:

```
[edit ethernet-switching-options secure-access-port]
user@switch# set vlan san1_vlan examine-fip fc-map 0x0EFC03
```



NOTE: Changing the FC-MAP value causes all logins to drop and forces ENodes to log in again.

- To enable VN2VF_Port FIP snooping on all VLANs and use the default FC-MAP value:

```
[edit ethernet-switching-options secure-access-port]
user@switch# set vlan all examine-fip
```

- To configure an interface as an FCoE trusted interface:

```
[edit ethernet-switching-options secure-access-port]
user@switch# set interface interface-name fcoe-trusted
```

For example, to configure interface **xe-0/0/30** as an FCoE trusted interface:

```
[edit ethernet-switching-options secure-access-port]
user@switch# set interface xe-0/0/30 fcoe-trusted
```

ELS CLI Configuration

To enable VN2VF_Port FIP snooping:

- To enable VN2VF_Port FIP snooping on a VLAN and specify the optional FC-MAP value:

```
[edit]
user@switch# set vlans vlan-name forwarding-options fip-security fc-map fc-map-value
examine-vn2vf
```

For example, to enable VN2VF_Port FIP snooping on a VLAN named **san1_vlan** and change the FC-MAP value to **0x0EFC03**:

```
[edit]
user@switch# set vlans san1_vlan forwarding-options fip-security fc-map 0x0EFC03
examine-vn2vf
```



NOTE: Changing the FC-MAP value causes all logins to drop and forces ENodes to log in again.

- To configure an interface as an FCoE trusted interface:

```
[edit]
user@switch# set vlans vlan-name forwarding-options fip-security interface interface-name
fcoe-trusted
```

For example, to configure interface **xe-0/0/30** on VLAN named **san1_vlan** as an FCoE trusted interface:

```
[edit]
user@switch# set vlans san1_vlan forwarding-options fip-security interface xe-0/0/30
fcoe-trusted
```

- Related Documentation**
- [Example: Configuring an FCoE Transit Switch](#)
 - [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
 - [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)
 - [Configuring an FCoE LAG on page 63](#)
 - [Disabling Enhanced FIP Snooping Scaling on page 142](#)
 - [Understanding FIP Snooping](#)
 - [Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch on page 101](#)
 - [Understanding FCoE LAGs on page 57](#)

Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch

VN_Port to VN_Port (VN2VN_Port) Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) snooping (FC-BB-6) on an FCoE transit switch is conceptually similar to VN_Port to VF_Port (VN2VF_Port) FIP snooping (FC-BB-5) on an FCoE transit switch. An FCoE transit switch is a data center bridging (DCB) switch with FIP snooping capability. VN2VN_Port FIP snooping provides security in the form of filters. The filters help prevent unauthorized access and data transmission on a bridge that connects ENodes on the Ethernet network.

The main difference between VN2VN_Port FIP snooping and VN2VF_Port FIP snooping is that you use VN2VN_Port FIP snooping when the FCoE devices reside on the Ethernet network, so there is no need to forward traffic between FCoE devices to the Fibre Channel (FC) network, and you use VN2VF_Port FIP snooping when FCoE devices on the Ethernet network need to access targets on the FC network, so FCoE traffic must be forwarded to the FC network. See [“Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch” on page 101](#) for information about VN2VF_Port FIP snooping.

You enable VN2VN_Port FIP snooping on the FCoE VLAN that transports the VN2VN traffic. The transit switch applies VN2VN_Port FIP snooping filters at the ports associated with the FCoE VLANs on which you enable VN2VN FIP snooping.

A key benefit of VN2VN_Port FIP snooping is that it enables FCoE initiators and targets to communicate directly through the switch without going through an FCoE forwarder (FCF) or an FC switch. The transit switch does not differentiate between initiators and targets because the transit switch sees both VN_Ports as FIP virtual link end points. Direct VN2VN_Port communication requires secure access (FIP snooping filters) because ENodes are not trusted entities.

This topic describes:

- [VN2VN_Port FIP Snooping and FIP Snooping Virtual Links on page 112](#)
- [VN2VN_Port Communication Modes on page 112](#)
- [Network Security on page 113](#)
- [VN2VN_Port FIP Snooping Functions on page 113](#)
- [Scalability on page 113](#)

- [VN2VN_Port FIP Snooping Implementation on page 114](#)
- [ENode-Facing Interfaces on page 114](#)
- [Network-Facing Interfaces \(Connecting to Another Transit Switch\) on page 116](#)
- [Beacon Period \(VN2VN_Port FIP Snooping Link Maintenance\) on page 116](#)
- [QFabric System Differences in VN2VN_Port FIP Snooping Traffic Handling on page 116](#)

VN2VN_Port FIP Snooping and FIP Snooping Virtual Links

FIP snooping under the T11 FC-BB-5 specification requires that an FC switch or an FCF be in the path between two VN_Ports when they communicate. Introduced in the T11 FC-BB-6 specification (see <http://www.t11.org/ftp/t11/pub/fc/bb-6/10-019v3.pdf>), VN2VN_Port FIP snooping allows the FCoE transit switch to connect two VN_Ports to each other directly, without going through an FC switch or an FCF, provided that the ENodes have logged in to the FC network.

In VN2VF_Port FIP snooping, when an ENode logs in to the FC network, the FCoE transit switch snoops the FIP communication between the ENode and the FC switch. In VN2VN_Port FIP snooping mode, the transit switch creates filters on the switch access ports to control VN_Port access to other VN_Ports on the Ethernet network. The VN2VN_Port FIP snooping filters allow the switch to establish a dedicated virtual link that emulates a point-to-point connection between two VN_Ports, through the switch.

Virtual links pass transparently through the transit switch. The VN_Ports do not detect the transit switch, and virtual links appear to be direct point-to-point links.

You explicitly enable VN2VN_Port FIP snooping on FCoE VLANs when the switch or QFabric system Node device is an FCoE transit switch connecting FCoE devices on the Ethernet network to each other and to FC switches or gateways at the FC storage area network (SAN) edge.



NOTE: An FCoE VLAN can support either VN2VF_Port FIP snooping or VN2VN_Port FIP snooping, but not both. Configure separate FCoE VLANs for VN2VF_Port FIP snooping traffic and for VN2VN_Port FIP snooping traffic. On FCoE VLANs that are configured as VN2VN_Port FIP snooping VLANs, VN_Port to VF_Port traffic is dropped.

When you enable FIP snooping, the system snoops VN2VF_Port packets and enforces security only on VN_Port to VF_Port virtual links. When you enable VN2VN_Port FIP snooping, the system snoops VN_Port to VN_Port FIP packets and enforces security only on VN_Port to VN_Port virtual links.

The transit switch applies VN2VN_Port FIP snooping filters at the ports associated with the FCoE VLANs on which you enable VN2VN_Port FIP snooping. VN2VN_Port FIP snooping provides security for virtual links by creating filters based on information gathered (snooped) about FCoE devices during FIP transactions.

VN2VN_Port Communication Modes

The transit switch supports two VN2VN_Port communication modes:

- Point-to-point mode
- Multipoint mode

In point-to-point mode, two ENodes are connected to the network and form a single VN_Port to VN_Port virtual link. This is analogous to the point-to-point FC link between an FC initiator and an FC target.

In multipoint mode, multiple ENodes are connected to the network and form multiple virtual links. Each virtual link is created between one pair of VN_Ports. This is analogous to loop mode in traditional FC networks.

The VN2VN_Port communication mode is not configured; it is determined by the number of ENodes connected to the network.

Network Security

In traditional FC networks, the FC switch is usually a trusted entity and the server ENodes are untrusted entities. The ENodes connect directly to the FC switch VF_Ports. After an ENode gains access to the network through the fabric login (FLOGI) process, the FC switch enforces zoning configurations, ensures that the ENode uses valid addresses, monitors the connection, and performs other security functions to prevent unauthorized access.

However, FCoE exposes FC frames to Ethernet networks, which do not have the same level of security as native FC networks. VN2VN_Port FIP snooping filters emulate the native FC network security functions by preventing unauthorized access and by ensuring the security of the virtual link between ENode VN_Ports. The transit switch performs VN2VN_Port FIP snooping at the ports connected to the FCoE VN_Port devices.

VN2VN_Port FIP Snooping Functions

When you enable VN2VN_Port FIP snooping, the transit switch sets and applies filters to block all FCoE traffic on the VLAN by default. The transit switch monitors FIP logins, solicitations, and advertisements that pass through it and gathers information about the ENode address. The transit switch uses the information to construct filters that permit access only to logged-in ENodes. All other traffic on the VLAN is denied.

The filters enable FCoE frames to pass through the transit switch only on a virtual link established between two VN_Ports. The filters ensure that ENodes can only connect to other ENodes if they have successfully logged in to each other, and that only valid FCoE traffic along valid paths is transmitted. VN2VN_Port FIP snooping maintains the filters by tracking VN_Port to VN_Port sessions.

Scalability

Because ENodes are untrusted and the system needs to apply filters to untrusted FIP snooping interfaces, the total number of combined VN2VN_Port FIP snooping sessions per switch is 376 sessions (ENode to ENode sessions) on untrusted interfaces. On interfaces that are configured as trusted interfaces, no FIP snooping filters are applied.



NOTE: The total number of sessions the system can support is the combined number of VN2VF_Port sessions and VN2VN_Port sessions. If VN2VF_Port sessions are active, the total number of available VN2VN_Port sessions is reduced.

VN2VN_Port FIP Snooping Implementation

You enable VN2VN_Port FIP snooping on a per-VLAN basis on VLANs that carry FCoE traffic. The switch snoops FIP frames at the ports associated with FCoE VLANs enabled for VN2VN_Port FIP snooping. The switch then installs the resulting filters on the ENode-facing ports to ensure that all FIP snooping occurs on the switch network edge.

VN2VN_Port FIP snooping FCoE VLANs must meet the following criteria:

- An FCoE VLAN should be dedicated to FCoE traffic only.
- An FCoE VLAN cannot support both VN2VF_Port FIP snooping (FC-BB-5) and VN2VN_Port FIP snooping (FC-BB-6) simultaneously. You must configure separate FCoE VLANs for FIP snooping traffic and for VN2VN_Port FIP snooping traffic.



NOTE: Changing an FCoE VLAN from VN2VF_Port FIP snooping mode to VN2VN_Port FIP snooping mode terminates the existing virtual links on the VLAN. The transit switch removes the existing FIP snooping filters, creates the new FIP snooping filters, and applies them to the FIP snooping ports. If you downgrade the software to Junos OS Release 12.1 or earlier, VLANs configured for VN2VN_Port FIP snooping revert to VN2VF_Port FIP snooping VLANs.

-
- For switches that do not run Enhanced Layer 2 Software (ELS), as a best practice, you should configure all access ports that belong to an FCoE VLAN (ports connected to a converged network adapter [CNA] in an FCoE device) in **tagged-access** port mode. However, access and trunk port modes are also supported. For switches that use ELS, configure access ports that belong to an FCoE VLAN in **trunk** interface mode.
 - Access ports should be configured as untrusted ports.
 - All ports connected to another transit switch must be configured in **trunk** port mode.
 - FIP traffic uses the native VLAN.
 - You can enable VN2VN_Port FIP snooping on a native VLAN.

ENode-Facing Interfaces

When the interfaces that belong to an FCoE VLAN connect directly to FCoE devices (there is no other transit switch between the FCoE devices and the switch), we recommend that you either enable VN2VN_Port FIP snooping on all FCoE VLANs to ensure secure connections between VN_Ports, or enable VN2VF_Port FIP snooping on FCoE VLANs that connect ENodes to an FC switch. FIP snooping should always be enabled at the access edge.

Systems that run Enhanced Layer 2 Software (ELS) support a slightly different configuration on ENode-facing interfaces than systems that do not run ELS. This section describes:

- [Non-ELS Port Mode for FCoE Interfaces on page 115](#)
- [ELS Interface Mode for FCoE Interfaces on page 115](#)
- [Trusted and Untrusted FCoE Interfaces on page 115](#)

Non-ELS Port Mode for FCoE Interfaces

The interfaces that belong to FCoE VLANs (interfaces that connect to CNAs in FCoE devices) should be configured in **tagged-access** port mode, unless your CNA does not support tagged VN2VN traffic. After you enable VN2VN_Port FIP snooping on an FCoE VLAN, the transit switch denies FCoE traffic from any ENode on that VLAN until the ENode performs a valid fabric login (FIP FLOGI) with another ENode.

The **tagged-access** port mode was not available in Junos OS Release 11.3 and prior releases. In Release 11.3 and earlier, **trunk** port mode was used for Ethernet interfaces that connected to FCoE access devices. Because **tagged-access** mode is now available, using **trunk** mode for interfaces connected to FCoE CNAs is not recommended.

If an existing configuration uses **trunk** mode for ports connected to FCoE CNAs, you can change the port mode to **tagged-access** without disrupting traffic. Although we recommend changing the port mode of these ports from **trunk** to **tagged-access** as a best practice, it is not mandatory. New configurations should use **tagged-access** mode for interfaces that connect to FCoE devices.

ELS Interface Mode for FCoE Interfaces

The interfaces that belong to FCoE VLANs (interfaces that connect to CNAs in FCoE devices) on systems that support ELS should be configured in **trunk** interface mode. After you enable VN2VF_Port FIP snooping on an FCoE VLAN, the transit switch denies FCoE traffic from any ENode on that VLAN until the ENode performs a valid fabric login with an FC switch.

Trusted and Untrusted FCoE Interfaces

Do not configure ENode-facing interfaces as FCoE trusted interfaces when VN2VF_Port FIP snooping is enabled on those interfaces. If you enable VN2VF_Port FIP snooping on an FCoE VLAN and you configure ENode-facing interfaces that are members of the FIP snooping VLAN as **fcoe-trusted**, then FCoE devices might not be able to log in to the FC network.

Changing ports from untrusted to trusted removes any existing VN2VF_Port FIP snooping filters from the ports and terminates the existing sessions. Changing the fabric ports from trusted to untrusted forces all of the FCoE sessions on those ports to log out so that when the ENodes and VN_Ports log in again, the switch can build the appropriate VN2VF_Port FIP snooping filters.

Network-Facing Interfaces (Connecting to Another Transit Switch)

Configure any interface that is connected to another transit switch (not to an ENode) as an FCoE trusted interface, in **trunk** port mode, and as a 10-Gigabit Ethernet interface.

Network-facing Ethernet interfaces have the following requirements and behaviors:

- You must explicitly configure network-facing trunk ports on an FCoE transit switch as FCoE trusted interfaces.
- After you configure a network-facing trunk port as a trusted interface, the FCoE transit switch always processes frames from the connected switch because they come from a source on a trusted interface.
- As a best practice, configure ports in an FCoE VLAN as tagged access ports, but access and trunk port modes are also supported to accommodate whatever types of VN2VN traffic your CNA supports.

Beacon Period (VN2VN_Port FIP Snooping Link Maintenance)

The transit switch needs to maintain the virtual links between VN_Ports, and needs to know when sessions begin and end, and when to install and remove the FIP snooping filters. FIP snooping uses a FIP keepalive advertisement to accomplish this task.

VN2VN_Port FIP snooping does not exchange FIP keepalive timer information. Instead, you configure a *beacon period*, which performs the same function as a keepalive timer.

The beacon period is the time interval between messages which verify that the connection is still valid and that the device at the other end of the virtual link is still reachable. You set the beacon period value for each FCoE VLAN that you configure to do VN2VN_Port FIP snooping.



NOTE: Explicitly set the beacon period when you configure VN2VN_Port FIP snooping. VN_Ports do not automatically send beacons.

ENodes transmit periodic multicast N_Port_ID beacons to the ALL-VN2VN-ENode-MACs address. The transmission period varies by a random delay of between 0 ms and 100 ms to avoid synchronized bursts of multicast traffic on the network.

If the transit switch does not receive a beacon message from an ENode within 2.5 times the configured beacon period, the transit switch considers the virtual link to be down and terminates the virtual link to that ENode.

QFabric System Differences in VN2VN_Port FIP Snooping Traffic Handling

Configuring VN2VN_Port FIP snooping on a QFabric system is the same as configuring VN2VN_Port FIP snooping on a standalone switch. However, there are internal differences in the way a QFabric system handles VN2VN_Port FIP snooping traffic compared to the way a standalone switch handles VN2VN_Port FIP snooping traffic. The internal differences are transparent. Whether you configure VN2VN_Port FIP snooping on a QFabric

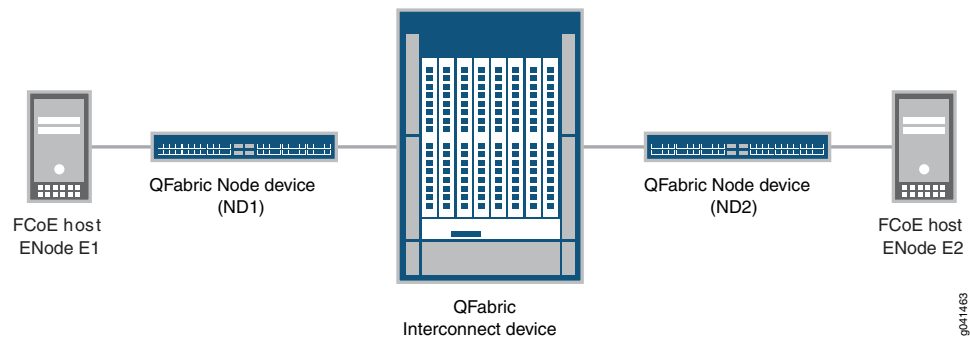
system or on a standalone switch, the proper FIP snooping filters and forwarding information are installed on each device.

On standalone switches, the VN2VN_Port FIP snooping traffic does not cross a fabric (Interconnect device). VN2VN_Port traffic enters and exits ports on a single switch, so the ingress port and the egress port have access to the same *local* forwarding and FIP snooping databases.

However, on a QFabric system, VN2VN_Port FIP snooping traffic might enter on the ingress port of one Node device, traverse the Interconnect device fabric, and exit on the egress port of a different Node device. In this case, the QFabric system must ensure that the FIP snooping database and forwarding information for the VN2VN_Port traffic is installed correctly on both of the Node devices so that traffic is correctly filtered and forwarded.

For example, [Figure 5 on page 117](#) shows that VN2VN_Port traffic from FCoE host ENode E1 enters the QFabric system at Node device ND1, traverses the Interconnect device fabric, and then exits from Node device ND2 before arriving at FCoE host ENode E2. Similarly, VN2VN_Port traffic from FCoE host ENode E2 enters the QFabric system at Node device ND2, traverses the Interconnect device fabric, and then exits from Node device ND1 before arriving at FCoE host ENode E1.

Figure 5: VN2VN_Port Traffic Across a QFabric Interconnect Device



When the QFabric system receives a FLOGI ACC from either ENode E1 or ENode E2, the QFabric system creates and installs the correct VN2VN_Port FIP snooping filters on both Node devices, and updates the forwarding tables accordingly.

In addition, the QFabric system must also ensure that the VN2VN_Port FIP snooping session statistics are correctly counted. Even though a session is running on each of the two Node devices, the QFabric system counts the complete VN2VN_Port connection as one session because the two Node devices belong to the same session. This ensures that VN2VN_Port sessions that traverse the Interconnect device fabric are counted as one unique session, not as two separate sessions.

Related Documentation

- [Understanding DCB Features and Requirements on page 292](#)
- [Understanding FCoE Transit Switch Functionality on page 46](#)
- [Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch on page 101](#)
- [Overview of FIP on page 41](#)

- [Understanding Fibre Channel Terminology on page 31](#)
- [Understanding FIP Snooping, FBF, and MVR Filter Scalability on page 91](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to the Same FCoE Transit Switch\) on page 120](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to Different FCoE Transit Switches\) on page 125](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch\) on page 132](#)
- [Enabling VN2VN_Port FIP Snooping and Configuring the Beacon Period on an FCoE Transit Switch on page 118](#)

Enabling VN2VN_Port FIP Snooping and Configuring the Beacon Period on an FCoE Transit Switch

VN_Port to VN_Port (VN2VN_Port) FIP snooping on an FCoE transit switch provides security to help prevent unauthorized access and data transmission on a bridge that connects ENodes in the Ethernet network. VN2VN_Port FIP snooping provides security for virtual links by creating filters based on information gathered (snooped) about FCoE devices during FIP transactions.

VN2VN_Port FIP snooping is conceptually similar to VN2VF_Port FIP snooping between VN_Ports and VF_Ports, but VN2VN_Port FIP snooping does not require traffic between VN_Ports to traverse the Fibre Channel (FC) switch or FCoE forwarder (FCF). Instead, a VN_Port communicates transparently through the transit switch on a virtual link that emulates a direct connection to the VN_Port at the other end of the virtual link.

VN2VN_Port FIP snooping is disabled by default. You enable VN2VN_Port FIP snooping on a per-VLAN basis on VLANs that carry VN2VN_Port FCoE traffic. Ensure that the VLAN carries only FCoE traffic between VN_Ports, because enabling VN2VN_Port FIP snooping denies access for all other traffic, including VN2VF_Port FIP snooping traffic.

All ENodes that you want to communicate using VN2VN_Port FIP snooping must use an FCoE VLAN dedicated to VN2VN_Port traffic. You cannot mix VN2VN_Port FIP snooping traffic with VN2VF_Port FIP snooping traffic in the same FCoE VLAN.



NOTE: An FCoE VLAN can support either VN2VF_Port FIP snooping or VN2VN_Port FIP snooping, but not both. Configure separate FCoE VLANs for VN2VF_Port FIP snooping traffic and for VN2VN_Port FIP snooping traffic. On FCoE VLANs that are configured as VN2VN_Port FIP snooping VLANs, VN2VF_Port traffic is dropped.

The *beacon period* is conceptually similar to the FIP keepalive period (timer) for VN2VF_Port FIP snooping virtual link maintenance. The beacon period performs virtual

link maintenance for VN2VN_Port FIP snooping. It is the time interval between messages that verify the connection is still valid and the device at the other end of the virtual link is still reachable. You set the beacon period value for each FCoE VLAN that you configure to do VN2VN_Port FIP snooping.



NOTE: In addition to enabling VN2VN_Port FIP snooping and configuring the beacon period, you must also configure a dedicated FCoE VLAN for the VN2VN_Port traffic, and set the FCoE transit switch ports in the proper port mode and trusted or untrusted state (interfaces are untrusted by default). See the VN2VN_Port FIP snooping configuration example topics for complete configurations of several common network topologies.

There are differences in the way you configure a native VLAN on an interface that depend on whether the switch uses the original CLI or the Enhanced Layer 2 Software (ELS) CLI. This topic includes two configuration procedures, one for switches that run the original CLI, and one for switches that run the ELS CLI.

Original CLI Configuration

To enable VN2VN_Port FIP snooping and set the beacon period on an FCoE VLAN that is dedicated to VN2VN_Port traffic:

- [edit ethernet-switching-options secure-access-port]
user@switch# **set vlan *vlan-name* examine-fip *examine-vn2vn* beacon-period *milliseconds***

For example, to enable VN2VN_Port FIP snooping on a VLAN named **vlan200** and set the beacon period to **90000** milliseconds:

```
[edit ethernet-switching-options secure-access-port]
user@switch# set vlan vlan200 examine-fip examine-vn2vn beacon-period 90000
```

ELS CLI Configuration

To enable VN2VN_Port FIP snooping and set the beacon period on an FCoE VLAN that is dedicated to VN2VN_Port traffic:

- [edit]
user@switch# **set vlans *vlan-name* forwarding-options fip-security examine-vn2vn beacon-period *milliseconds***

For example, to enable VN2VN_Port FIP snooping on a VLAN named **vlan200** and set the beacon period to **90000** milliseconds:

```
[edit]
user@switch# set vlans vlan200 forwarding-options fip-security examine-vn2vn beacon-period 90000
```

Related Documentation

- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to the Same FCoE Transit Switch\) on page 120](#)

- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to Different FCoE Transit Switches\) on page 125](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch\) on page 132](#)
- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch on page 111](#)

Example: Configuring VN2VN_Port FIP Snooping (FCoE Hosts Directly Connected to the Same FCoE Transit Switch)

This example shows how to configure VN_Port to VN_Port (VN2VN_Port) FIP snooping when the hosts are directly connected to the same FCoE transit switch.



NOTE: This example uses the Junos OS Enhanced Layer 2 Software (ELS) configuration style for QFX Series switches. For ELS details, see *Using the Enhanced Layer 2 Software CLI*.

VN2VN_Port FIP snooping on an FCoE transit switch provides security to help prevent unauthorized access and data transmission on a bridge that connects ENodes in the Ethernet network. VN2VN_Port FIP snooping provides security for virtual links by creating filters based on information gathered (snooped) about FCoE devices during FIP transactions.

VN2VN_Port FIP snooping is conceptually similar to VN2VN_Port FIP snooping between VN_Ports and VF_Ports, but VN2VN_Port FIP snooping does not require traffic between VN_Ports to traverse the Fibre Channel (FC) switch or FCoE forwarder (FCF). Instead, a VN_Port communicates transparently through the transit switch on a virtual link that emulates a direct connection to the VN_Port at the other end of the virtual link.

To configure VN2VN_Port FIP snooping when the hosts are directly connected to the same FCoE transit switch, you must follow these configuration rules:

- VN2VN_Port traffic must use a dedicated FCoE VLAN, and all ENodes that communicate using VN2VN_Port FIP snooping must use that FCoE VLAN. You cannot mix VN2VN_Port FIP snooping traffic with VN2VF_Port FIP snooping traffic in the same FCoE VLAN.



NOTE: An FCoE VLAN can support either VN2VF_Port FIP snooping or VN2VN_Port FIP snooping, but not both. Configure separate FCoE VLANs for VN2VF_Port FIP snooping traffic and for VN2VN_Port FIP snooping traffic. On FCoE VLANs that are configured as VN2VN_Port FIP snooping VLANs, VN_Port to VF_Port (FIP snooping) traffic is dropped.

- ENode-facing ports must be set in **trunk** interface mode.

- ENode-facing ports must be untrusted ports.
- Network-facing (switch-facing) ports must be set in **trunk** interface mode.
- Network-facing ports must be FCoE trusted ports.
- Explicitly configure the beacon period. The beacon period is essentially a keepalive timer for virtual link maintenance.

When you enable VN2VF_Port FIP snooping, the system snoops VN_Port to VF_Port packets and enforces security only on VN_Port to VF_Port virtual links. When you enable VN2VN_Port FIP snooping, the system snoops VN_Port to VN_Port packets and enforces security only on VN_Port to VN_Port virtual links.

The transit switch applies VN2VN_Port FIP snooping filters at the ports associated with the FCoE VLANs on which you enable VN2VN FIP snooping.

This example describes how to configure VN2VN_Port FIP snooping when the FCoE hosts are directly connected to the same transit switch:

- [Requirements on page 121](#)
- [Overview on page 121](#)
- [Configuration on page 122](#)
- [Verification on page 123](#)

Requirements

This example uses the following hardware and software components:

- One Juniper Networks QFX5100 Switch running the ELS CLI and used as a transit switch
- Junos OS Release 13.2 or later for the QFX Series
- Two FCoE hosts that have ENodes

Overview

This example shows you how to:

- Set the correct interface mode on the transit switch.
- Configure the interfaces to use the dedicated FCoE VLAN for VN2VN_Port FIP snooping.
- Configure the dedicated FCoE VLAN for VN2VN_Port FIP snooping traffic.
- Enable VN2VN_Port FIP snooping on the FCoE VLAN and configure the beacon period.

Topology

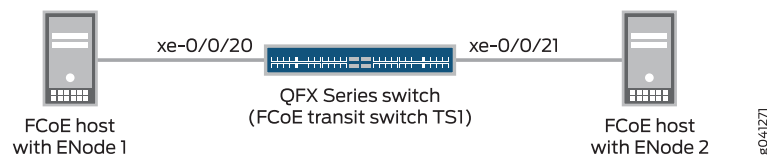
[Table 8 on page 122](#) shows the configuration components for this example.

Table 8: Components of the VN2VN_Port FIP Snooping Configuration Topology (FCoE Hosts Directly Connected to the Same FCoE Transit Switch)

Component	Settings
Hardware	QFX5100 switch running the ELS CLI (FCoE transit switch TS1) Two FCoE hosts that have ENodes (ENode1 and ENode2, respectively)
Interfaces and interface mode	<ul style="list-style-type: none"> Interface xe-0/0/20, interface mode trunk, connects directly to the FCoE host with ENode1. Interface xe-0/0/21, interface mode trunk, connects directly to the FCoE host with ENode2.
Interface VLAN membership	Both interfaces use VLAN vlan200 .
VN2VN_Port FIP snooping VLAN	VLAN name— vlan200 VLAN ID— 200
FIP snooping mode and beacon period	Set examine-vn2vn (VN2VN_Port FIP snooping) Beacon period— 90000 ms

Figure 6 on page 122 shows the network topology for this example.

Figure 6: VN2VN_Port FIP Snooping (FCoE Hosts Connected to Same Transit Switch) Topology



Configuration

CLI Quick Configuration

To quickly configure VN2VN_Port FIP snooping for FCoE hosts connected directly to the same transit switch, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the [edit] hierarchy level:

```

set interfaces xe-0/0/20 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/21 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/20 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/21 unit 0 family ethernet-switching vlan members vlan200
set vlans vlan200 vlan-id 200
set vlans vlan200 forwarding-options fip-security examine-vn2vn beacon-period 90000
  
```

Configuring VN2VN_Port FIP Snooping (FCoE Hosts Directly Connected to the Same FCoE Transit Switch)

- Step-by-Step Procedure** To configure interface mode, configure interface VLAN membership in the FCoE VLAN dedicated to VN2VN_Port traffic, configure the VLAN, set the beacon period, and enable VN2VN_Port FIP snooping:
1. Configure the modes of the interfaces that connect directly to the FCoE host ENodes:


```
user@switch# set interfaces xe-0/0/20 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/21 unit 0 family ethernet-switching interface-mode trunk
```
 2. Configure the interface VLAN membership so that the interfaces connected to the ENodes are members of the dedicated VN2VN_Port VLAN (**vlan200**):


```
user@switch# set interfaces xe-0/0/20 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/21 unit 0 family ethernet-switching vlan members vlan200
```
 3. Configure the FCoE VLAN dedicated to VN2VN_Port FIP snooping:


```
user@switch# set vlans vlan200 vlan-id 200
```
 4. Enable VN2VN_Port FIP snooping on the VLAN and configure the beacon period:


```
user@switch# set vlans vlan200 forwarding-options fip-security examine-vn2vn beacon-period 90000
```

Verification

To verify that the VN2VN_Port FIP snooping configuration has been created and is operating properly, perform these tasks:

- [Verifying That VN2VN_Port FIP Snooping is Enabled on the FCoE VLAN on page 123](#)

Verifying That VN2VN_Port FIP Snooping is Enabled on the FCoE VLAN

- Purpose** Verify that VN2VN_Port FIP snooping is enabled on the correct VLAN (**vlan200**), the beacon period is set to **90000** milliseconds, and the correct interfaces (**xe-0/0/20** and **xe-0/0/21**) are members of the VLAN.

Action List the FIP snooping information using the operational mode command **show fip snooping detail**.

```
user@switch> show fip snooping detail

VLAN: vlan200, Mode: VN2VN Snooping
FC-MAP: 0e:fd:00
Beacon_Period: 90000
VN2VN Mode: Point-to-Point
  Enode Information
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/20
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fd:00:00:0a:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fd:00:00:0b:01
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/21
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fd:00:00:0b:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fd:00:00:0a:01
```

Meaning The **show fip snooping detail** command lists all of the transit switch information about VN2VN_Port FIP snooping and VN2VF_Port FIP snooping. The command shows that:

- The VLAN is **vlan200**.
- The mode is FIP snooping mode **VN2VN**, for VN2VN_Port FIP snooping. (If the Mode field shows **VN2VF**, then the FIP snooping mode is VN2VF_Port FIP snooping.)
- The beacon period is **90000**.
- The interfaces for the ENodes are **xe-0/0/20** and **xe-0/0/21**.

In addition, this useful command shows information about the ENodes and the VN2VN_Port sessions.

- Related Documentation**
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to Different FCoE Transit Switches\) on page 125](#)
 - [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch\) on page 132](#)
 - [Enabling VN2VN_Port FIP Snooping and Configuring the Beacon Period on an FCoE Transit Switch on page 118](#)
 - [Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch on page 111](#)

Example: Configuring VN2VN_Port FIP Snooping (FCoE Hosts Directly Connected to Different FCoE Transit Switches)

This example shows how to configure VN_Port to VN_Port (VN2VN_Port) FIP snooping when the hosts are directly connected to different FCoE transit switches, and the transit switches are directly connected to each other.



NOTE: This example uses the Junos OS Enhanced Layer 2 Software (ELS) configuration style for QFX Series switches. For ELS details, see *Using the Enhanced Layer 2 Software CLI*.

VN2VN_Port FIP snooping on an FCoE transit switch provides security to help prevent unauthorized access and data transmission on a bridge that connects ENodes in the Ethernet network. VN2VN_Port FIP snooping provides security for virtual links by creating filters based on information gathered (snooped) about FCoE devices during FIP transactions.

VN2VN_Port FIP snooping is conceptually similar to VN2VF_Port FIP snooping between VN_Ports and VF_Ports, but VN2VN_Port FIP snooping does not require traffic between VN_Ports to traverse the Fibre Channel (FC) switch or FCoE forwarder (FCF). Instead, a VN_Port communicates transparently through one or more transit switches on a virtual link that emulates a direct connection to the VN_Port at the other end of the virtual link.

To configure VN2VN_Port FIP snooping when the hosts are directly connected to different FCoE transit switches, and the transit switches are directly connected to each other, you must follow these configuration rules:

- VN2VN_Port traffic must use a dedicated FCoE VLAN, and all ENodes that communicate using VN2VN_Port FIP snooping must use that FCoE VLAN. The FCoE VLAN must be configured on each transit switch. You cannot mix VN2VN_Port FIP snooping traffic with VN2VF_Port FIP snooping traffic in the same FCoE VLAN.



NOTE: An FCoE VLAN can support either VN2VF_Port FIP snooping or VN2VN_Port FIP snooping, but not both. Configure separate FCoE VLANs for VN2VF_Port FIP snooping traffic and for VN2VN_Port FIP snooping traffic. On FCoE VLANs that are configured as VN2VN_Port FIP snooping VLANs, VN2VF_Port traffic is dropped.

- ENode-facing ports must be set in **trunk** interface mode.
- ENode-facing ports must be untrusted ports.
- Network-facing (switch-facing) ports must be set in **trunk** interface mode.
- Network-facing ports must be FCoE trusted ports.
- Explicitly configure the beacon period. The beacon period is essentially a keepalive timer for virtual link maintenance.

When you enable VN2VF_Port FIP snooping, the system snoops VN_Port to VF_Port packets and enforces security only on VN_Port to VF_Port virtual links. When you enable VN2VN_Port FIP snooping, the system snoops VN_Port to VN_Port packets and enforces security only on VN_Port to VN_Port virtual links.

The transit switch applies VN2VN_Port FIP snooping filters at the ports associated with the FCoE VLANs on which you enable VN2VN FIP snooping.

This example describes how to configure VN2VN_Port FIP snooping when the FCoE hosts are directly connected to different transit switches, and the transit switches are directly connected to each other:

- [Requirements on page 126](#)
- [Overview on page 126](#)
- [Configuration on page 127](#)
- [Verification on page 130](#)

Requirements

This example uses the following hardware and software components:

- Two Juniper Networks QFX5100 Switches running the ELS CLI and used as transit switches
- Junos OS Release 13.2 or later for the QFX Series
- Two FCoE hosts that have ENodes

Overview

This example shows you how to:

- Set the correct interface mode on the transit switch.
- Configure the interfaces to use the dedicated FCoE VLAN for VN2VN_Port FIP snooping.
- Configure the network-facing interfaces as FCoE trusted interfaces.
- Configure the dedicated FCoE VLAN for VN2VN_Port FIP snooping traffic.
- Enable VN2VN_Port FIP snooping on the FCoE VLAN and configure the beacon period.

Topology

[Table 9 on page 126](#) shows the configuration components for this example.

Table 9: Components of the VN2VN_Port FIP Snooping Configuration Topology (FCoE Hosts Directly Connected to Different FCoE Transit Switches)

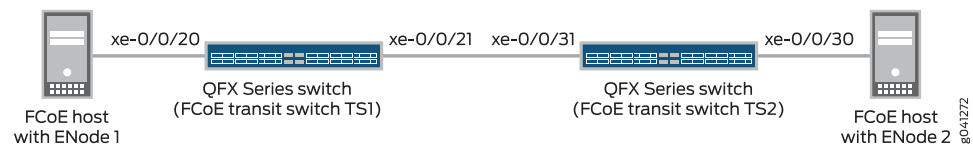
Component	Settings
Hardware	Two QFX5100 switches running the ELS CLI (FCoE transit switch TS1 and FCoE transit switch TS2) Two FCoE hosts that have ENodes (ENode1 and ENode2, respectively)

Table 9: Components of the VN2VN_Port FIP Snooping Configuration Topology (FCoE Hosts Directly Connected to Different FCoE Transit Switches) (continued)

Component	Settings
Interfaces and interface mode	<ul style="list-style-type: none"> Interface xe-0/0/20, interface mode trunk, connects directly from transit switch TS1 to the FCoE host with ENode1. Interface xe-0/0/21, interface mode trunk, connects directly from transit switch TS1 to transit switch TS2. Interface xe-0/0/31, interface mode trunk, connects directly from transit switch TS2 to transit switch TS1. Interface xe-0/0/30, interface mode trunk, connects directly from transit switch TS2 to the FCoE host with ENode2.
Interface VLAN membership	The interfaces on both transit switches use VLAN vlan200 .
VN2VN_Port FIP snooping VLAN	VLAN name (both transit switches)— vlan200 VLAN ID— 200
FIP snooping mode and beacon period	Set examine-vn2vn (VN2VN_Port FIP snooping) Beacon period— 90000 ms

Figure 7 on page 127 shows the network topology for this example.

Figure 7: VN2VN_Port FIP Snooping (FCoE Hosts Connected to Different Transit Switches) Topology



Configuration

To configure VN2VN_Port FIP snooping for VN_Ports that are directly connected to different transit switches (and the transit switches are directly connected to each other), perform these tasks:

- [Configuring VN2VN_Port FIP Snooping on FCoE Transit Switch TS1 on page 128](#)
- [Configuring VN2VN_Port FIP Snooping on FCoE Transit Switch TS2 on page 129](#)

CLI Quick Configuration

The configuration for each FCoE transit switch is shown separately.

To quickly configure VN2VN_Port FIP snooping for FCoE hosts connected directly to different transit switches, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the [edit] hierarchy level. To configure FCoE transit switch TS1:

FCoE Transit Switch TS1

```
set interfaces xe-0/0/20 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/21 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/20 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/21 unit 0 family ethernet-switching vlan members vlan200
set vlans vlan200 vlan-id 200
set vlans vlan200 forwarding-options fip-security interface xe-0/0/21 fcoe-trusted
set vlans vlan200 forwarding-options fip-security examine-vn2vn beacon-period 90000
```

To quickly configure VN2VN_Port FIP snooping for FCoE hosts connected directly to different transit switches, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the [edit] hierarchy level. To configure FCoE transit switch TS2:

FCoE Transit Switch TS2

```
set interfaces xe-0/0/30 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/31 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/30 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/31 unit 0 family ethernet-switching vlan members vlan200
set vlans vlan200 vlan-id 200
set vlans vlan200 forwarding-options fip-security interface xe-0/0/31 fcoe-trusted
set vlans vlan200 forwarding-options fip-security examine-vn2vn beacon-period 90000
```

Configuring VN2VN_Port FIP Snooping on FCoE Transit Switch TS1

Step-by-Step Procedure

To configure interface mode, configure interface VLAN membership in the FCoE VLAN dedicated to VN2VN_Port traffic, set the network-facing port as FCoE trusted, configure the VLAN, set the beacon period, and enable VN2VN_Port FIP snooping:

1. Configure the modes of the interfaces that connect directly to the FCoE host with ENode1 (**xe-0/0/20**) and to FCoE transit switch TS2 (**xe-0/0/21**):

```
user@switch# set interfaces xe-0/0/20 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/21 unit 0 family ethernet-switching interface-mode trunk
```

2. Configure the interface VLAN membership so that the interfaces are members of the dedicated VN2VN_Port VLAN (**vlan200**):

```
user@switch# set interfaces xe-0/0/20 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/21 unit 0 family ethernet-switching vlan members vlan200
```

3. Configure the FCoE VLAN dedicated to VN2VN_Port FIP snooping:

```
user@switch# set vlans vlan200 vlan-id 200
```


4. Configure the network-facing port (**xe-0/0/21**) as an FCoE trusted port:

```
user@switch# set vlans vlan200 forwarding-options fip-security interface xe-0/0/21
fcoe-trusted
```

5. Enable VN2VN_Port FIP snooping on the VLAN and configure the beacon period:

```
user@switch# set vlans vlan200 forwarding-options fip-security examine-vn2vn
beacon-period 90000
```

Configuring VN2VN_Port FIP Snooping on FCoE Transit Switch TS2

Step-by-Step Procedure

To configure interface mode, configure interface VLAN membership in the FCoE VLAN dedicated to VN2VN_Port traffic, set the network-facing port as FCoE trusted, configure the VLAN, set the beacon period, and enable VN2VN_Port FIP snooping:

1. Configure the modes of the interfaces that connect directly to the FCoE host with ENode2 (**xe-0/0/30**) and to FCoE transit switch TS1 (**xe-0/0/31**):

```
user@switch# set interfaces xe-0/0/30 unit 0 family ethernet-switching interface-mode
trunk
set interfaces xe-0/0/31 unit 0 family ethernet-switching interface-mode trunk
```

2. Configure the interface VLAN membership so that the interfaces are members of the dedicated VN2VN_Port VLAN (**vlan200**):

```
user@switch# set interfaces xe-0/0/30 unit 0 family ethernet-switching vlan members
vlan200
set interfaces xe-0/0/31 unit 0 family ethernet-switching vlan members vlan200
```

3. Configure the FCoE VLAN dedicated to VN2VN_Port FIP snooping:

```
user@switch# set vlans vlan200 vlan-id 200
```

4. Configure the network-facing port (**xe-0/0/31**) as an FCoE trusted port:

```
user@switch# set vlans vlan200 forwarding-options fip-security interface xe-0/0/31
fcoe-trusted
```

5. Enable VN2VN_Port FIP snooping on the VLAN and configure the beacon period:

```
user@switch# set vlans vlan200 forwarding-options fip-security examine-vn2vn
beacon-period 90000
```

Verification

To verify that the VN2VN_Port FIP snooping configuration has been created and is operating properly on both switches, perform these tasks:

- [Verifying That VN2VN_Port FIP Snooping is Enabled on the FCoE VLAN \(Transit Switches TS1 and TS2\)](#) on page 130

[Verifying That VN2VN_Port FIP Snooping is Enabled on the FCoE VLAN \(Transit Switches TS1 and TS2\)](#)

Purpose Verify that VN2VN_Port FIP snooping is enabled on the correct VLAN (**vlan200**), the beacon period is set to **90000** milliseconds, and that the correct interfaces (**xe-0/0/20** and **xe-0/0/21** on TS1, and **xe-0/0/30** and **xe-0/0/31** on TS2) are members of the VLAN.

Action List the FIP snooping information on transit switch TS1 using the operational mode command **show fip snooping detail**

```
user@switch> show fip snooping detail
VLAN: vlan200, Mode: VN2VN Snooping
FC-MAP: 0e:fc:00
Beacon_Period: 90000
VN2VN Mode: Point-to-Point
  Enode Information
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/20
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fc:00:01:0a:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fc:00:01:0b:01
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/21
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fc:00:01:0b:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fc:00:01:0a:01
```

List the FIP snooping information on transit switch TS2 using the operational mode command **show fip snooping detail**

```
user@switch> show fip snooping detail
VLAN: vlan200, Mode: VN2VN Snooping
FC-MAP: 0e:fd:00
Beacon_Period: 90000
VN2VN Mode: Point-to-Point
  Enode Information
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/30
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fd:00:00:0b:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fd:00:00:0a:01
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/31
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fd:00:00:0a:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fd:00:00:0b:01
```

Meaning The **show fip snooping detail** command lists all of the transit switch information about VN2VN_Port FIP snooping and VN2VF_Port FIP snooping on each transit switch. The command shows that:

- The VLAN is **vlan200**.
- The mode is FIP snooping mode **VN2VN**, for VN2VN_Port FIP snooping. (If the Mode field shows **VN2VF**, then the FIP snooping mode is VN2VF_Port FIP snooping.)
- The beacon period is **90000**.
- The interfaces connected to the ENodes are **xe-0/0/20** and **xe-0/0/21** on transit switch TS1, and **xe-0/0/30** and **xe-0/0/31** on transit switch TS2. Because the transit switches are transparent passthrough switches, the network-facing trunk ports “see” the FCoE host ENodes at the far end of the VN2VN_Port virtual link.

In addition, this useful command shows information about the ENodes and the VN2VN_Port sessions.

Related Documentation

- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to the Same FCoE Transit Switch\) on page 120](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch\) on page 132](#)
- [Enabling VN2VN_Port FIP Snooping and Configuring the Beacon Period on an FCoE Transit Switch on page 118](#)
- [Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch on page 111](#)

Example: Configuring VN2VN_Port FIP Snooping (FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch)

This example shows how to configure VN_Port to VN_Port (VN2VN_Port) FIP snooping when the hosts are indirectly connected through an aggregation layer FCoE transit switch. Each FCoE host ENode is directly connected to an FCoE transit switch, but the FCoE transit switches are not directly connected to each other. The FCoE transit switches are both connected to a third FCoE transit switch that acts as an aggregation layer switch.



NOTE: This example uses the Junos OS Enhanced Layer 2 Software (ELS) configuration style for QFX Series switches. For ELS details, see *Using the Enhanced Layer 2 Software CLI*.

VN2VN_Port FIP snooping on an FCoE transit switch provides security to help prevent unauthorized access and data transmission on a bridge that connects ENodes in the Ethernet network. VN2VN_Port FIP snooping provides security for virtual links by creating filters based on information gathered (snooped) about FCoE devices during FIP transactions.

VN2VN_Port FIP snooping is conceptually similar to VN2VN_Port FIP snooping between VN_Ports and VF_Ports, but VN2VN_Port FIP snooping does not require traffic between VN_Ports to traverse the Fibre Channel (FC) switch or FCoE forwarder (FCF). Instead, a

VN_Port communicates transparently through one or more transit switches on a virtual link that emulates a direct connection to the VN_Port at the other end of the virtual link.

To configure VN2VN_Port FIP snooping when the hosts are indirectly connected, you must follow these configuration rules:

- VN2VN_Port traffic must use a dedicated FCoE VLAN, and all ENodes that communicate using VN2VN_Port FIP snooping must use that FCoE VLAN. The FCoE VLAN must be configured on each transit switch. You cannot mix VN2VN_Port FIP snooping traffic with VN2VF_Port FIP snooping traffic in the same FCoE VLAN.



NOTE: An FCoE VLAN can support either VN2VF_Port FIP snooping or VN2VN_Port FIP snooping, but not both. Configure separate FCoE VLANs for VN2VF_Port FIP snooping traffic and for VN2VN_Port FIP snooping traffic. On FCoE VLANs that are configured as VN2VN_Port FIP snooping VLANs, VN_Port to VF_Port traffic is dropped.

- ENode-facing ports must be set in **trunk** interface mode.
- ENode-facing ports must be untrusted ports.
- Network-facing (switch-facing) ports must be set in **trunk** interface mode.
- Network-facing ports must be FCoE trusted ports.
- Explicitly configure the beacon period. The beacon period is essentially a keepalive timer for virtual link maintenance.

When you enable FIP snooping, the system snoops VN_Port to VF_Port packets and enforces security only on VN_Port to VF_Port virtual links. When you enable VN2VN_Port FIP snooping, the system snoops VN_Port to VN_Port packets and enforces security only on VN_Port to VN_Port virtual links.

The transit switch applies VN2VN_Port FIP snooping filters at the ports associated with the FCoE VLANs on which you enable VN2VN FIP snooping.

This example describes how to configure VN2VN_Port FIP snooping when the FCoE hosts are indirectly connected across an aggregation layer FCoE transit switch:

- [Requirements on page 133](#)
- [Overview on page 134](#)
- [Configuration on page 135](#)
- [Verification on page 138](#)

Requirements

This example uses the following hardware and software components:

- Three Juniper Networks QFX5100 Switches running the ELS CLI and used as transit switches
- Junos OS Release 13.2 or later for the QFX Series

- Two FCoE hosts that have ENodes

Overview

This example shows you how to:

- Set the correct interface mode on the transit switch.
- Configure the interfaces to use the dedicated FCoE VLAN for VN2VN_Port FIP snooping.
- Configure the network-facing interfaces as FCoE trusted interfaces.
- Configure the dedicated FCoE VLAN for VN2VN_Port FIP snooping traffic.
- Enable VN2VN_Port FIP snooping on the FCoE VLAN and configure the beacon period.

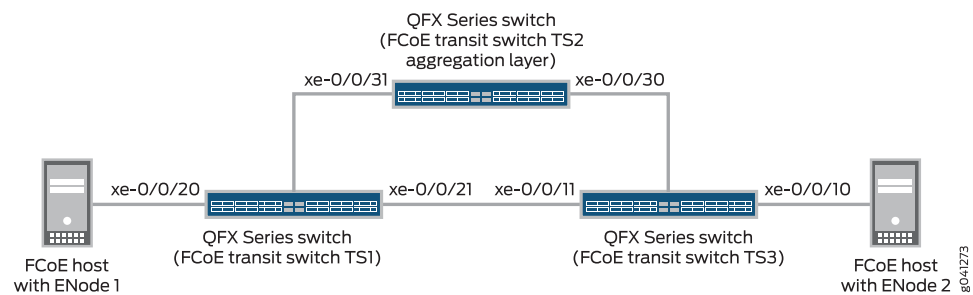
Topology

Table 10 on page 134 shows the configuration components for this example.

Table 10: Components of the VN2VN_Port FIP Snooping Configuration Topology (FCoE Hosts Indirectly Connected Across an Aggregation Layer FCoE Transit Switch)

Component	Settings
Hardware	<p>Three QFX5100 switches running the ELS CLI, two of which are FCoE transit switches that are directly attached to the FCoE hosts (transit switches TS1 and TS2) and one of which is an aggregation layer FCoE transit switch (TS3)</p> <p>Two FCoE hosts that have ENodes (ENode1 and ENode2, respectively)</p>
Interfaces and interface mode	<ul style="list-style-type: none"> • Interface xe-0/0/20, interface mode trunk, connects directly from transit switch TS1 to the FCoE host with ENode1. • Interface xe-0/0/21, interface mode trunk, connects directly from transit switch TS1 to aggregation layer transit switch TS2. • Interface xe-0/0/31, interface mode trunk, connects directly from aggregation layer transit switch TS2 to transit switch TS1. • Interface xe-0/0/30, interface mode trunk, connects directly from aggregation layer transit switch TS2 to transit switch TS3. • Interface xe-0/0/11, interface mode trunk, connects directly from transit switch TS3 to aggregation layer transit switch TS2. • Interface xe-0/0/10, interface mode trunk, connects directly from transit switch TS3 to the FCoE host with ENode2.
Interface VLAN membership	The interfaces on all three switches use VLAN vlan200 .
VN2VN_Port FIP snooping VLAN	<p>VLAN name (all three switches)—vlan200</p> <p>VLAN ID—200</p>
FIP snooping mode and beacon period	<p>Set examine-vn2vn (VN2VN_Port FIP snooping)</p> <p>Beacon period—90000 ms</p>

Figure 8 on page 135 shows the network topology for this example.

Figure 8: VN2VN_Port FIP Snooping (FCoE Hosts Indirectly Connected) Topology

Configuration

To configure VN2VN_Port FIP snooping for VN_Ports that are indirectly connected across an aggregation layer FCoE transit switch, perform these tasks:

- [Configuring VN2VN_Port FIP Snooping on FCoE Transit Switch TS1 on page 136](#)
- [Configuring VN2VN_Port FIP Snooping on Aggregation Layer FCoE Transit Switch TS2 on page 137](#)
- [Configuring VN2VN_Port FIP Snooping on FCoE Transit Switch TS3 on page 138](#)

CLI Quick Configuration

The configuration for each FCoE transit switch is shown separately.

To quickly configure VN2VN_Port FIP snooping for FCoE hosts that are indirectly connected across an aggregation layer FCoE transit switch, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the [edit] hierarchy level. To configure FCoE transit switch TS1:

FCoE Transit Switch TS1

```
set interfaces xe-0/0/20 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/21 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/20 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/21 unit 0 family ethernet-switching vlan members vlan200
set vlans vlan200 vlan-id 200
set vlans vlan200 forwarding-options fip-security interface xe-0/0/21 fcoe-trusted
set vlans vlan200 forwarding-options fip-security examine-vn2vn beacon-period 90000
```

To quickly configure VN2VN_Port FIP snooping for FCoE hosts that are indirectly connected across an aggregation layer FCoE transit switch, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the [edit] hierarchy level. To configure FCoE transit switch TS2:

FCoE Transit Switch TS2

```
set interfaces xe-0/0/30 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/31 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/30 unit 0 family ethernet-switching vlan members vlan200
```

```

set interfaces xe-0/0/31 unit 0 family ethernet-switching vlan members vlan200
set vlans vlan200 vlan-id 200
set vlans vlan200 forwarding-options fip-security interface xe-0/0/30 fcoe-trusted
set vlans vlan200 forwarding-options fip-security interface xe-0/0/31 fcoe-trusted
set vlans vlan200 forwarding-options fip-security examine-vn2vn beacon-period 90000

```

To quickly configure VN2VN_Port FIP snooping for FCoE hosts that are indirectly connected across an aggregation layer FCoE transit switch, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the [edit] hierarchy level. To configure FCoE transit switch TS3:

FCoE Transit Switch TS3

```

set interfaces xe-0/0/10 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/11 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/10 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/11 unit 0 family ethernet-switching vlan members vlan200
set vlans vlan200 vlan-id 200
set vlans vlan200 forwarding-options fip-security interface xe-0/0/11 fcoe-trusted
set vlans vlan200 forwarding-options fip-security examine-vn2vn beacon-period 90000

```

Configuring VN2VN_Port FIP Snooping on FCoE Transit Switch TS1

Step-by-Step Procedure

To configure interface mode, configure interface VLAN membership in the FCoE VLAN dedicated to VN2VN_Port traffic, set the network-facing port as FCoE trusted, configure the VLAN, set the beacon period, and enable VN2VN_Port FIP snooping:

1. Configure the modes of the interfaces that connect directly to the FCoE host with ENode1 (**xe-0/0/20**) and to aggregation layer FCoE transit switch TS2 (**xe-0/0/21**):

```

user@switch# set interfaces xe-0/0/20 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/21 unit 0 family ethernet-switching interface-mode trunk

```

2. Configure the interface VLAN membership so that the interfaces are members of the dedicated VN2VN_Port VLAN (**vlan200**):

```

user@switch# set interfaces xe-0/0/20 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/21 unit 0 family ethernet-switching vlan members vlan200

```

3. Configure the FCoE VLAN dedicated to VN2VN_Port FIP snooping:

```

user@switch# set vlans vlan200 vlan-id 200

```

4. Configure the network-facing port (**xe-0/0/21**) as an FCoE trusted port:

```

user@switch# set vlans vlan200 forwarding-options fip-security interface xe-0/0/21 fcoe-trusted

```


5. Enable VN2VN_Port FIP snooping on the VLAN and configure the beacon period:

```
user@switch# set vlans vlan200 forwarding-options fip-security examine-vn2vn
beacon-period 90000
```

Configuring VN2VN_Port FIP Snooping on Aggregation Layer FCoE Transit Switch TS2

Step-by-Step Procedure

To configure interface mode, configure interface VLAN membership in the FCoE VLAN dedicated to VN2VN_Port traffic, set the network-facing ports as FCoE trusted, configure the VLAN, set the beacon period, and enable VN2VN_Port FIP snooping:

1. Configure the mode of the interfaces that connect directly to FCoE transit switches TS1 (**xe-0/0/31**) and TS3 (**xe-0/0/30**). Both interfaces are network-facing and must be configured as trunk interfaces:

```
user@switch# set interfaces xe-0/0/30 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/31 unit 0 family ethernet-switching interface-mode trunk
```

2. Configure the interface VLAN membership so that the interfaces are members of the dedicated VN2VN_Port VLAN (**vlan200**):

```
user@switch# set interfaces xe-0/0/30 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/31 unit 0 family ethernet-switching vlan members vlan200
```

3. Configure the FCoE VLAN dedicated to VN2VN_Port FIP snooping:

```
user@switch# set vlans vlan200 vlan-id 200
```

4. Configure the network-facing ports (**xe-0/0/30** and **xe-0/0/31**) as FCoE trusted ports:

```
user@switch# set vlans vlan200 forwarding-options fip-security interface xe-0/0/30 fcoe-trusted
user@switch# set vlans vlan200 forwarding-options fip-security interface xe-0/0/31 fcoe-trusted
```

5. Enable VN2VN_Port FIP snooping on the VLAN and configure the beacon period:

```
user@switch# set vlans vlan200 forwarding-options fip-security examine-vn2vn
beacon-period 90000
```

Configuring VN2VN_Port FIP Snooping on FCoE Transit Switch TS3

- Step-by-Step Procedure**
- To configure interface mode, configure interface VLAN membership in the FCoE VLAN dedicated to VN2VN_Port traffic, set the network-facing port as FCoE trusted, configure the VLAN, set the beacon period, and enable VN2VN_Port FIP snooping:
1. Configure the mode of the interfaces that connect directly to the FCoE host with ENode2 (**xe-0/0/10**) and to aggregation layer FCoE transit switch TS2 (**xe-0/0/11**):


```
user@switch# set interfaces xe-0/0/10 unit 0 family ethernet-switching interface-mode trunk
set interfaces xe-0/0/11 unit 0 family ethernet-switching interface-mode trunk
```
 2. Configure the interface VLAN membership so that the interfaces are members of the dedicated VN2VN_Port VLAN (**vlan200**):


```
user@switch# set interfaces xe-0/0/10 unit 0 family ethernet-switching vlan members vlan200
set interfaces xe-0/0/11 unit 0 family ethernet-switching vlan members vlan200
```
 3. Configure the FCoE VLAN dedicated to VN2VN_Port FIP snooping:


```
user@switch# set vlans vlan200 vlan-id 200
```
 4. Configure the network-facing port (**xe-0/0/11**) as an FCoE trusted port:


```
user@switch# set vlans vlan200 forwarding-options fip-security interface xe-0/0/11 fcoe-trusted
```
 5. Enable VN2VN_Port FIP snooping on the VLAN and configure the beacon period:


```
user@switch# set vlans vlan200 forwarding-options fip-security examine-vn2vn beacon-period 90000
```

Verification

To verify that the VN2VN_Port FIP snooping configuration has been created and is operating properly on all three switches, perform these tasks:

- [Verifying That VN2VN_Port FIP Snooping Is Enabled on the FCoE VLAN \(All Three Transit Switches\)](#) on page 138

Verifying That VN2VN_Port FIP Snooping Is Enabled on the FCoE VLAN (All Three Transit Switches)

- Purpose** Verify that VN2VN_Port FIP snooping is enabled on the correct VLAN (**vlan200**), the beacon period is set to **90000** milliseconds, and that the correct interfaces (**xe-0/0/20**)

and **xe-0/0/21** on TS1, **xe-0/0/30** and **xe-0/0/31** aggregation layer TS2, and **xe-0/0/10** and **xe-0/0/11** on TS3) are members of the VLAN.

Action List the FIP snooping information on transit switch TS1 using the operational mode command **show fip snooping detail**

```
user@switch> show fip snooping detail
VLAN: vlan200, Mode: VN2VN Snooping
FC-MAP: 0e:fc:00
Beacon_Period: 90000
VN2VN Mode: Point-to-Point
  Enode Information
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/20
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fc:00:01:0a:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fc:00:01:0b:01
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/21
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fc:00:01:0b:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fc:00:01:0a:01
```

List the FIP snooping information on aggregation layer transit switch TS2 using the operational mode command **show fip snooping detail**

```
user@switch> show fip snooping detail
VLAN: vlan200, Mode: VN2VN Snooping
FC-MAP: 0e:fc:00
Beacon_Period: 90000
VN2VN Mode: Point-to-Point
  Enode Information
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/30
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fc:00:01:0b:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fc:00:01:0a:01
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/31
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fc:00:01:0a:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fc:00:01:0b:01
```

List the FIP snooping information on transit switch TS3 using the operational mode command **show fip snooping detail**

```
user@switch> show fip snooping detail
VLAN: vlan200, Mode: VN2VN Snooping
```

```

FC-MAP: 0e:fd:00
Beacon_Period: 90000
VN2VN Mode: Point-to-Point
  Enode Information
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/10
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fd:00:00:0b:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fd:00:00:0a:01
    Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/11
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fd:00:00:0a:01
      Active Sessions : 1
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fd:00:00:0b:01

```

Meaning The **show fip snooping detail** command lists all of the transit switch information about VN2VN_Port FIP snooping and VN2VF_Port FIP snooping on each transit switch. The command shows that:

- The VLAN is **vlan200**.
- The mode is FIP snooping mode **VN2VN**, for VN2VN_Port FIP snooping. (If the Mode field shows **VN2VF**, then the FIP snooping mode is VN2VF_Port FIP snooping.)
- The beacon period is **90000**.
- The interfaces connected to the ENodes are **xe-0/0/20** and **xe-0/0/21** on transit switch TS1, **xe-0/0/30** and **xe-0/0/31** on aggregation layer transit switch TS2, and **xe-0/0/10** and **xe-0/0/11** on transit switch TS3. Because the transit switches are transparent passthrough switches, the network-facing trunk ports “see” the FCoE host ENodes at the far end of the VN2VN_Port virtual link.

In addition, this useful command shows information about the ENodes and the VN2VN_Port sessions.

- Related Documentation**
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to the Same FCoE Transit Switch\)](#) on page 120
 - [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to Different FCoE Transit Switches\)](#) on page 125
 - [Enabling VN2VN_Port FIP Snooping and Configuring the Beacon Period on an FCoE Transit Switch](#) on page 118
 - [Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch](#) on page 111

Disabling Enhanced FIP Snooping Scaling

Enhanced FIP snooping scaling (introduced in Junos OS Release 12.3) scales up to 2,500 sessions and is the default FIP snooping scaling mode. On QFabric systems only, you can disable enhanced FIP snooping scaling. Disabling FIP snooping scaling reduces the number of supported FIP snooping sessions to 376 sessions.

On QFabric system Node device in FCoE-FC gateway mode, you disable FIP snooping scaling globally, on all of the Fibre Channel (FC) fabrics (fc-fabrics) on the Node device. Either all FC fabrics on a Node device use enhanced FIP snooping scaling (2,500 sessions), or all FC fabrics on a Node device disable FIP snooping scaling (376 sessions). On an FCoE-FC gateway, you must disable FIP snooping scaling if the member interfaces of an FCoE VLAN are configured as members of an FCoE LAG *and* if the FC fabric is an FCoE untrusted fabric. If the FC fabric is an FCoE trusted fabric, then you do not need to disable FIP snooping scaling on the gateway.

On a QFabric system Node device in FCoE transit switch mode, you do not need to disable FIP snooping scaling. However, you can disable FIP snooping scaling on a per-VLAN basis if you want to do so.

Disabling FIP snooping scaling is done differently on an FCoE-FC gateway than on an FCoE transit switch. This document provides the method for each mode.

Disabling Enhanced FIP Snooping Scaling on an FCoE-FC Gateway

If you configure an FCoE LAG on an FCoE untrusted gateway fabric, you must disable FIP snooping scaling. Disabling FIP snooping scaling is global and affects all FC fabrics on the gateway.

```
1. admin@qfabric# set fc-options no-fip-snooping-scaling
```

Disabling Enhanced FIP Snooping Scaling on an FCoE Transit Switch

If you choose to disable FIP snooping scaling on an FCoE transit switch, you can disable it on individual FCoE VLANs:

```
1. admin@qfabric# set ethernet-switching-options secure-access-port vlan fcoe-vlan-name
   examine-fip no-fip-snooping-scaling
```

For example, if the FCoE VLAN name is **fcoe-vlan-blue**:

```
admin@qfabric# set ethernet-switching-options secure-access-port vlan fcoe-vlan-blue
   examine-fip no-fip-snooping-scaling
```

- Related Documentation**
- [Configuring an FCoE LAG on page 63](#)
 - [Example: Configuring an FCoE LAG on a Redundant Server Node Group on page 66](#)
 - [Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch on page 101](#)
 - [Understanding FCoE LAGs on page 57](#)

Understanding MC-LAGs on an FCoE Transit Switch

Use an MC-LAG to provide a redundant aggregation layer for Fibre Channel over Ethernet (FCoE) traffic.

This topic describes:

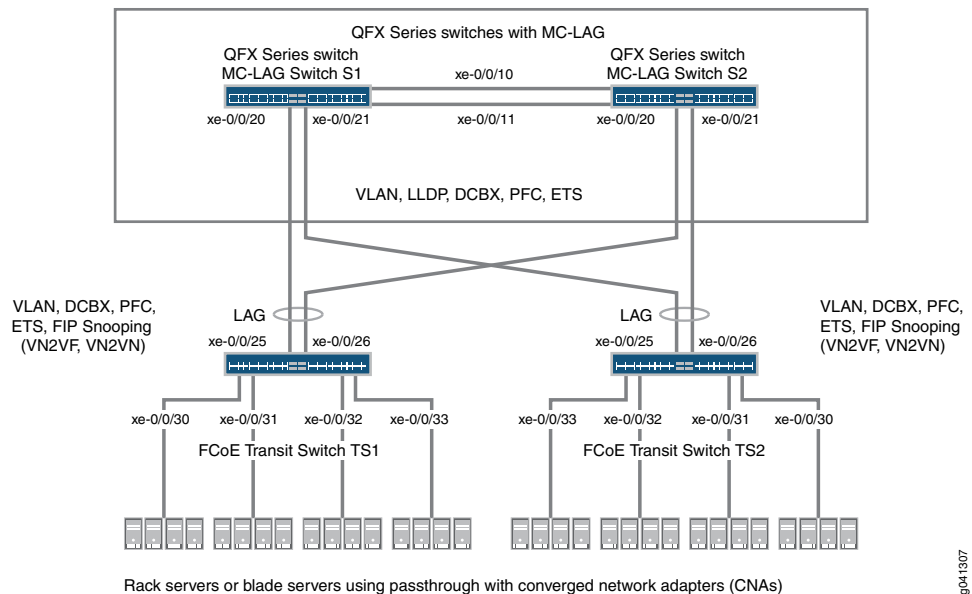
- [Supported MC-LAG Topology on page 143](#)
- [FIP Snooping and FCoE Trusted Ports on page 145](#)
- [CoS and Data Center Bridging \(DCB\) on page 146](#)

Supported MC-LAG Topology

To support lossless transport of FCoE traffic across an MC-LAG, you must configure the appropriate class of service (CoS) on both of the switches with MC-LAG port members. The CoS configuration must be the same on both of the MC-LAG switches because MC-LAGs do not carry forwarding class and IEEE 802.1p priority information.

Switches that are not directly connected to FCoE hosts and that act as pass-through transit switches support MC-LAGs for FCoE traffic in an *inverted-U* network topology. [Figure 9 on page 143](#) shows an inverted-U topology using QFX3500 switches.

Figure 9: Supported Topology for an MC-LAG on an FCoE Transit Switch



g041307

Standalone switches support MC-LAGs. QFabric system Node devices do not support MC-LAGs. Virtual Chassis and mixed-mode Virtual Chassis Fabric (VCF) configurations do not support FCoE. Only pure QFX5100 VCFs (consisting of only QFX5100 switches) support FCoE.

Ports that are part of an FCoE-FC gateway configuration (a virtual FCoE-FC gateway fabric) do not support MC-LAGs. Ports that are members of an MC-LAG act as pass-through transit switch ports.

The following rules and guidelines apply to MC-LAGs when used for FCoE traffic. The rules and guidelines help to ensure the proper handling and lossless transport characteristics required for FCoE traffic.

- The two switches that form the MC-LAG (Switches S1 and S2) cannot use ports that are part of an FCoE-FC gateway fabric. The MC-LAG switch ports must be pass-through transit switch ports (used as part of an intermediate transit switch that is not directly connected to FCoE hosts).
- MC-LAG Switches S1 and S2 cannot be directly connected to the FCoE hosts.
- The two switches that serve as access devices for FCoE hosts (FCoE Transit Switches TS1 and TS2) use standard LAGs to connect to MC-LAG Switches S1 and S2. FCoE Transit Switches TS1 and TS2 can be standalone switches or they can be Node devices in a QFabric system.
- Transit Switches TS1 and TS2 must use transit switch ports for the FCoE hosts and for the standard LAGs to MC-LAG Switches S1 and S2.
- Enable FIP snooping on the FCoE VLAN on Transit Switches TS1 and TS2. You can configure either VN_Port to VF_Port (VN2VF_Port) FIP snooping or VN_Port to VN_Port (VN2VN_Port) FIP snooping, depending on whether the FCoE hosts need to access targets in the FC SAN (VN2VF_Port FIP snooping) or targets in the Ethernet network (VN2VN_Port FIP snooping).

FIP snooping should be performed at the access edge and is not supported on MC-LAG switches. Do not enable FIP snooping on MC-LAG Switches S1 and S2. (Do not enable FIP snooping on the MC-LAG ports that connect Switches S1 and S2 to Switches TS1 and TS2 or on the LAG ports that connect Switch S1 to S2.)



NOTE: Juniper Networks QFX10000 aggregation switches do not support FIP snooping, so they cannot be used as FIP snooping access switches (Transit Switches TS1 and TS2) in this topology.

- The CoS configuration must be consistent on the MC-LAG switches. Because MC-LAGs carry no forwarding class or priority information, each MC-LAG switch needs to have the same CoS configuration to support lossless transport. (On each MC-LAG switch, the name, egress queue, and CoS provisioning of each forwarding class must be the same, and the priority-based flow control (PFC) configuration must be the same.)

Transit Switches (Server Access)

The role of FCoE Transit Switches TS1 and TS2 is to connect FCoE hosts in a multihomed fashion to the MC-LAG switches, so Transit Switches TS1 and TS2 act as access switches for the FCoE hosts. (FCoE hosts are directly connected to Transit Switches TS1 and TS2.)

The transit switch configuration depends on whether you want to do VN2VF_Port FIP snooping or VN2VN_Port FIP snooping, and whether the transit switches also have ports configured as part of an FCoE-FC gateway virtual fabric. Ports that a QFX3500 switch uses in an FCoE-FC gateway virtual fabric cannot be included in the transit switch LAG connection to the MC-LAG switches. (Ports cannot belong to both a transit switch and an FCoE-FC gateway; you must use different ports for each mode of operation.)

MC-LAG Switches (FCoE Aggregation)

The role of MC-LAG Switches S1 and S2 is to provide redundant, load-balanced connections between FCoE transit switches. The MC-LAG Switches S1 and S2 act as aggregation switches. FCoE hosts are not directly connected to the MC-LAG switches.

The MC-LAG switch configuration is the same regardless of which type of FIP snooping FCoE Transit Switches TS1 and TS2 perform.

FIP Snooping and FCoE Trusted Ports

To maintain secure access, enable VN2VF_Port FIP snooping or VN2VN_Port FIP snooping at the transit switch access ports connected directly to the FCoE hosts. FIP snooping should be performed at the access edge of the network to prevent unauthorized access. For example, in [Figure 9 on page 143](#), you enable FIP snooping on the FCoE VLANs on Transit Switches TS1 and TS2 that include the access ports connected to the FCoE hosts.

Do not enable FIP snooping on the switches used to create the MC-LAG. For example, in [Figure 9 on page 143](#), you would not enable FIP snooping on the FCoE VLANs on Switches S1 and S2.

Configure links between switches as FCoE trusted ports to reduce FIP snooping overhead and ensure that the system performs FIP snooping only at the access edge. In the sample topology, configure the Transit Switch TS1 and TS2 LAG ports connected to the MC-LAG switches as FCoE trusted ports, configure the Switch S1 and S2 MC-LAG ports connected to Switches TS1 and TS2 as FCoE trusted ports, and configure the ports in the LAG that connects Switches S1 to S2 as FCoE trusted ports.

CoS and Data Center Bridging (DCB)

The MC-LAG links do not carry forwarding class or priority information. The following CoS properties must have the same configuration on each MC-LAG switch or on each MC-LAG interface to support lossless transport:

- FCoE forwarding class name—For example, the forwarding class for FCoE traffic could use the default **fcoe** forwarding class on both MC-LAG switches.
- FCoE output queue—For example, the **fcoe** forwarding class could be mapped to queue 3 on both MC-LAG switches (queue 3 is the default mapping for the **fcoe** forwarding class).
- Classifier—The forwarding class for FCoE traffic must be mapped to the same IEEE 802.1p code point on each member interface of the MC-LAG on both MC-LAG switches. For example, the FCoE forwarding class **fcoe** could be mapped to IEEE 802.1p code point **011** (code point **011** is the default mapping for the **fcoe** forwarding class).
- Priority-based flow control (PFC)—PFC must be enabled on the FCoE code point on each MC-LAG switch and applied to each MC-LAG interface using a congestion notification profile.

You must also configure enhanced transmission selection (ETS) on the MC-LAG interfaces to provide sufficient scheduling resources (bandwidth, priority) for lossless transport. The ETS configuration can be different on each MC-LAG switch, as long as enough resources are scheduled to support lossless transport for the expected FCoE traffic.

Link Layer Discovery Protocol (LLDP) and Data Center Bridging Capability Exchange Protocol (DCBX) must be enabled on each MC-LAG member interface (LLDP and DCBX are enabled by default on all interfaces).



NOTE: As with all other FCoE configurations, FCoE traffic requires a dedicated VLAN that carries only FCoE traffic, and IGMP snooping must be disabled on the FCoE VLAN.

Example: Configuring CoS Using ELS for FCoE Transit Switch Traffic Across an MC-LAG

Multichassis link aggregation groups (MC-LAGs) provide redundancy and load balancing between two QFX Series switches, multihoming support for client devices such as servers, and a loop-free Layer 2 network without running Spanning Tree Protocol (STP).



NOTE: This example uses the Junos OS Enhanced Layer 2 Software (ELS) configuration style for QFX Series switches. If your switch runs software that does not support ELS, see *Example: Configuring CoS for FCoE Transit Switch Traffic Across an MC-LAG*. For ELS details, see *Using the Enhanced Layer 2 Software CLI*.

You can use an MC-LAG to provide a redundant aggregation layer for Fibre Channel over Ethernet (FCoE) traffic in an *inverted-U* topology. To support lossless transport of FCoE traffic across an MC-LAG, you must configure the appropriate class of service (CoS) on both of the QFX Series switches with MC-LAG port members. The CoS configuration must be the same on both of the MC-LAG switches because an MC-LAG does not carry forwarding class and IEEE 802.1p priority information.

Ports that are members of an MC-LAG act as FCoE passthrough transit switch ports.



NOTE: This example describes how to configure CoS to provide lossless transport for FCoE traffic across an MC-LAG that connects two QFX Series switches. It also describes how to configure CoS on the FCoE transit switches that connect FCoE hosts to the QFX Series switches that form the MC-LAG.

This example does *not* describe how to configure the MC-LAG itself. For a detailed example of MC-LAG configuration, see *Example: Configuring Multichassis Link Aggregation*. However, this example includes a subset of MC-LAG configuration that only shows how to configure interface membership in the MC-LAG.



NOTE: Juniper Networks QFX10000 aggregation switches do not support FIP snooping, so they cannot be used as FIP snooping access switches (Transit Switches TS1 and TS2) in this example. However, QFX10000 switches can play the role of the MC-LAG switches (MC-LAG Switch S1 and MC-LAG Switch S2) in this example.

QFX3500 and QFX3600 Virtual Chassis switches do not support FCoE.

This topic describes:

- [Requirements on page 147](#)
- [Overview on page 148](#)
- [Configuration on page 153](#)
- [Verification on page 164](#)

Requirements

This example uses the following hardware and software components:

- Two Juniper Networks QFX5100 Switches running the ELS CLI that form an MC-LAG for FCoE traffic.
- Two Juniper Networks QFX5100 Switches running the ELS CLI that provide FCoE server access in transit switch mode and that connect to the MC-LAG switches.
- FCoE servers (or other FCoE hosts) connected to the transit switches.
- Junos OS Release 13.2 or later for the QFX Series.

Overview

FCoE traffic requires lossless transport. This example shows you how to:

- Configure CoS for FCoE traffic on the two QFX5100 switches that form the MC-LAG, including priority-based flow control (PFC). The example also includes configuration for both enhanced transmission selection (ETS) hierarchical scheduling of resources for the FCoE forwarding class priority and for the forwarding class set priority group, and also direct port scheduling. You can only use one of the scheduling methods on a port. Different switches support different scheduling methods.



NOTE: Configuring or changing PFC on an interface blocks the entire port until the PFC change is completed. After a PFC change is completed, the port is unblocked and traffic resumes. Blocking the port stops ingress and egress traffic, and causes packet loss on all queues on the port until the port is unblocked.

- Configure CoS for FCoE on the two FCoE transit switches that connect FCoE hosts to the MC-LAG switches and enable FIP snooping on the FCoE VLAN at the FCoE transit switch access ports.
- Configure the appropriate port mode, MTU, and FCoE trusted or untrusted state for each interface to support lossless FCoE transport.

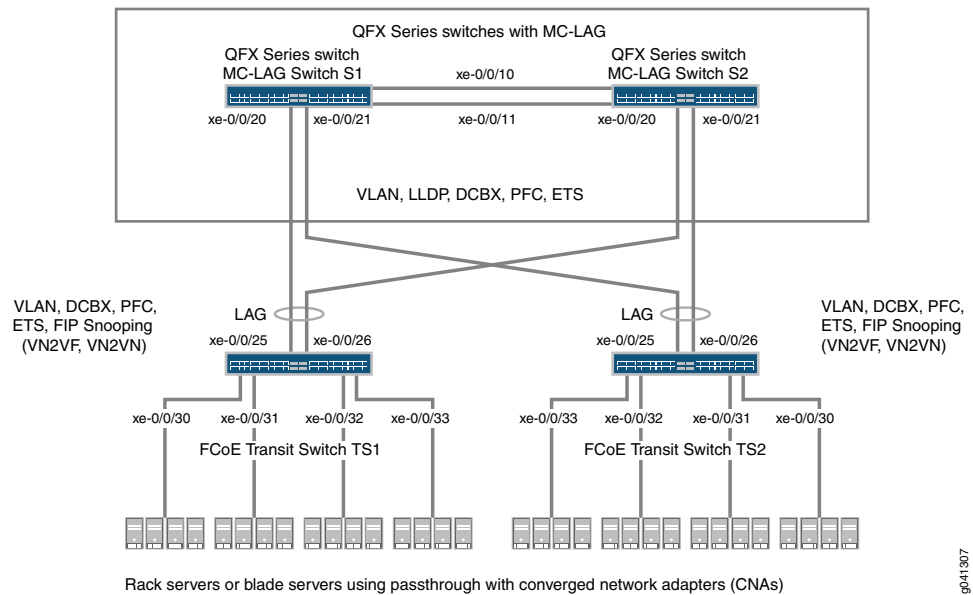


NOTE: Do not enable IGMP snooping on the FCoE VLAN. (IGMP snooping is enabled on the default VLAN by default, but is disabled by default on all other VLANs.)

Topology

QFX5100 switches that act as transit switches support MC-LAGs for FCoE traffic in an inverted-U network topology, as shown in [Figure 10 on page 149](#).

Figure 10: Supported Topology for an MC-LAG on an FCoE Transit Switch



NOTE: Juniper Networks QFX10000 aggregation switches do not support FIP snooping, so they cannot be used as FIP snooping access switches (Transit Switches TS1 and TS2) in this example. However, QFX10000 switches can play the role of the MC-LAG switches (MC-LAG Switch S1 and MC-LAG Switch S2) in this example.

Table 11 on page 149 shows the configuration components for this example.

Table 11: Components of the CoS for FCoE Traffic Across an MC-LAG Configuration Topology

Component	Settings
Hardware	Four QFX5100 switches running the ELS CLI (two to form the MC-LAG as passthrough transit switches and two transit switches for FCoE access).
Forwarding class (all switches)	Default fcoe forwarding class.
Classifier (forwarding class mapping of incoming traffic to IEEE priority)	Default IEEE 802.1p trusted classifier on all FCoE interfaces.

Table 11: Components of the CoS for FCoE Traffic Across an MC-LAG Configuration Topology (continued)

Component	Settings
LAGs and MC-LAG	<p>S1—Ports xe-0/0/10 and x-0/0/11 are members of LAG ae0, which connects Switch S1 to Switch S2. Ports xe-0/0/20 and xe-0/0/21 are members of MC-LAG ae1. All ports are configured in trunk interface mode, as fcoe-trusted, and with an MTU of 2180.</p> <p>S2—Ports xe-0/0/10 and x-0/0/11 are members of LAG ae0, which connects Switch S2 to Switch S1. Ports xe-0/0/20 and xe-0/0/21 are members of MC-LAG ae1. All ports are configured in trunk interface mode, as fcoe-trusted, and with an MTU of 2180.</p> <p>NOTE: Ports xe-0/0/20 and xe-0/0/21 on Switches S1 and S2 are the members of the MC-LAG.</p> <p>TS1—Ports xe-0/0/25 and x-0/0/26 are members of LAG ae1, configured in trunk interface mode, as fcoe-trusted, and with an MTU of 2180. Ports xe-0/0/30, xe-0/0/31, xe-0/0/32, and xe-0/0/33 are configured in trunk interface mode, with an MTU of 2180.</p> <p>TS2—Ports xe-0/0/25 and x-0/0/26 are members of LAG ae1, configured in trunk interface mode, as fcoe-trusted, and with an MTU of 2180. Ports xe-0/0/30, xe-0/0/31, xe-0/0/32, and xe-0/0/33 are configured in trunk interface mode, with an MTU of 2180.</p>
FCoE queue scheduler (all switches)	<p>fcoe-sched: Minimum bandwidth 3g Maximum bandwidth 100% Priority low</p>
Forwarding class-to-scheduler mapping (all switches)	<p>Scheduler map fcoe-map: Forwarding class fcoe Scheduler fcoe-sched</p>
PFC congestion notification profile (all switches)	<p>fcoe-cnp: Code point 011</p> <p>Ingress interfaces:</p> <ul style="list-style-type: none"> • S1—LAG ae0 and MC-LAG ae1 • S2—LAG ae0 and MC-LAG ae1 • TS1—LAG ae1, interfaces xe-0/0/30, xe-0/0/31, xe-0/0/32, and xe-0/0/33 • TS2—LAG ae1, interfaces xe-0/0/30, xe-0/0/31, xe-0/0/32, and xe-0/0/33
FCoE VLAN name and tag ID	<p>Name—fcoe_vlan ID—100</p> <p>Include the FCoE VLAN on the interfaces that carry FCoE traffic on all four switches.</p>

Table 11: Components of the CoS for FCoE Traffic Across an MC-LAG Configuration Topology (continued)

Component	Settings
ETS only—forwarding class set (FCoE priority group, all switches)	fcoe-pg: Forwarding class fcoe Egress interfaces: <ul style="list-style-type: none"> • S1—LAG ae0 and MC-LAG ae1 • S2—LAG ae0 and MC-LAG ae1 • TS1—LAG ae1, interfaces xe-0/0/30, xe-0/0/31, xe-0/0/32, and xe-0/0/33 • TS2—LAG ae1, interfaces xe-0/0/30, xe-0/0/31, xe-0/0/32, and xe-0/0/33
ETS only—traffic control profile (all switches)	fcoe-tcp: Scheduler map fcoe-map Minimum bandwidth 3g Maximum bandwidth 100% The traffic control profile is applied to the same interfaces as the forwarding class set, using the same CLI statement. This applies ETS hierarchical scheduling to the interfaces.
Port scheduling only—apply scheduling to interfaces	On switches that support direct port scheduling, if you use port scheduling, apply scheduling by attaching the scheduler map directly to interfaces: <ul style="list-style-type: none"> • S1—LAG ae0 and MC-LAG ae1 • S2—LAG ae0 and MC-LAG ae1 • TS1—LAG ae1, interfaces xe-0/0/30, xe-0/0/31, xe-0/0/32, and xe-0/0/33 • TS2—LAG ae1, interfaces xe-0/0/30, xe-0/0/31, xe-0/0/32, and xe-0/0/33
FIP snooping	Enable FIP snooping on Transit Switches TS1 and TS2 on the FCoE VLAN. Configure the LAG interfaces that connect to the MC-LAG switches as FCoE trusted interfaces so that they do not perform FIP snooping. This example enables VN2VN_Port FIP snooping on the FCoE transit switch interfaces connected to the FCoE servers. The example is equally valid with VN2VF_Port FIP snooping enabled on the transit switch access ports. The method of FIP snooping you enable depends on your network configuration. NOTE: Juniper Networks QFX10000 aggregation switches do not support FIP snooping, so they cannot be used as FIP snooping access switches (Transit Switches TS1 and TS2) in this example.



NOTE: This example uses the default IEEE 802.1p trusted BA classifier, which is automatically applied to trunk mode interfaces if you do not apply an explicitly configured classifier.

To configure CoS for FCoE traffic across an MC-LAG:

- Use the default FCoE forwarding class and forwarding-class-to-queue mapping (do not explicitly configure the FCoE forwarding class or output queue). The default FCoE forwarding class is **fcoe**, and the default output queue is queue **3**.
- Use the default trusted BA classifier, which maps incoming packets to forwarding classes by the IEEE 802.1p code point (CoS priority) of the packet. The trusted classifier is the default classifier for interfaces in trunk interface mode. The default trusted classifier maps incoming packets with the IEEE 802.1p code point 3 (**011**) to the FCoE forwarding class. If you choose to configure the BA classifier instead of using the default classifier, you must ensure that FCoE traffic is classified into forwarding classes in exactly the same way on both MC-LAG switches. Using the default classifier ensures consistent classifier configuration on the MC-LAG ports.
- Configure a congestion notification profile that enables PFC on the FCoE code point (code point **011** in this example). The congestion notification profile configuration must be the same on both MC-LAG switches.
- Apply the congestion notification profile to the interfaces.
- Configure the interface mode, MTU, and FCoE trusted or untrusted state for each interface to support lossless FCoE transport.
- For ETS hierarchical port scheduling, configure ETS on the interfaces to provide the bandwidth required for lossless FCoE transport. Configuring ETS includes configuring bandwidth scheduling for the FCoE forwarding class, a forwarding class set (priority group) that includes the FCoE forwarding class, and a traffic control profile to assign bandwidth to the forwarding class set that includes FCoE traffic, and applying the traffic control profile and forwarding class set to interfaces..

On switches that support direct port scheduling, configure CoS properties on interfaces by applying scheduler maps directly to interfaces.

In addition, this example describes how to enable FIP snooping on the Transit Switch TS1 and TS2 ports that are connected to the FCoE servers. To provide secure access, FIP snooping must be enabled on the FCoE access ports.

This example focuses on the CoS configuration to support lossless FCoE transport across an MC-LAG. This example does not describe how to configure the properties of MC-LAGs and LAGs, although it does show you how to configure the port characteristics required to support lossless transport and how to assign interfaces to the MC-LAG and to the LAGs.

Before you configure CoS, configure:

- The MC-LAGs that connect Switches S1 and S2 to Switches TS1 and TS2. (*Example: Configuring Multichassis Link Aggregation* describes how to configure MC-LAGs.)
- The LAGs that connect the Transit Switches TS1 and TS2 to MC-LAG Switches S1 and S2. (*Configuring Link Aggregation* describes how to configure LAGs.)
- The LAG that connects Switch S1 to Switch S2.

Configuration

To configure CoS for lossless FCoE transport across an MC-LAG, perform these tasks:

- [MC-LAG Switches S1 and S2 Common Configuration \(Applies to ETS and Port Scheduling\) on page 155](#)
- [MC-LAG Switches S1 and S2 ETS Hierarchical Scheduling Configuration on page 157](#)
- [MC-LAG Switches S1 and S2 Port Scheduling Configuration on page 157](#)
- [FCoE Transit Switches TS1 and TS2 Common Configuration \(Applies to ETS and Port Scheduling\) on page 158](#)
- [FCoE Transit Switches TS1 and TS2 ETS Hierarchical Scheduling Configuration on page 160](#)
- [FCoE Transit Switches TS1 and TS2 Port Scheduling Configuration on page 161](#)
- [Results on page 161](#)

CLI Quick Configuration



NOTE: The CLI configurations for the MC-LAG switches and for the FCoE transit switches are each separated into three sections:

- Configuration common to all port scheduling methods
- Configuration specific to ETS hierarchical port scheduling
- Configuration specific to direct port scheduling

MC-LAG Switch S1 and Switch S2

To quickly configure CoS for lossless FCoE transport across an MC-LAG, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI for MC-LAG Switch S1 and MC-LAG Switch S2 at the **[edit]** hierarchy level. The configurations on Switches S1 and S2 are identical because the CoS configuration must be identical, and because this example uses the same ports on both switches.

MC-LAG Switches Configuration Common to ETS Hierarchical Port Scheduling and to Direct Port Scheduling

```
set class-of-service schedulers fcoe-sched priority low transmit-rate 3g
set class-of-service schedulers fcoe-sched shaping-rate percent 100
set class-of-service scheduler-maps fcoe-map forwarding-class fcoe scheduler fcoe-sched
set class-of-service congestion-notification-profile fcoe-cnp input ieee-802.1 code-point 011 pfc
set class-of-service interfaces ae0 congestion-notification-profile fcoe-cnp
set class-of-service interfaces ae1 congestion-notification-profile fcoe-cnp
set vlans fcoe_vlan vlan-id 100
set interfaces xe-0/0/10 ether-options 802.3ad ae0
set interfaces xe-0/0/11 ether-options 802.3ad ae0
set interfaces xe-0/0/20 ether-options 802.3ad ae1
set interfaces xe-0/0/21 ether-options 802.3ad ae1
set interfaces ae0 unit 0 family ethernet-switching interface-mode trunk vlan members fcoe_vlan
set interfaces ae1 unit 0 family ethernet-switching interface-mode trunk vlan members fcoe_vlan
set interfaces ae0 mtu 2180
```

```

set interfaces ae1 mtu 2180
set vlans fcoe_vlan forwarding-options fip-security interface ae0 fcoe-trusted
set vlans fcoe_vlan forwarding-options fip-security interface ae1 fcoe-trusted

```

MC-LAG Switches Configuration for ETS Hierarchical Port Scheduling

```

set class-of-service forwarding-class-sets fcoe-pg class fcoe
set class-of-service traffic-control-profiles fcoe-tcp scheduler-map fcoe-map guaranteed-rate
3g
set class-of-service traffic-control-profiles fcoe-tcp shaping-rate percent 100
set class-of-service interfaces ae0 forwarding-class-set fcoe-pg output-traffic-control-profile
fcoe-tcp
set class-of-service interfaces ae1 forwarding-class-set fcoe-pg output-traffic-control-profile
fcoe-tcp

```

MC-LAG Switches Configuration for Direct Port Scheduling

```

set class-of-service interfaces ae0 scheduler-map fcoe-map
set class-of-service interfaces ae1 scheduler-map fcoe-map

```

FCoE Transit Switch TS1 and Switch TS2

To quickly configure CoS for lossless FCoE transport across an MC-LAG, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI for Transit Switch TS1 and Transit Switch TS2 at the **[edit]** hierarchy level. The configurations on Switches TS1 and TS2 are identical because the CoS configuration must be identical, and because this example uses the same ports on both switches.

FCoE Transit Switches Configuration Common to ETS Hierarchical Port Scheduling and to Direct Port Scheduling

```

set class-of-service schedulers fcoe-sched priority low transmit-rate 3g
set class-of-service schedulers fcoe-sched shaping-rate percent 100
set class-of-service scheduler-maps fcoe-map forwarding-class fcoe scheduler fcoe-sched
set class-of-service congestion-notification-profile fcoe-cnp input ieee-802.1 code-point 011 pfc
set class-of-service interfaces ae1 congestion-notification-profile fcoe-cnp
set class-of-service interfaces xe-0/0/30 congestion-notification-profile fcoe-cnp
set class-of-service interfaces xe-0/0/31 congestion-notification-profile fcoe-cnp
set class-of-service interfaces xe-0/0/32 congestion-notification-profile fcoe-cnp
set class-of-service interfaces xe-0/0/33 congestion-notification-profile fcoe-cnp
set vlans fcoe_vlan vlan-id 100
set interfaces xe-0/0/25 ether-options 802.3ad ae1
set interfaces xe-0/0/26 ether-options 802.3ad ae1
set interfaces ae1 unit 0 family ethernet-switching interface-mode trunk vlan members fcoe_vlan
set interfaces xe-0/0/30 unit 0 family ethernet-switching interface-mode trunk vlan members
fcoe_vlan
set interfaces xe-0/0/31 unit 0 family ethernet-switching interface-mode trunk vlan members
fcoe_vlan
set interfaces xe-0/0/32 unit 0 family ethernet-switching interface-mode trunk vlan members
fcoe_vlan
set interfaces xe-0/0/33 unit 0 family ethernet-switching interface-mode trunk vlan members
fcoe_vlan
set interfaces ae1 mtu 2180
set interfaces xe-0/0/30 mtu 2180
set interfaces xe-0/0/31 mtu 2180
set interfaces xe-0/0/32 mtu 2180
set interfaces xe-0/0/33 mtu 2180

```

```
set vlans fcoe_vlan forwarding-options fip-security interface ae1 fcoe-trusted
set vlans fcoe_vlan forwarding-options fip-security examine-vn2v2 beacon-period 90000
```

FCoE Transit Switches Configuration for ETS Hierarchical Port Scheduling

```
set class-of-service forwarding-class-sets fcoe-pg class fcoe
set class-of-service traffic-control-profiles fcoe-tcp scheduler-map fcoe-map guaranteed-rate
3g
set class-of-service traffic-control-profiles fcoe-tcp shaping-rate percent 100
set class-of-service interfaces ae1 forwarding-class-set fcoe-pg output-traffic-control-profile
fcoe-tcp
set class-of-service interfaces xe-0/0/30 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
set class-of-service interfaces xe-0/0/31 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
set class-of-service interfaces xe-0/0/32 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
set class-of-service interfaces xe-0/0/33 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
```

FCoE Transit Switches Configuration for Direct Port Scheduling

```
set class-of-service interfaces ae1 scheduler-map fcoe-map
set class-of-service interfaces xe-0/0/30 scheduler-map fcoe-map
set class-of-service interfaces xe-0/0/31 scheduler-map fcoe-map
set class-of-service interfaces xe-0/0/32 scheduler-map fcoe-map
set class-of-service interfaces xe-0/0/33 scheduler-map fcoe-map
```

MC-LAG Switches S1 and S2 Common Configuration (Applies to ETS and Port Scheduling)

Step-by-Step Procedure

To configure queue scheduling, PFC, the FCoE VLAN, and LAG and MC-LAG interface membership and characteristics to support lossless FCoE transport across an MC-LAG (this example uses the default **fcoe** forwarding class and the default classifier to map incoming FCoE traffic to the FCoE IEEE 802.1p code point **011**), for both ETS hierarchical port scheduling and port scheduling (common configuration):

1. Configure output scheduling for the FCoE queue:

```
[edit class-of-service]
user@switch# set schedulers fcoe-sched priority low transmit-rate 3g
user@switch# set schedulers fcoe-sched shaping-rate percent 100
```

2. Map the FCoE forwarding class to the FCoE scheduler (**fcoe-sched**):

```
[edit class-of-service]
user@switch# set scheduler-maps fcoe-map forwarding-class fcoe scheduler fcoe-sched
```

3. Enable PFC on the FCoE priority by creating a congestion notification profile (**fcoe-cnp**) that applies FCoE to the IEEE 802.1 code point **011**:

```
[edit class-of-service]
```

```
user@switch# set congestion-notification-profile fcoe-cnp input ieee-802.1 code-point 011 pfc
```

4. Apply the PFC configuration to the LAG and MC-LAG interfaces:

```
[edit class-of-service]
user@switch# set interfaces ae0 congestion-notification-profile fcoe-cnp
user@switch# set interfaces ae1 congestion-notification-profile fcoe-cnp
```

5. Configure the VLAN for FCoE traffic (**fcoe_vlan**):

```
[edit vlans]
user@switch# set fcoe_vlan vlan-id 100
```

6. Add the member interfaces to the LAG between the two MC-LAG switches:

```
[edit interfaces]
user@switch# set xe-0/0/10 ether-options 802.3ad ae0
user@switch# set xe-0/0/11 ether-options 802.3ad ae0
```

7. Add the member interfaces to the MC-LAG:

```
[edit interfaces]
user@switch# set xe-0/0/20 ether-options 802.3ad ae1
user@switch# set xe-0/0/21 ether-options 802.3ad ae1
```

8. Configure the interface mode as **trunk** and membership in the FCoE VLAN (**fcoe_vlan**) for the LAG (**ae0**) and for the MC-LAG (**ae1**):

```
[edit interfaces]
user@switch# set interfaces ae0 unit 0 family ethernet-switching interface-mode trunk
vlan members fcoe_vlan
user@switch# set interfaces ae1 unit 0 family ethernet-switching interface-mode trunk
vlan members fcoe_vlan
```

9. Set the MTU to **2180** for the LAG and MC-LAG interfaces. 2180 bytes is the minimum size required to handle FCoE packets because of the payload and header sizes; you can configure the MTU to a higher number of bytes if desired, but not less than 2180 bytes:

```
[edit interfaces]
user@switch# set ae0 mtu 2180
user@switch# set ae1 mtu 2180
```

10. Set the LAG and MC-LAG interfaces as FCoE trusted ports. Ports that connect to other switches should be trusted and should not perform FIP snooping:

```
[edit]
user@switch# set vlans fcoe_vlan forwarding-options fip-security interface ae0 fcoe-trusted
```

```
user@switch# set vlans fcoe_vlan forwarding-options fip-security interface ae1 fcoe-trusted
```

MC-LAG Switches S1 and S2 ETS Hierarchical Scheduling Configuration

Step-by-Step Procedure To configure the forwarding class set (priority group) and priority group scheduling (in a traffic control profile), and apply the ETS hierarchical scheduling for FCoE traffic to interfaces:

1. Configure the forwarding class set (**fcoe-pg**) for the FCoE traffic:

```
[edit class-of-service]
user@switch# set forwarding-class-sets fcoe-pg class fcoe
```

2. Define the traffic control profile (**fcoe-tcp**) to use on the FCoE forwarding class set:

```
[edit class-of-service]
user@switch# set traffic-control-profiles fcoe-tcp scheduler-map fcoe-map
guaranteed-rate 3g
user@switch# set traffic-control-profiles fcoe-tcp shaping-rate percent 100
```

3. Apply the FCoE forwarding class set and traffic control profile to the LAG and MC-LAG interfaces:

```
[edit class-of-service]
user@switch# set interfaces ae0 forwarding-class-set fcoe-pg output-traffic-control-profile
fcoe-tcp
user@switch# set interfaces ae1 forwarding-class-set fcoe-pg output-traffic-control-profile
fcoe-tcp
```

MC-LAG Switches S1 and S2 Port Scheduling Configuration

Step-by-Step Procedure To apply port scheduling for FCoE traffic to interfaces:

1. Apply the scheduler map to the egress ports:

```
set class-of-service interfaces ae0 scheduler-map fcoe-map
set class-of-service interfaces ae1 scheduler-map fcoe-map
```

FCoE Transit Switches TS1 and TS2 Common Configuration (Applies to ETS and Port Scheduling)

Step-by-Step Procedure

The CoS configuration on FCoE Transit Switches TS1 and TS2 is similar to the CoS configuration on MC-LAG Switches S1 and S2. However, the port configurations differ, and you must enable FIP snooping on the Switch TS1 and Switch TS2 FCoE access ports.

To configure queue scheduling, PFC, the FCoE VLAN, and LAG interface membership and characteristics to support lossless FCoE transport across the MC-LAG (this example uses the default **fcoe** forwarding class and the default classifier to map incoming FCoE traffic to the FCoE IEEE 802.1p code point **011**, so you do not configure them), or both ETS hierarchical scheduling and port scheduling (common configuration):

1. Configure output scheduling for the FCoE queue:

```
[edit class-of-service]
user@switch# set schedulers fcoe-sched priority low transmit-rate 3g
user@switch# set schedulers fcoe-sched shaping-rate percent 100
```

2. Map the FCoE forwarding class to the FCoE scheduler (**fcoe-sched**):

```
[edit class-of-service]
user@switch# set scheduler-maps fcoe-map forwarding-class fcoe scheduler fcoe-sched
```

3. Enable PFC on the FCoE priority by creating a congestion notification profile (**fcoe-cnp**) that applies FCoE to the IEEE 802.1 code point **011**:

```
[edit class-of-service]
user@switch# set congestion-notification-profile fcoe-cnp input ieee-802.1 code-point 011 pfc
```

4. Apply the PFC configuration to the LAG interface and to the FCoE access interfaces:

```
[edit class-of-service]
user@switch# set interfaces ae1 congestion-notification-profile fcoe-cnp
user@switch# set class-of-service interfaces xe-0/0/30 congestion-notification-profile fcoe-cnp
user@switch# set class-of-service interfaces xe-0/0/31 congestion-notification-profile fcoe-cnp
user@switch# set class-of-service interfaces xe-0/0/32 congestion-notification-profile fcoe-cnp
user@switch# set class-of-service interfaces xe-0/0/33 congestion-notification-profile fcoe-cnp
```

5. Configure the VLAN for FCoE traffic (**fcoe_vlan**):

```
[edit vlans]
user@switch# set fcoe_vlan vlan-id 100
```

6. Add the member interfaces to the LAG:

```
[edit interfaces]
user@switch# set xe-0/0/25 ether-options 802.3ad ae1
user@switch# set xe-0/0/26 ether-options 802.3ad ae1
```

7. On the LAG (**ae1**), configure the interface mode as **trunk** and membership in the FCoE VLAN (**fcoe_vlan**):

```
[edit interfaces]
user@switch# set interfaces ae1 unit 0 family ethernet-switching interface-mode trunk
vlan members fcoe_vlan
```

8. On the FCoE access interfaces (**xe-0/0/30**, **xe-0/0/31**, **xe-0/0/32**, **xe-0/0/33**), configure the interface mode as **trunk** and membership in the FCoE VLAN (**fcoe_vlan**):

```
[edit interfaces]
user@switch# set interfaces xe-0/0/30 unit 0 family ethernet-switching interface-mode
trunk vlan members fcoe_vlan
user@switch# set interfaces xe-0/0/31 unit 0 family ethernet-switching interface-mode
trunk vlan members fcoe_vlan
user@switch# set interfaces xe-0/0/32 unit 0 family ethernet-switching interface-mode
trunk vlan members fcoe_vlan
user@switch# set interfaces xe-0/0/33 unit 0 family ethernet-switching interface-mode
trunk vlan members fcoe_vlan
```

9. Set the MTU to **2180** for the LAG and FCoE access interfaces. 2180 bytes is the minimum size required to handle FCoE packets because of the payload and header sizes; you can configure the MTU to a higher number of bytes if desired, but not less than 2180 bytes:

```
[edit interfaces]
user@switch# set ae1 mtu 2180
user@switch# set xe-0/0/30 mtu 2180
user@switch# set xe-0/0/31 mtu 2180
user@switch# set xe-0/0/32 mtu 2180
user@switch# set xe-0/0/33 mtu 2180
```

10. Set the LAG interface as an FCoE trusted port. Ports that connect to other switches should be trusted and should not perform FIP snooping:

```
[edit]
user@switch# set vlans fcoe_vlan forwarding-options fip-security interface ae1 fcoe-trusted
```



NOTE: Access ports **xe-0/0/30**, **xe-0/0/31**, **xe-0/0/32**, and **xe-0/0/33** are not configured as FCoE trusted ports. The access ports remain in the default state as untrusted ports because they connect directly to FCoE devices and must perform FIP snooping to ensure network security.

11. Enable FIP snooping on the FCoE VLAN to prevent unauthorized FCoE network access (this example uses VN2VN_Port FIP snooping; the example is equally valid if you use VN2VF_Port FIP snooping):

```
[edit]
user@switch# set vlans fcoe_vlan forwarding-options fip-security examine-vn2vn
beacon-period 90000
```



NOTE: QFX10000 switches do not support FIP snooping and cannot be used as FCoE access transit switches. (QFX10000 switches can be used as FCoE aggregation switches.)

FCoE Transit Switches TS1 and TS2 ETS Hierarchical Scheduling Configuration

Step-by-Step Procedure To configure the forwarding class set (priority group) and priority group scheduling (in a traffic control profile), and apply the ETS hierarchical scheduling for FCoE traffic to interfaces:

1. Configure the forwarding class set (**fcoe-pg**) for the FCoE traffic:

```
[edit class-of-service]
user@switch# set forwarding-class-sets fcoe-pg class fcoe
```

2. Define the traffic control profile (**fcoe-tcp**) to use on the FCoE forwarding class set:

```
[edit class-of-service]
user@switch# set traffic-control-profiles fcoe-tcp scheduler-map fcoe-map
guaranteed-rate 3g
user@switch# set traffic-control-profiles fcoe-tcp shaping-rate percent 100
```

3. Apply the FCoE forwarding class set and traffic control profile to the LAG interface and to the FCoE access interfaces:

```
[edit class-of-service]
user@switch# set interfaces ae1 forwarding-class-set fcoe-pg output-traffic-control-profile
fcoe-tcp
user@switch# set class-of-service interfaces xe-0/0/30 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
user@switch# set class-of-service interfaces xe-0/0/31 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
user@switch# set class-of-service interfaces xe-0/0/32 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
user@switch# set class-of-service interfaces xe-0/0/33 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
```


FCoE Transit Switches TS1 and TS2 Port Scheduling Configuration

Step-by-Step Procedure

To apply port scheduling for FCoE traffic to interfaces:

1. Apply the scheduler map to the egress ports:

```
user@switch# set class-of-service interfaces ae1 scheduler-map fcoe-map
user@switch# set class-of-service interfaces xe-0/0/30 scheduler-map fcoe-map
user@switch# set class-of-service interfaces xe-0/0/31 scheduler-map fcoe-map
user@switch# set class-of-service interfaces xe-0/0/32 scheduler-map fcoe-map
user@switch# set class-of-service interfaces xe-0/0/33 scheduler-map fcoe-map
```

Results

Display the results of the CoS configuration on MC-LAG Switch S1 and on MC-LAG Switch S2 (the results on both switches are the same). The results are from the ETS hierarchical scheduling configuration, which shows the more complex configuration. Direct port scheduling results would not show the traffic control profile or forwarding class set portions of the configuration, but would display the name of the scheduler map under each interface (instead of the names of the forwarding class set and output traffic control profile). Other than that, they are the same.

```
user@switch> show configuration class-of-service
traffic-control-profiles {
  fcoe-tcp {
    scheduler-map fcoe-map;
    shaping-rate percent 100;
    guaranteed-rate 30000000000;
  }
}
forwarding-class-sets {
  fcoe-pg {
    class fcoe;
  }
}
congestion-notification-profile {
  fcoe-cnp {
    input {
      ieee-802.1 {
        code-point 011 {
          pfc;
        }
      }
    }
  }
}
}
interfaces {
  ae0 {
    forwarding-class-set {
      fcoe-pg {
        output-traffic-control-profile fcoe-tcp;
      }
    }
  }
}
```

```

    }
  }
  congestion-notification-profile fcoe-cnp;
}
ae1 {
  forwarding-class-set {
    fcoe-pg {
      output-traffic-control-profile fcoe-tcp;
    }
  }
  congestion-notification-profile fcoe-cnp;
}
}
scheduler-maps {
  fcoe-map {
    forwarding-class fcoe scheduler fcoe-sched;
  }
}
schedulers {
  fcoe-sched {
    transmit-rate 3000000000;
    shaping-rate percent 100;
    priority low;
  }
}
}

```



NOTE: The forwarding class and classifier configurations are not shown because the show command does not display default portions of the configuration.

For MC-LAG verification commands, see *Example: Configuring Multichassis Link Aggregation*.

Display the results of the CoS configuration on FCoE Transit Switch TS1 and on FCoE Transit Switch TS2 (the results on both transit switches are the same). The results are from the ETS hierarchical port scheduling configuration, which shows the more complex configuration. Direct port scheduling results would not show the traffic control profile or forwarding class set portions of the configuration, but would display the name of the scheduler map under each interface (instead of the names of the forwarding class set and output traffic control profile). Other than that, they are the same.

```

user@switch> show configuration class-of-service
traffic-control-profiles {
  fcoe-tcp {
    scheduler-map fcoe-map;
    shaping-rate percent 100;
    guaranteed-rate 3000000000;
  }
}
forwarding-class-sets {

```

```
fcoe-pg {
  class fcoe;
}
}
congestion-notification-profile {
  fcoe-cnp {
    input {
      ieee-802.1 {
        code-point 011 {
          pfc;
        }
      }
    }
  }
}
}
interfaces {
  xe-0/0/30 {
    forwarding-class-set {
      fcoe-pg {
        output-traffic-control-profile fcoe-tcp;
      }
    }
    congestion-notification-profile fcoe-cnp;
  }
  xe-0/0/31 {
    forwarding-class-set {
      fcoe-pg {
        output-traffic-control-profile fcoe-tcp;
      }
    }
    congestion-notification-profile fcoe-cnp;
  }
  xe-0/0/32 {
    forwarding-class-set {
      fcoe-pg {
        output-traffic-control-profile fcoe-tcp;
      }
    }
    congestion-notification-profile fcoe-cnp;
  }
  xe-0/0/33 {
    forwarding-class-set {
      fcoe-pg {
        output-traffic-control-profile fcoe-tcp;
      }
    }
    congestion-notification-profile fcoe-cnp;
  }
  ae1 {
    forwarding-class-set {
      fcoe-pg {
        output-traffic-control-profile fcoe-tcp;
      }
    }
    congestion-notification-profile fcoe-cnp;
  }
}
```

```

    }
  }
  scheduler-maps {
    fcoe-map {
      forwarding-class fcoe scheduler fcoe-sched;
    }
  }
  schedulers {
    fcoe-sched {
      transmit-rate 3000000000;
      shaping-rate percent 100;
      priority low;
    }
  }
}

```



NOTE: The forwarding class and classifier configurations are not shown because the show command does not display default portions of the configuration.

Verification

To verify that the CoS components and FIP snooping have been configured and are operating properly, perform these tasks. Because this example uses the default **fcoe** forwarding class and the default IEEE 802.1p trusted classifier, the verification of those configurations is not shown:

- [Verifying That the Output Queue Schedulers Have Been Created on page 164](#)
- [Verifying That the Priority Group Output Scheduler \(Traffic Control Profile\) Has Been Created \(ETS Configuration Only\) on page 165](#)
- [Verifying That the Forwarding Class Set \(Priority Group\) Has Been Created \(ETS Configuration Only\) on page 166](#)
- [Verifying That Priority-Based Flow Control Has Been Enabled on page 166](#)
- [Verifying That the Interface Class of Service Configuration Has Been Created on page 167](#)
- [Verifying That the Interfaces Are Correctly Configured on page 169](#)
- [Verifying That FIP Snooping Is Enabled on the FCoE VLAN on FCoE Transit Switches TS1 and TS2 Access Interfaces on page 172](#)
- [Verifying That the FIP Snooping Mode Is Correct on FCoE Transit Switches TS1 and TS2 on page 173](#)

Verifying That the Output Queue Schedulers Have Been Created

Purpose Verify that the output queue scheduler for FCoE traffic has the correct bandwidth parameters and priorities, and is mapped to the correct forwarding class (output queue). Queue scheduler verification is the same on each of the four switches.

Action List the scheduler map using the operational mode command **show class-of-service scheduler-map fcoe-map**:

```
user@switch> show class-of-service scheduler-map fcoe-map
Scheduler map: fcoe-map, Index: 9023

Scheduler: fcoe-sched, Forwarding class: fcoe, Index: 37289
Transmit rate: 3000000000 bps, Rate Limit: none, Buffer size: remainder,
Buffer Limit: none, Priority: low
Excess Priority: unspecified
Shaping rate: 100 percent,
drop-profile-map-set-type: mark
Drop profiles:
  Loss priority  Protocol  Index  Name
  Low           any       1      <default-drop-profile>
  Medium high   any       1      <default-drop-profile>
  High          any       1      <default-drop-profile>
```

Meaning The **show class-of-service scheduler-map fcoe-map** command lists the properties of the scheduler map **fcoe-map**. The command output includes:

- The name of the scheduler map (**fcoe-map**)
- The name of the scheduler (**fcoe-sched**)
- The forwarding classes mapped to the scheduler (**fcoe**)
- The minimum guaranteed queue bandwidth (transmit rate **3000000000 bps**)
- The scheduling priority (**low**)
- The maximum bandwidth in the priority group the queue can consume (shaping rate **100 percent**)
- The drop profile loss priority for each drop profile name. This example does not include drop profiles because you do not apply drop profiles to FCoE traffic.

Verifying That the Priority Group Output Scheduler (Traffic Control Profile) Has Been Created (ETS Configuration Only)

Purpose Verify that the traffic control profile **fcoe-tcp** has been created with the correct bandwidth parameters and scheduler mapping. Priority group scheduler verification is the same on each of the four switches.

Action List the FCoE traffic control profile properties using the operational mode command **show class-of-service traffic-control-profile fcoe-tcp**:

```
user@switch> show class-of-service traffic-control-profile fcoe-tcp
Traffic control profile: fcoe-tcp, Index: 18303
Shaping rate: 100 percent
Scheduler map: fcoe-map
Guaranteed rate: 3000000000
```

- Meaning** The `show class-of-service traffic-control-profile fcoe-tcp` command lists all of the configured traffic control profiles. For each traffic control profile, the command output includes:
- The name of the traffic control profile (**fcoe-tcp**)
 - The maximum port bandwidth the priority group can consume (shaping rate **100 percent**)
 - The scheduler map associated with the traffic control profile (**fcoe-map**)
 - The minimum guaranteed priority group port bandwidth (guaranteed rate **3000000000** in bps)

Verifying That the Forwarding Class Set (Priority Group) Has Been Created (ETS Configuration Only)

- Purpose** Verify that the FCoE priority group has been created and that the **fcoe** priority (forwarding class) belongs to the FCoE priority group. Forwarding class set verification is the same on each of the four switches.

- Action** List the forwarding class sets using the operational mode command `show class-of-service forwarding-class-set fcoe-pg`:

```
user@switch> show class-of-service forwarding-class-set fcoe-pg
```

```
Forwarding class set: fcoe-pg, Type: normal-type, Forwarding class set index: 31420
```

Forwarding class	Index
fcoe	1

- Meaning** The `show class-of-service forwarding-class-set fcoe-pg` command lists all of the forwarding classes (priorities) that belong to the **fcoe-pg** priority group, and the internal index number of the priority group. The command output shows that the forwarding class set **fcoe-pg** includes the forwarding class **fcoe**.

Verifying That Priority-Based Flow Control Has Been Enabled

- Purpose** Verify that PFC is enabled on the FCoE code point. PFC verification is the same on each of the four switches.

- Action** List the FCoE congestion notification profile using the operational mode command `show class-of-service congestion-notification fcoe-cnp`:

```
user@switch> show class-of-service congestion-notification fcoe-cnp
```

```
Type: Input, Name: fcoe-cnp, Index: 6879  
Cable Length: 100 m
```

Priority	PFC	MRU
000	Disabled	
001	Disabled	
010	Disabled	
011	Enabled	2500
100	Disabled	
101	Disabled	
110	Disabled	
111	Disabled	
Type: Output		
Priority	Flow-Control-Queues	
000	0	
001	1	
010	2	
011	3	
100	4	
101	5	
110	6	
111	7	

Meaning The `show class-of-service congestion-notification fcoe-cnp` command lists all of the IEEE 802.1p code points in the congestion notification profile that have PFC enabled. The command output shows that PFC is enabled on code point **011** (**fcoe** queue) for the **fcoe-cnp** congestion notification profile.

The command also shows the default cable length (100 meters), the default maximum receive unit (2500 bytes), and the default mapping of priorities to output queues because this example does not include configuring these options.

Verifying That the Interface Class of Service Configuration Has Been Created

Purpose Verify that the CoS properties of the interfaces are correct. The verification output on MC-LAG Switches S1 and S2 differs from the output on FCoE Transit Switches TS1 and TS2.



NOTE: The output is from the ETS hierarchical port scheduling configuration to show the more complex configuration. Direct port scheduling results do not show the traffic control profile or forwarding class sets because those elements are configured only for ETS. Instead, the name of the scheduler map is displayed under each interface.

Action List the interface CoS configuration on MC-LAG Switches S1 and S2 using the operational mode command **show configuration class-of-service interfaces**:

```
user@switch> show configuration class-of-service interfaces
```

```
ae0 {
  forwarding-class-set {
    fcoe-pg {
      output-traffic-control-profile fcoe-tcp;
    }
  }
  congestion-notification-profile fcoe-cnp;
}

ae1 {
  forwarding-class-set {
    fcoe-pg {
      output-traffic-control-profile fcoe-tcp;
    }
  }
  congestion-notification-profile fcoe-cnp;
}
```

List the interface CoS configuration on FCoE Transit Switches TS1 and TS2 using the operational mode command **show configuration class-of-service interfaces**:

```
user@switch> show configuration class-of-service interfaces
```

```
xe-0/0/30 {
  forwarding-class-set {
    fcoe-pg {
      output-traffic-control-profile fcoe-tcp;
    }
  }
  congestion-notification-profile fcoe-cnp;
}

xe-0/0/31 {
  forwarding-class-set {
    fcoe-pg {
      output-traffic-control-profile fcoe-tcp;
    }
  }
  congestion-notification-profile fcoe-cnp;
}

xe-0/0/32 {
  forwarding-class-set {
    fcoe-pg {
      output-traffic-control-profile fcoe-tcp;
    }
  }
  congestion-notification-profile fcoe-cnp;
}

xe-0/0/33 {
  forwarding-class-set {
    fcoe-pg {
      output-traffic-control-profile fcoe-tcp;
    }
  }
}
```



```

    congestion-notification-profile fcoe-cnp;
}
ae1 {
    forwarding-class-set {
        fcoe-pg {
            output-traffic-control-profile fcoe-tcp;
        }
    }
    congestion-notification-profile fcoe-cnp;
}

```

Meaning The **show configuration class-of-service interfaces** command lists the class of service configuration for all interfaces. For each interface, the command output includes:

- The name of the interface (for example, **ae0** or **xe-0/0/30**)
- The name of the forwarding class set associated with the interface (**fcoe-pg**)
- The name of the traffic control profile associated with the interface (output traffic control profile, **fcoe-tcp**)
- The name of the congestion notification profile associated with the interface (**fcoe-cnp**)



NOTE: Interfaces that are members of a LAG are not shown individually. The LAG or MC-LAG CoS configuration is applied to all interfaces that are members of the LAG or MC-LAG. For example, the interface CoS configuration output on MC-LAG Switches S1 and S2 shows the LAG CoS configuration but does not show the CoS configuration of the member interfaces separately. The interface CoS configuration output on FCoE Transit Switches TS1 and TS2 shows the LAG CoS configuration but also shows the configuration for interfaces xe-0/0/30, xe-0/0/31, xe-0/0/32, and xe-0/0/33, which are not members of a LAG.

Verifying That the Interfaces Are Correctly Configured

Purpose Verify that the LAG membership, MTU, VLAN membership, and port mode of the interfaces are correct. The verification output on MC-LAG Switches S1 and S2 differs from the output on FCoE Transit Switches T1 and T2.

Action List the interface configuration on MC-LAG Switches S1 and S2 using the operational mode command **show configuration interfaces**:

```

user@switch> show configuration interfaces
xe-0/0/10 {
    ether-options {
        802.3ad ae0;
    }
}

```

```

    }
  }
  xe-0/0/11 {
    ether-options {
      802.3ad ae0;
    }
  }
  xe-0/0/20 {
    ether-options {
      802.3ad ae1;
    }
  }
  xe-0/0/21 {
    ether-options {
      802.3ad ae1;
    }
  }
  ae0 {
    mtu 2180;
    unit 0 {
      family ethernet-switching {
        interface-mode trunk;
        vlan {
          members fcoe_vlan;
        }
      }
    }
  }
  ae1 {
    mtu 2180;
    unit 0 {
      family ethernet-switching {
        interface-mode trunk;
        vlan {
          members fcoe_vlan;
        }
      }
    }
  }
}

```

List the interface configuration on FCoE Transit Switches TS1 and TS2 using the operational mode command **show configuration interfaces**:

```
user@switch> show configuration interfaces
```

```

xe-0/0/25 {
  ether-options {
    802.3ad ae1;
  }
}
xe-0/0/26 {
  ether-options {
    802.3ad ae1;
  }
}
xe-0/0/30 {
  mtu 2180;
  unit 0 {

```

```

        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members fcoe_vlan;
            }
        }
    }
}
xe-0/0/31 {
    mtu 2180;
    unit 0 {
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members fcoe_vlan;
            }
        }
    }
}
xe-0/0/32 {
    mtu 2180;
    unit 0 {
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members fcoe_vlan;
            }
        }
    }
}
xe-0/0/33 {
    mtu 2180;
    unit 0 {
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members fcoe_vlan;
            }
        }
    }
}
}
ae1 {
    mtu 2180;
    unit 0 {
        family ethernet-switching {
            interface-mode trunk;
            vlan {
                members fcoe_vlan;
            }
        }
    }
}
}

```

Meaning The `show configuration interfaces` command lists the configuration of each interface by interface name.

For each interface that is a member of a LAG, the command lists only the name of the LAG to which the interface belongs.

For each LAG interface and for each interface that is not a member of a LAG, the command output includes:

- The MTU (**2180**)
- The unit number of the interface (**0**)
- The interface mode (**trunk** mode both for interfaces that connect two switches and for interfaces that connect to FCoE hosts)
- The name of the VLAN in which the interface is a member (**fcoe_vlan**)

Verifying That FIP Snooping Is Enabled on the FCoE VLAN on FCoE Transit Switches TS1 and TS2 Access Interfaces

Purpose Verify that FIP snooping is enabled on the FCoE VLAN access interfaces. FIP snooping is enabled only on the FCoE access interfaces, so it is enabled only on FCoE Transit Switches TS1 and TS2. FIP snooping is not enabled on MC-LAG Switches S1 and S2 because FIP snooping is done at the Transit Switch TS1 and TS2 FCoE access ports.

Action List the port security configuration on FCoE Transit Switches TS1 and TS2 using the operational mode command **show configuration vlans fcoe_vlan forwarding-options fip-security**:

```
user@switch> show configuration vlans fcoe_vlan forwarding-options fip-security
interface ae1.0 {
    fcoe-trusted;
}
examine-vn2vn {
    beacon-period 90000;
}
```

Meaning The **show configuration vlans fcoe_vlan forwarding-options fip-security** command lists VLAN FIP security information, including whether a port member of the VLAN is trusted. The command output shows that:

- LAG port **ae1.0**, which connects the FCoE transit switch to the MC-LAG switches, is configured as an FCoE trusted interface. FIP snooping is not performed on the member interfaces of the LAG (**xe-0/0/25** and **xe-0/0/26**).
- VN2VN_Port FIP snooping is enabled (**examine-vn2vn**) on the FCoE VLAN and the beacon period is set to 90000 milliseconds. On Transit Switches TS1 and TS2, all interface members of the FCoE VLAN perform FIP snooping unless the interface is configured as FCoE trusted. On Transit Switches TS1 and TS2, interfaces **xe-0/0/30**, **xe-0/0/31**, **xe-0/0/32**, and **xe-0/0/33** perform FIP snooping because they are not configured as FCoE trusted. The interface members of LAG **ae1** (**xe-0/0/25** and **xe-0/0/26**) do not perform FIP snooping because the LAG is configured as FCoE trusted.

Verifying That the FIP Snooping Mode Is Correct on FCoE Transit Switches TS1 and TS2

Purpose Verify that the FIP snooping mode is correct on the FCoE VLAN. FIP snooping is enabled only on the FCoE access interfaces, so it is enabled only on FCoE Transit Switches TS1 and TS2. FIP snooping is not enabled on MC-LAG Switches S1 and S2 because FIP snooping is done at the Transit Switch TS1 and TS2 FCoE access ports.

Action List the FIP snooping configuration on FCoE Transit Switches TS1 and TS2 using the operational mode command **show fip snooping brief**:

```
user@switch> show fip snooping brief
VLAN: fcoe_vlan,      Mode: VN2VN Snooping
FC-MAP: 0e:fc:00
...
```



NOTE: The output has been truncated to show only the relevant information.

Meaning The **show fip snooping brief** command lists FIP snooping information, including the FIP snooping VLAN and the FIP snooping mode. The command output shows that:

- The VLAN on which FIP snooping is enabled is **fcoe_vlan**
- The FIP snooping mode is VN2VN_Port FIP snooping (**VN2VN Snooping**)

Related Documentation

- *Example: Configuring Multichassis Link Aggregation*
- *Configuring Link Aggregation*
- [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)
- *Example: Configuring CoS Hierarchical Port Scheduling (ETS)*
- *Example: Configuring Queue Schedulers for Port Scheduling*
- [Understanding MC-LAGs on an FCoE Transit Switch on page 143](#)

Understanding FCoE and FIP Session High Availability

High availability features maintain storage network sessions when a system process is terminated and during certain types of upgrades:

- [High Availability for Fibre Channel Process Termination \(FCoE-FC Gateway Mode, QFX3500 Only\)](#) on page 174
- [High Availability for FIP Snooping](#) on page 174
- [Nonstop Software Upgrade \(QFabric Systems\)](#) on page 175

High Availability for Fibre Channel Process Termination (FCoE-FC Gateway Mode, QFX3500 Only)

In FCoE-FC gateway mode, the QFX3500 switch provides high availability to restore the FCoE sessions running on the switch in case the Fibre Channel (FC) process is terminated. A session is a fabric login (FLOGI) or fabric discovery (FDISC) login to the FC SAN fabric, not an end-to-end server-to-storage session.

The switch stores FCoE session data in a persistent storage module. If the FC process terminates, the switch restores the existing FCoE sessions on the same interfaces that they were on before the FC process terminated. Data traffic for existing sessions is not affected during session restoration.

For a brief time, the system does not process control traffic because of the FC process restart and session restoration. During this brief time, no new FCoE sessions can be established, and no existing sessions can log out.



NOTE: During the restoration process, if the FC process does not receive an *interface up* notification from a particular interface within a certain time, the switch times out the restore operation and discards the data on that interface. The previously existing FCoE sessions on that interface are not restored, and the ENodes must log in again.



NOTE: An FC process restart and session restoration resets the Fibre Channel statistics.

If the FC process terminates repeatedly, the operating system disables the process until you manually restart it. To restart the FC process manually, issue the **restart fibre-channel** command.

High Availability for FIP Snooping

You can configure the system to perform FIP snooping on Ethernet interfaces that are connected to FCoE devices that have ENodes. The high availability function restores running FIP snooping sessions in case the Ethernet switching process is terminated.



NOTE: Juniper Networks QFX10000 switches do not support FIP snooping. (Aggregation devices do not need to enable FIP snooping because FIP snooping is performed at the FCoE access edge.)

The Ethernet switching process stores the FIP snooping state in a persistent storage module. If the Ethernet switching process terminates, the switch restores the existing FIP snooping sessions on the same interfaces that they were on before the Ethernet switching process terminated. The high availability features preserve:

- Logged in ENodes
- Discovered FCFs
- Existing sessions
- Existing FIP snooping filters

The complete restoration process, including reconciling all valid states, takes a maximum of 8 seconds. During the restoration process, the switch can learn a new FCF or a new FC switch, and new ENodes can log in to the FC network. However, FDISC messages from an ENode that is already logged in to the network might be dropped if the ENode has not yet been restored.

When the Ethernet switching process terminates ungracefully, the FIP keepalive timer is reset to the normal initial value, not the value at the time of the Ethernet switching process termination.

In the event of an Ethernet switching process termination, ENodes remain logged in, and existing sessions are not interrupted.



NOTE: An Ethernet switching process restart and session restoration resets the FIP snooping statistics.

Nonstop Software Upgrade (QFabric Systems)

On QFabric system Node groups that have more than one Node device, nonstop software upgrade (NSSU) enables you to upgrade the Node devices with minimal packet loss and maximum uptime. NSSU automates software upgrades on the QFabric system components in an orderly and consistent manner to maximize system uptime.

The system upgrades components with redundant architectures, such as redundant server Node groups and network Node groups that have two or more members, in stages. While the system upgrades one component, the redundant component continues to function.

For example, while one member of a redundant server Node group is upgraded, the other member continues to forward traffic. When the first Node group member completes the upgrade, it comes online while the system upgrades the second member.

NSSU provides high availability for the lossless traffic forwarding required to support storage networks. If your system design includes redundancy (redundant Node devices in Node groups, LAGs, and so on) so that an alternate traffic path is available, when you upgrade a Node device, traffic is not impacted.

In fully redundant topologies, NSSU preserves FIP session, FIP snooping filter, VN2VF_Port session, and VN2VN_Port session information and prevents traffic loss in most cases. An exception is that Node devices that are directly connected to ENodes experience momentary traffic loss when the Node device reboots.

Related Documentation

- [Understanding FCoE on page 51](#)

Troubleshooting Dropped FIP Traffic

- | | |
|-----------------|--|
| Problem | Description: Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) traffic such as FIP VLAN discovery and notification frames is dropped. |
| Cause | The interface on which the FIP traffic is dropped does not have a native VLAN configured. FIP VLAN discovery and notification messages are exchanged as untagged packets on the native VLAN. (After the FCoE session with the Fibre Channel switch is established, FCoE traffic uses the FCoE VLAN.) |
| Solution | Check to ensure that every 10-Gigabit Ethernet interface that connects to an FCoE device includes a native VLAN. Configure a native VLAN on all 10-Gigabit Ethernet interfaces that connect to FCoE devices. |



NOTE: Make sure that the native VLAN you are using is the same native VLAN that the FCoE devices use for Ethernet traffic.

The procedure for configuring a native VLAN on an interface is different on switches that use the original CLI than on switches that use the Enhanced Layer 2 Software (ELS) CLI. This topic provides the configuration procedure for each CLI.

Configuring a Native VLAN on Switches Using the Original CLI

To configure a native VLAN on an interface:

1. Set the interface port mode to **tagged-access** if you have not already done so:

```
[edit]
user@switch# set interfaces interface unit unit family ethernet-switching port-mode
tagged-access
```

For example, to set the port mode to **tagged-access** for interface **xe-0/0/6.0**:


```
[edit]
user@switch# set interfaces xe-0/0/6 unit 0 family ethernet-switching port-mode
tagged-access
```

2. Configure the native VLAN if it does not already exist:

```
[edit]
user@switch# set vlans vlan-name vlan-id vlan-id
```

For example, to name the native VLAN **native** and use the VLAN ID 1:

```
[edit]
user@switch# set vlans native vlan-id 1
```

3. Configure the native VLAN on the interface:

```
[edit]
user@switch# set interfaces interface unit unit family ethernet-switching native-vlan-id
vlan-id
```

For example, to configure a native VLAN with the VLAN ID 1 on interface **xe-0/0/6.0**:

```
[edit]
user@switch# set interfaces xe-0/0/6 unit 0 family ethernet-switching native-vlan-id 1
```

Configuring a Native VLAN on Switches Using the ELS CLI

To configure a native VLAN on an interface:

1. Set the interface mode to **trunk** if you have not already done so:

```
[edit]
user@switch# set interfaces interface unit unit family ethernet-switching interface-mode
trunk
```

For example, to set the interface mode to **trunk** for interface **xe-0/0/6.0**:

```
[edit]
user@switch# set interfaces xe-0/0/6 unit 0 family ethernet-switching interface-mode trunk
```

2. Configure the native VLAN if it does not already exist:

```
[edit]
user@switch# set vlans vlan-name vlan-id vlan-id
```

For example, to name the native VLAN **native** and use the VLAN ID 1:

```
[edit]
user@switch# set vlans native vlan-id 1
```

3. Configure the native VLAN on the physical Ethernet interface:

```
[edit]
user@switch# set interfaces interface native-vlan-id vlan-id
```

For example, to configure a native VLAN with the VLAN ID 1 on interface **xe-0/0/6.0**:

```
[edit]
user@switch# set interfaces xe-0/0/6 native-vlan-id 1
```

4. Configure the Ethernet interface as a member of the native VLAN:

```
[edit]
user@switch# set interfaces interface unit unit family ethernet-switching vlan members
vlan-name
```

For example, to configure an Ethernet interface as a member of a native VLAN with the VLAN ID 1 on interface **xe-0/0/6.0**:

```
[edit]
user@switch# set interfaces xe-0/0/6 unit 0 family ethernet-switching vlan members native
```

Related Documentation

- [interfaces](#)
- [vlans](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)

Troubleshooting Dropped FCoE Traffic

Problem	Description: Fibre Channel over Ethernet (FCoE) traffic for which you want guaranteed delivery is dropped.
Cause	<p>There are several possible causes of dropped FCoE traffic (the list numbers of the possible causes correspond to the list numbers of the solutions in the <i>Solution</i> section.):</p> <ol style="list-style-type: none">1. Priority-based flow control (PFC) is not enabled on the FCoE priority (IEEE 802.1p code point) in both the input and output stanzas of the congestion notification profile.2. The FCoE traffic is not classified correctly at the ingress interface. FCoE traffic should either use the default fcoe forwarding class and classifier configuration (maps the fcoe forwarding class to IEEE 802.1p code point 011) or be mapped to a lossless forwarding class and to the code point enabled for PFC on the input and output interfaces.3. The congestion notification profile that enables PFC on the FCoE priority is not attached to the interface.

4. The forwarding class set (priority group) used for guaranteed delivery traffic does not include the forwarding class used for FCoE traffic.



NOTE: This issue can occur only on switches that support enhanced transmission selection (ETS) hierarchical port scheduling. (Direct port scheduling does not use forwarding class sets.)

5. Insufficient bandwidth has been allocated for the FCoE queue or for the forwarding class set to which the FCoE queue belongs.



NOTE: This issue can occur for forwarding class sets only on switches that support ETS hierarchical port scheduling. (Direct port scheduling does not use forwarding class sets.)

6. If you are using Junos OS Release 12.2, the **fcoe** forwarding class has been explicitly configured instead of using the default **fcoe** forwarding class configuration (forwarding-class-to-queue mapping).



NOTE: If you are using Junos OS Release 12.2, use the default forwarding-class-to-queue mapping for the lossless **fcoe** and **no-loss** forwarding classes. If you explicitly configure the lossless forwarding classes, the traffic mapped to those forwarding classes is treated as lossy (best effort) traffic and does *not* receive lossless treatment.

7. If you are using Junos OS Release 12.3 or later and you are not using the default **fcoe** forwarding class configuration, the forwarding class used for FCoE is not configured with the **no-loss** packet drop attribute. In Junos OS 12.3 or later, explicit forwarding classes configurations must include the **no-loss** packet drop attribute to be treated as lossless forwarding classes.

Solution The list numbers of the possible solutions correspond to the list numbers of the causes in the *Cause* section.

1. Check the congestion notification profile (CNP) to see if PFC is enabled on the FCoE priority (the correct IEEE 802.1p code point) on both input and output interfaces. Use the **show class-of-service congestion-notification** operational command to show the code points that are enabled for PFC in each CNP.

If you are using the default configuration, FCoE traffic is mapped to code point 011 (priority 3). In this case, the input stanza of the CNP should show that PFC is enabled on code point 011, and the output stanza should show that priority 011 is mapped to flow control queue 3.

If you explicitly configured a forwarding class for FCoE traffic, ensure that:

- You specified the **no-loss** packet drop attribute in the forwarding class configuration
- The code point mapped to the FCoE forwarding class in the ingress classifier is the code point enabled for PFC in the CNP input stanza
- The code point and output queue used for FCoE traffic are mapped to each other in the CNP output stanza (if you are not using the default priority and queue, you must explicitly configure each output queue that you want to respond to PFC messages)

For example, if you explicitly configure a forwarding class for FCoE traffic that is mapped to output queue 5 and to code point 101 (priority 5), the output of the **show class-of-service congestion-notification** looks like:

```
Name: fcoe_p5_cnp, Index: 12183
Type: Input
Cable Length: 100 m
  Priority    PFC      MRU
  000        Disabled
  001        Disabled
  010        Disabled
  011        Disabled
  100        Disabled
  101        Enabled   2500
  110        Disabled
  111        Disabled
Type: Output
  Priority    Flow-Control-Queues
  101        5
```

2. Use the **show class-of-service classifier type ieee-802.1p** operational command to check if the classifier maps the forwarding class used for FCoE traffic to the correct IEEE 802.1p code point.
3. Ensure that the congestion notification profile and classifier are attached to the correct ingress interface. Use the operational command **show configuration class-of-service interfaces interface-name**.
4. Check that the forwarding class set includes the forwarding class used for FCoE traffic. Use the operational command **show configuration class-of-service**

forwarding-class-sets to show the configured priority groups and their forwarding classes.

5. Verify the amount of bandwidth allocated to the queue mapped to the FCoE forwarding class and to the forwarding class set to which the FCoE traffic queue belongs. Use the **show configuration class-of-service schedulers *scheduler-name*** operational command (specify the scheduler for FCoE traffic as the *scheduler-name*) to see the minimum guaranteed bandwidth (**transmit-rate**) and maximum bandwidth (**shaping-rate**) for the queue.

Use the **show configuration class-of-service traffic-control-profiles *traffic-control-profile*** operational command (specify the traffic control profile used for FCoE traffic as the *traffic-control-profile*) to see the minimum guaranteed bandwidth (**guaranteed-rate**) and maximum bandwidth (**shaping-rate**) for the forwarding class set.

6. Delete the explicit FCoE forwarding-class-to-queue mapping so that the system uses the default FCoE forwarding-class-to-queue mapping. Include the **delete forwarding-classes class fcoe queue-num 3** statement at the **[edit class-of-service]** hierarchy level to remove the explicit configuration. The system then uses the default configuration for the FCoE forwarding class and preserves the lossless treatment of FCoE traffic.
7. Use the **show class-of-service forwarding-class** operational command to display the configured forwarding classes. The *No-Loss* column shows whether lossless transport is enabled or disabled for each forwarding class. If the forwarding class used for FCoE traffic is not enabled for lossless transport, include the **no-loss** packet drop attribute in the forwarding class configuration (**set class-of-service forwarding-classes class *fcoe-forwarding-class-name* queue-num *queue-number* no-loss**).

See “[Example: Configuring CoS PFC for FCoE Traffic](#)” on page 339 for step-by-step instructions on how to configure PFC for FCoE traffic, including classifier, interface, congestion notification profile, PFC, and bandwidth scheduling configuration.

Related Documentation

- *show class-of-service congestion-notification*
- *Configuring CoS PFC (Congestion Notification Profiles)*
- [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)
- [Understanding CoS Flow Control \(Ethernet PAUSE and PFC\) on page 327](#)

PART 2

Fibre Channel and FCoE-FC Gateways

- [Using Fibre Channel and FCoE-FC Gateways on page 185](#)

CHAPTER 3

Using Fibre Channel and FCoE-FC Gateways

- [Understanding Fibre Channel on page 186](#)
- [Understanding an FCoE-FC Gateway on page 190](#)
- [Understanding Fibre Channel Fabrics on the QFabric System on page 194](#)
- [Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195](#)
- [Understanding FCoE-FC Gateway Functions on page 196](#)
- [Disabling the Fabric WWN Verification Check on page 200](#)
- [Understanding FCoE and FIP Session High Availability on page 201](#)
- [Understanding FIP Functions on page 203](#)
- [Understanding FIP Implementation on an FCoE-FC Gateway on page 208](#)
- [Understanding FIP Parameters on an FCoE-FC Gateway on page 212](#)
- [Configuring FIP on an FCoE-FC Gateway on page 216](#)
- [Setting the Maximum Number of FIP Login Sessions per ENode on page 219](#)
- [Setting the Maximum Number of FIP Login Sessions per FC Interface on page 220](#)
- [Setting the Maximum Number of FIP Login Sessions per FC Fabric on page 221](#)
- [Setting the Maximum Number of FIP Login Sessions per Node Device on page 222](#)
- [Troubleshooting Dropped FIP Traffic on page 223](#)
- [Understanding Fibre Channel Virtual Links on page 225](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
- [Configuring a Physical Fibre Channel Interface on page 254](#)
- [Converting an Ethernet Interface To a Fibre Channel Interface on page 255](#)
- [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
- [Assigning Interfaces to a Fibre Channel Fabric on page 262](#)
- [Deleting a Fibre Channel Interface on page 263](#)
- [Troubleshooting Fibre Channel Interface Deletion on page 264](#)

- [Disabling VN2VF_Port FIP Snooping on an FCoE-FC Gateway Switch Interface on page 265](#)
- [Disabling Storm Control on FCoE Interfaces on an FCoE-FC Gateway on page 266](#)
- [Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267](#)
- [Defining the Proxy Load-Balancing Algorithm on page 283](#)
- [Simulating On-Demand Fibre Channel Link Load Rebalancing \(Dry Run Test\) on page 285](#)
- [Example: Configuring Automated Fibre Channel Interface Load Rebalancing on page 285](#)

Understanding Fibre Channel

Fibre Channel (FC) is a serial I/O interconnect network technology capable of supporting multiple protocols. It is used primarily for storage area networks (SANs). The committee standardizing FC is the International Committee for Information Technology Standards (INCITS).

When configured as a Fibre Channel over Ethernet (FCoE)-FC gateway, the QFX3500 switch supports the transport of native FC traffic between FC switches and the gateway's native FC interfaces.



NOTE: Only the QFX3500 switch has native FC ports and supports native FC connection to the SAN. Only the QFX3500 can be configured as an FCoE-FC gateway, and only as a standalone switch or as a QFabric system Node device. FCoE-FC gateway configuration is not supported in Virtual Chassis or Virtual Chassis Fabric configurations.

FC concepts include:

- [FC Fabrics on page 186](#)
- [FC Port Types on page 187](#)
- [FC Switches on page 187](#)
- [Adapters on page 188](#)
- [N_Port ID Virtualization \(NPIV\) on page 188](#)
- [FC Services on page 188](#)

FC Fabrics

An FC fabric is a switched network topology that interconnects FC devices using FC switches, usually to create a SAN. An FC switch is a Layer 3 network switch that is compatible with the FC protocol, forwards FC traffic, and provides FC services to the components of the FC fabric. FC devices are usually servers or storage devices such as disk arrays.

Switches called FCoE forwarders (FCFs) perform a subset of FC switch functions. An FCF is a Layer 3 network switch that is compatible with the FC protocol and forwards FC traffic, but does not provide network services.

When configured as an FCoE-FC gateway, the QFX3500 switch acts as a proxy for the FCF functionality of an FC switch. The gateway provides FCoE devices on the Ethernet network access to the FC network without requiring the FC switches in the SAN to support Ethernet interfaces. The gateway is not an FCF and does not provide FC services.

FC network design often uses two fabrics (dual-rail topology) for redundancy. The two fabrics connect to edge devices but are otherwise unconnected, so that if one fabric goes down, the other fabric can continue to provide connectivity.

FC Port Types

The QFX3500 switch supports the following FC port types:

- **N_Port**—An N_Port is a port on the node of an FC device such as a server or a storage device and is also known as a node port.
- **F_Port**—An F_Port is a port on an FC switch that connects to an FC device N_Port in a point-to-point connection. F_Ports are also known as fabric ports.

These port types are a subset of the existing FC port types that can be supported in an FC fabric.

FC Switches

FC switches provide FC services to the FC network. FC switches forward Layer 3 traffic. They may transport a combination of native FC traffic and other traffic, such as Internet Small Computer Systems Interface (iSCSI) or FCoE, or they may transport only native FC traffic. When an FC switch supports FCoE, it combines FCoE termination functions with the FC stack on an FC switching element. This is also known as a dual-stack switch.

When FC switches support FCoE, they present virtual FC interfaces in the form of virtual F_Ports (VF_Ports) to the FCoE nodes (ENodes) on FCoE devices. A VF_Port is an endpoint in a virtual point-to-point connection with an ENode virtual N_Port (VN_Port). A VF_Port emulates a native FC F_Port and performs similar functions. A VF_Port is an intermediate port in a connection between an FCoE device such as a server in the Ethernet network and a storage device in the FC SAN.

FC switches that support FCoE contain at least one lossless Ethernet media access controller (MAC) paired with an FCoE controller. The lossless Ethernet MAC implements Ethernet extensions to avoid frame loss due to congestion. The FCoE controller instantiates and terminates virtual port instances as they are needed. Each VF_Port instance has one unique virtual link to an ENode VN_Port.

FCoE support also requires one FCoE Link End Point (LEP) for each VF_Port connection. An FCoE LEP is a virtual FC interface mapped onto the physical Ethernet interface. It transmits and receives FCoE frames on the virtual link, and handles FC frame encapsulation for traffic going from the FC switch to the FCoE device and frame de-encapsulation of traffic received from the FCoE device.

When you configure the QFX3500 switch as an FCoE-FC gateway, the gateway performs these FC-to-Ethernet and Ethernet-to-FC conversion functions so that the FC switch does not need Ethernet (FCoE) ports.

Adapters

FC host bus adapters (HBAs) in FC switches and devices perform functions similar to those of Ethernet adapters in Ethernet switches and devices. Switches that perform FCoE functions and FCoE devices have converged network adapters (CNAs) that support both native FC and Ethernet functionality.

N_Port ID Virtualization (NPIV)

FC requires a unique point-to-point link between the FC switch (F_Port) and each host N_Port. In order to avoid using one physical link for each F_Port to N_Port connection, the port connections must be virtualized so that they can share a physical link while maintaining logical separation.

FC accomplishes this by enabling you to create an independent virtual link for each FC session by mapping each session to a virtualized N_Port. This process is called N_Port ID virtualization (NPIV).

NPIV makes each virtual link look like a dedicated point-to-point link. In this way, multiple FC devices and multiple applications or virtual machines (VMs) on a single FC device can connect to an FC switch using one physical port instead of using a physical port for each connection. The virtual link creates a secure boundary between traffic from different sources on a single physical connection.

NPIV works by creating a unique virtual port identifier for each logical connection on a physical port. Conceptually, this is similar to splitting a single physical interface into multiple logical interfaces or subinterfaces. A virtual port identifier consists of the port's unique worldwide name (WWN) combined with a Fibre Channel ID (FCID) that the FC switch assigns to the virtual connection. This creates a virtual host bus adapter (HBA) for each virtual link that uniquely identifies the link to the FC switch.

FC Services

When you configure the QFX3500 switch as an FCoE-FC gateway, the gateway connects FCoE devices in the Ethernet network to the FC fabric. The gateway does not provide FC services directly. The gateway logs in to the FC fabric and obtains FC services from the FC fabric, including:

- Management servers
 - Zone server—Defines which devices can connect to each other in the FC fabric.
 - Fabric configuration server—Discovers FC fabric topology and attributes.
 - Policy server—Distributes the rules for administering, managing, and controlling access to FC fabric resources.
 - HBA management server—Registers HBA information with the FC fabric.
- Domain manager—Allocates domain IDs to virtual switches.
- Fabric login server—Provides login services to the gateway so that the native FC ports on the gateway can perform initial fabric login (FLOGI) to the FC fabric and subsequent

fabric discovery (FDISC) logs in for the physical and virtual ports on the FCoE devices in the Ethernet network. This includes allocating Fibre Channel IDs (FCIDs) to ports.

- Name server—Discovers, registers, and unregisters N_Port attributes, including the attributes of the native FC ports on the gateway that connect to the FC fabric.
- Event server—Validates incoming events to ensure transaction integrity.
- Time server—Maintains a common time for devices in the FC fabric.
- Fabric controller
 - Fabric Shortest Path First (FSPF)—The FC fabric provides link-state path selection to the gateway.
 - State change notification (SCN) / registered state change notification server (RSCN)—Notifies the appropriate nodes when new devices come online, when other nodes fail, or when changes on an online node affect system operation.

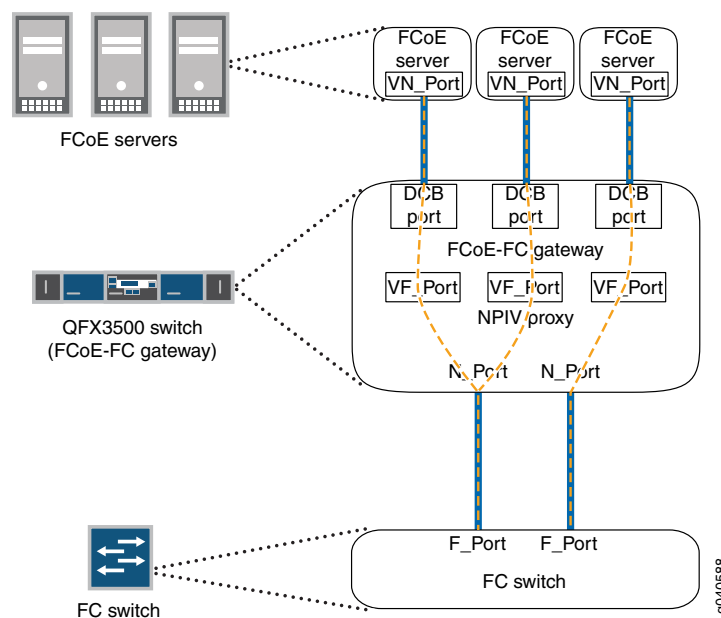
**Related
Documentation**

- [Overview of Fibre Channel on page 26](#)
- [Understanding FCoE on page 51](#)
- [Understanding an FCoE-FC Gateway on page 190](#)
- [Understanding Fibre Channel Terminology on page 31](#)

Understanding an FCoE-FC Gateway

A Fibre Channel over Ethernet (FCoE)-Fibre Channel (FC) gateway connects FCoE devices on an Ethernet network to an FC switch in an FC storage area network (SAN) as shown in [Figure 11 on page 190](#). To FCoE devices such as servers, the FCoE-FC gateway presents virtual fabric ports (VF_Ports) and appears to be an FCoE forwarder (FCF). To the FC switch, the FCoE-FC gateway presents a proxy node port (NP_Port) and appears to be an FC device. Only the QFX3500 switch, both in standalone mode and as a QFabric system Node device, supports configuration as an FCoE-FC gateway.

Figure 11: FCoE-FC Gateway Topology



The FCoE-FC gateway handles FCoE Initialization Protocol (FIP) and FCoE traffic on the interfaces connected to FCoE devices. The gateway forwards native FC traffic on the interfaces to the FC switch. The gateway does not provide FC services (such as fabric login server or name server). It is a proxy for an FCF, not an FCF or an FC switch. The gateway transparently substitutes for the FC switch when communicating with FCoE devices and transparently substitutes for FCoE devices when communicating with the FC switch.

The gateway does not use an FC domain ID, so it extends the SAN fabric while saving domain resources. Using the gateway also means that the FC switch does not have to handle FCoE traffic (and therefore requires no FCoE blades or ports). The gateway converges Ethernet and FC backbones to leverage existing resources.

- [Gateway FC Fabric on page 191](#)
- [Fabric Services on page 192](#)
- [FCoE-FC Gateway Traffic Switching on page 192](#)

Gateway FC Fabric

A gateway FC fabric is a QFX3500 configuration construct. It is not the same thing as an FC fabric in the SAN; the gateway FC fabric is local to the switch. It creates associations that connect FCoE devices with converged network adapters (CNAs) on the Ethernet network to an FC switch on the Fibre Channel network. A gateway FC fabric consists of:

- A unique fabric name.
- A unique fabric ID.
- At least one dedicated VLAN for FCoE traffic. VLANs that carry FCoE traffic should not carry any other type of traffic.



NOTE: On a QFX3500 or QFabric system QFX3500 Node device, the same VLAN cannot be used in both transit switch mode and FCoE-FC gateway mode.

- At least one FCoE VLAN interface (Layer 3 VLAN interface) that includes one or more 10-Gigabit Ethernet interfaces connected to FCoE devices. The FCoE VLANs transport traffic between the FCoE servers and the FCoE-FC gateway. Each FCoE VLAN must carry only FCoE traffic. You cannot mix FCoE traffic and standard Ethernet traffic on the same VLAN.

The 10-Gigabit Ethernet interfaces that connect to FCoE devices must include a native VLAN to transport FIP traffic because FIP VLAN discovery and notification frames are exchanged as untagged packets.

Each FCoE VLAN interface can present multiple VF_Port interfaces to the FCoE network.



NOTE: Storm control must be disabled on all Ethernet interfaces that belong to the FCoE VLAN to prevent FCoE traffic from being dropped.

- One or more native FC interfaces. The native FC interfaces transport traffic between the gateway and the FC switch.



TIP: If the network does not use a dual-rail architecture for redundancy, configure more than one native FC interface for each FC fabric to create redundant connections between the FCoE devices and the FC switch. If one physical link goes down, any sessions it carried can log in again and connect to the FC switch on a different interface. Even in dual-rail architecture networks, creating redundant connections between the QFabric system and the FC switch is the best practice.

You can also configure FIP parameters for the fabric or accept the default FIP parameters. VN_Port to VF_Port (VN2VF_Port) FIP snooping is automatically enabled on all server-facing ports because all ports are untrusted by default. You can disable VN2VF_Port

FIP snooping on a port-by-port basis by marking a port as an FCoE trusted interface. You can disable VN2VF_Port FIP snooping on all Ethernet ports in an FC fabric by configuring the fabric as FCoE trusted.

Because the switch has 12 native FC ports and each FC fabric requires a minimum of one native FC port, the switch supports a maximum of 12 FC fabrics. However, as a best practice for redundancy, we recommend that you assign at least two native FC interfaces to each FC fabric.

On a QFabric system, all of the FC and FCoE traffic that belongs to a particular gateway FC fabric must ingress and egress the same gateway Node device. Gateway FC fabrics do not span across Node devices. All of the native FC interfaces and the Ethernet interfaces that belong to the FCoE VLAN must reside on the same gateway Node device to be included in an FC fabric on that Node device.

Traffic from FC and FCoE devices that are not in the same FC fabric remain separate and cannot communicate with each other through the gateway.

Fabric Services

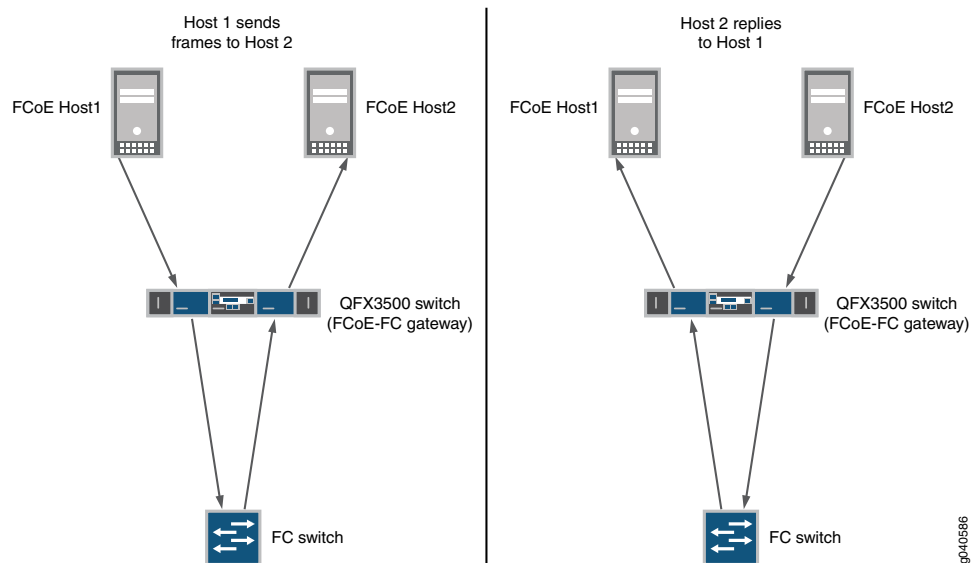
The FC switch provides all FC services (domain manager, name server, fabric login server, and so on) except FIP to the FCoE devices. The FC switch assigns all FCIDs (through N_Port ID virtualization) and fabric attributes to FCoE device VN_Ports.

The FCoE-FC gateway does not provide FC services (except FIP). The gateway relays communication between the FC switch and the FCoE devices, encapsulates and de-encapsulates native FC frames, converges Ethernet and FC backbones, and aggregates FCoE device VN_Port sessions.

FCoE-FC Gateway Traffic Switching

All traffic that flows through the gateway FC fabric is switched through the FC switch. Even if two hosts on the Ethernet FCoE network connect directly to the gateway, FCoE communication between them goes through the FC switch, as shown in [Figure 12 on page 193](#).

Figure 12: Traffic Switching Between FCoE Hosts Connected to the FC Network by an FCoE-FC Gateway



For example, FCoE host server *Host1* sends frames destined for FCoE host server *Host2*. Both *Host1* and *Host2* are directly connected to the gateway. The communication path looks like this:

1. *Host1* sends FCoE frames destined for *Host2* to the gateway .
2. The gateway de-encapsulates the FCoE frames from *Host1* into native FC frames and switches them to the FC switch.
3. The FC switch processes the native FC frames and sends them back to the gateway destined for *Host2*.
4. The gateway encapsulates the FC frames in Ethernet and sends the resulting FCoE frames to *Host2*.
5. When *Host2* replies, the FCoE reply goes to the gateway. The gateway de-encapsulates the reply and switches it to the FC switch for processing. The FC switch then sends it back to the gateway, which encapsulates the FC frames and sends them to *Host1*.

Related Documentation

- [Overview of Fibre Channel on page 26](#)
- [Understanding Fibre Channel on page 186](#)
- [Understanding FCoE-FC Gateway Functions on page 196](#)
- [Overview of FIP on page 41](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
- [Disabling Storm Control on FCoE Interfaces on an FCoE-FC Gateway on page 266](#)
- [Understanding Fibre Channel Terminology on page 31](#)

Understanding Fibre Channel Fabrics on the QFabric System

A Fibre Channel (FC) fabric on a QFabric system is a construct that you configure on a QFX3500 Node device when the Node device is in FCoE-FC gateway mode. The FC fabric on a QFabric Node device is not the same as an FC fabric on a storage area network (SAN). The FC fabric on a QFabric Node device is local to that particular node device. We call the FC fabric on a QFabric Node device a *local FC fabric* to differentiate it from an FC fabric on the SAN.



NOTE: The QFX3600 Node device does not support FC or FCoE features.

A local FC fabric does not span Node devices and does not span the fabric Interconnect device. Local FC fabrics are entirely contained on a single Node device. A local FC fabric creates associations that connect FCoE devices that have converged network adapters (CNAs) on the Ethernet network to an FC switch or FCoE forwarder (FCF) on the FC network. A local FC fabric consists of:

- A unique fabric name.
- A unique fabric ID.
- One or more FCoE VLAN interfaces that include one or more 10-Gigabit Ethernet interfaces connected to FCoE devices. The FCoE VLANs transport traffic between the FCoE servers and the FCoE-FC gateway. Each FCoE VLAN must carry only FCoE traffic. You cannot mix FCoE traffic and standard Ethernet traffic on the same VLAN.

The 10-Gigabit Ethernet interfaces that connect to FCoE devices must include a native VLAN to transport FIP traffic because FIP VLAN discovery and notification frames are exchanged as untagged packets.

Each FCoE VLAN interface can present multiple VF_Port interfaces to the FCoE network.

- One or more native FC interfaces. The native FC interfaces transport traffic between the gateway and the FC switch or FCF.



TIP: If the network does not use a dual-rail architecture for redundancy, configure more than one native FC interface for each local FC fabric to create redundant connections between the FCoE devices and the FC network. If one physical link goes down, any sessions it carried can log in again and connect to the FC network on a different interface.

All of the FC and FCoE traffic that belongs to a local FC fabric on a Node device must enter and exit that Node device. This means that the FC switch or FCF and the FCoE devices in the Ethernet network must be connected to the same Node device. The interfaces that connect to the FC switch and the interfaces that connect to the FCoE devices must be included in the local FC fabric. You cannot configure a local FC fabric that spans more than one Node device.

Traffic flows from FC and FCoE devices that are not in the same local FC fabric remain separate and cannot communicate with each other through the FCoE-FC gateway.



NOTE: The QFabric system enforces commit checks to ensure that local FC fabrics and FCoE VLANs on FCoE-FC gateways do not span more than one Node device.

**Related
Documentation**

- [Overview of Fibre Channel on page 26](#)
- [Understanding an FCoE-FC Gateway on page 190](#)
- [Understanding FCoE-FC Gateway Functions on page 196](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

Configuring an FCoE-FC Gateway Fibre Channel Fabric

Fibre Channel (FC) fabric configuration consists of creating a unique name and identifier for each FC fabric you want to create and configuring it as an FCoE-FC gateway.

You can create a maximum of 12 FC fabrics on a QFX3500 switch. After you create a fabric, you can create and assign interfaces to the fabric, configure FIP parameters for the fabric, and set proxy traceoptions.

To configure an FC fabric using the CLI, specify a unique name and identification number for the fabric:

1. Configure the fabric name and fabric ID:

```
[edit]
user@switch# set fc-fabrics fabric-name fabric-id fabric-id
```



NOTE: Changing the fabric name or the fabric ID causes all logins to drop and forces the ENodes to log in again.

For example, to configure an FC fabric with the name **fab_ulous** and the fabric ID 10 (the range of **fabric-id** values is 1 through 4095):

```
[edit]
user@switch# set fc-fabrics fab_ulous fabric-id 10
```

2. Configure the fabric as a gateway fabric:

```
[edit fc-fabrics fabric-name]
user@switch# set fabric-type proxy
```

For example, to configure the FC fabric with the name **fab_ulous** as a gateway fabric:

```
[edit fc-fabrics fab_ulous]
user@switch# set fabric-type proxy
```

Related Documentation

- [Converting an Ethernet Interface To a Fibre Channel Interface on page 255](#)
- [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
- [Assigning Interfaces to a Fibre Channel Fabric on page 262](#)
- [Configuring FIP on an FCoE-FC Gateway on page 216](#)
- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
- [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)
- [Understanding an FCoE-FC Gateway on page 190](#)

Understanding FCoE-FC Gateway Functions

When it functions as a Fibre Channel over Ethernet (FCoE)-Fibre Channel (FC) gateway, the QFX3500 switch provides the following functions:

- [Login and Logout on page 196](#)
- [FCoE and FC Frame Handling on page 197](#)
- [Data Center Bridging on page 197](#)
- [Disabling the Fabric WWN Verification Check on page 197](#)
- [Load Balancing on page 198](#)

Login and Logout

Each of the native FC interfaces on the gateway performs a fabric login (FLOGI) to the FC switch when each interface initializes. This establishes the link between each gateway FC interface and the FC switch.

When FCoE devices on the Ethernet network send an FCoE Initialization Protocol (FIP) login (FIP FLOGI) or FIP discovery (FIP FDISC) request to the gateway, the gateway acts on behalf of those devices and converts their FIP FLOGI and FIP FDISC requests to FC FDISC requests. The gateway then sends the FC FDISC requests to the FC switch. When the FC switch responds to an FDISC request, the gateway converts the FC response into a FIP response and sends it to the appropriate FCoE device.

The gateway also converts FIP logout (LOGO) requests from FCoE devices into FC LOGO requests to the FC switch, and converts the FC switch response into a FIP response for the FCoE device.

FCoE and FC Frame Handling

When it receives FCoE frames from FCoE devices, the gateway strips away the Ethernet encapsulation from the FC frame before sending the native FC frame to the FC switch.

When it receives native FC frames from the FC switch, the gateway encapsulates the native FC frames in Ethernet before sending the resulting FCoE frames to the appropriate VN_Port.

Data Center Bridging

The Ethernet ports connected to the FCoE devices are 10-Gbps Ethernet ports and support data center bridging (DCB) specifications:

- Priority-based flow control (PFC, described in IEEE 802.1Qbb)
- Data Center Bridging Capability Exchange protocol (DCBX), which is an extension of Link Layer Data Protocol (LLDP, described in IEEE 802.1AB)
- Enhanced transmission selection (ETS, described in IEEE 802.1Qaz)
- 10-Gigabit Ethernet ports

Disabling the Fabric WWN Verification Check

The gateway connects to a SAN fabric using the gateway NP_Ports (native FC ports). When the NP_Ports initialize, each port sends a FLOGI to the FC switch to which it is connected in the SAN fabric. The FC switch sends a FLOGI accept (FLOGI-ACC) message back to each NP_Port. The FLOGI-ACC message includes the SAN fabric worldwide name (WWN). The gateway uses the SAN fabric WWN in the multicast discovery advertisement (MDA) that the gateway sends to the ENodes in the FCoE network.

Some FC switches substitute their own WWN (often the FC switch's virtual WWN) for the SAN fabric WWN in the FLOGI-ACC message. When the FC switch substitutes its own WWN for the fabric WWN, gateway NP_Ports that log in to the same SAN fabric might receive different fabric WWNs in the FLOGI-ACC messages if the NP_Ports are connected to different FC switches in that SAN fabric. This creates a problem, because different fabric WWNs indicate different SAN fabrics. But in this scenario, the different fabric WWNs come from different FC switches in the same SAN fabric.

If the gateway receives different fabric WWNs on NP_Ports that are connected to the same SAN fabric, the gateway uses the first fabric WWN it receives in the MDA it sends to the ENodes. The gateway isolates the NP_Ports connected to that fabric that receive a different fabric WWN in the FLOGI-ACC message. No ENode sessions are assigned to the isolated NP_Ports. FC traffic is assigned only to NP_Ports that receive a fabric WWN that matches the fabric WWN received by the first NP_Port to log in to the FC fabric. (If an NP_Port receives a fabric WWN that does not match the fabric WWN received by the first NP_Port to log in to the FC fabric, it does not carry traffic to the SAN fabric.)

In summary, the scenario is:

1. The gateway has multiple NP_Ports connected to more than one FC switch in a SAN fabric.
2. When the NP_Ports initialize, each NP_Port sends a FLOGI to the FC switch to which it is connected.
3. The FC switches substitute their own WWNs for the fabric WWN in the FLOGI-ACC message, so different NP_Ports receive different fabric WWNs.
4. In the MDA the gateway sends to FCoE devices, the gateway uses the fabric WWN that the first NP_Port to log in to the fabric receives in the FLOGI-ACC message. If other NP_Ports receive a different fabric WWN from other FC switches in the SAN fabric, that fabric WWN is not advertised.
5. NP_Ports that receive a fabric WWN that does not match the first received fabric WWN are isolated, and the ENode sessions cannot use those ports.

To prevent this from happening, you can disable the gateway fabric WWN verification check so that all NP_Ports connected to a SAN fabric are used to carry traffic between the gateway and the FC switch, regardless of the fabric WWN the NP_Port receives in the FLOGI-ACC message.



NOTE: Disabling or enabling the fabric WWN verification check logs out all FCoE sessions.

Load Balancing

The switch performs automatic link load balancing for the connections between the gateway and the FC SAN and can also perform load balancing for the connections between the gateway and the FCoE devices in the Ethernet network. On the native FC links (NP_Ports) between the gateway and the FC SAN, the gateway can use one of the following three load-balancing algorithms:

- Simple load balancing—The switch assigns each ENode FLOGI session and VN_Port FDISC session to the least-loaded link. The switch can place FDISC sessions on a different link than the parent FLOGI session (an ENode FLOGI session and its subsequent FDISC sessions can be placed on different links). Simple load balancing is the default load-balancing algorithm. Rebalancing the link load disrupts only selected sessions to minimize the impact (the switch uses an algorithm to log out only the sessions that need to be moved to other links to balance the load when those sessions log in again).
- ENode-based load balancing—When an ENode logs in to the fabric, the switch places all subsequent VN_Port FDISC sessions associated with that ENode on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed

on the least-loaded link. The switch calculates the link load based on the combined total of FLOGIs and FDISCs on each NP_Port link. Rebalancing the link load disrupts all sessions (all sessions log out and then log in again).

- FLOGI-based load balancing—Similar to ENode-based load balancing; when an ENode logs in to the fabric, the switch places all subsequent VN_Port FDISC sessions associated with that ENode on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link.



NOTE: Changing the load-balancing algorithm when FCoE sessions are running forces the FCoE sessions to log out, then log in again.

**Related
Documentation**

- [Understanding Fibre Channel on page 186](#)
- [Understanding an FCoE-FC Gateway on page 190](#)
- [Understanding DCB Features and Requirements on page 292](#)
- [Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Disabling the Fabric WWN Verification Check on page 200](#)
- [Monitoring Fibre Channel Interface Load Balancing on page 474](#)

Disabling the Fabric WWN Verification Check

When a QFX Series NP_Port sends a fabric login (FLOGI) request to a Fibre Channel (FC) switch, the FLOGI accept (FLOGI-ACC) reply from the FC switch contains the SAN fabric worldwide name (WWN). The QFX Series uses the SAN fabric WWN in the multicast discovery advertisement (MDA) that the QFX Series sends to the ENodes in the FCoE network.

However, some FC switches substitute their own WWN (often the FC switch's virtual WWN) for the SAN fabric WWN in the FLOGI-ACC message. In this case, different NP_Ports that log in to the same FC fabric might receive different fabric WWNs in the FLOGI-ACC messages if the NP_Ports are connected to different FC switches in the SAN fabric.

If the QFX Series receives different fabric WWNs on NP_Ports that are connected to the same SAN fabric, the QFX Series uses the first fabric WWN it receives in the MDA it sends to the ENodes. The QFX Series isolates the NP_Ports that receive a different fabric WWN from other FC switches in that SAN fabric. No ENode sessions are assigned to the isolated NP_Ports. FC traffic is assigned only to NP_Ports that receive a fabric WWN in the FLOGI-ACC message that matches the fabric WWN received by the first NP_Port to log in to the FC fabric. (If an NP_Port receives a fabric WWN that does not match the fabric WWN received by the first NP_Port to log in to the FC fabric, it does not carry traffic to the SAN fabric.)

To prevent ENodes from being isolated due to a mismatched fabric WWN, you can disable the gateway fabric WWN verification check. Disabling the fabric WWN verification check enables all NP_Ports connected to a SAN fabric are used to carry traffic between the gateway and the FC switch, regardless of the fabric WWN the NP_Port receives in the FLOGI-ACC message.



NOTE: Disabling or enabling the fabric WWN verification check logs out all FCoE sessions.

To disable the fabric WWN verification check:

- [edit fc-fabrics *fabric-name* proxy]
user@switch# **set no-fabric-wwn-verify**

Related Documentation

- [Understanding FCoE-FC Gateway Functions on page 196](#)
- [show fibre-channel proxy fabric-state on page 544](#)

Understanding FCoE and FIP Session High Availability

High availability features maintain storage network sessions when a system process is terminated and during certain types of upgrades:

- [High Availability for Fibre Channel Process Termination \(FCoE-FC Gateway Mode, QFX3500 Only\)](#) on page 201
- [High Availability for FIP Snooping](#) on page 201
- [Nonstop Software Upgrade \(QFabric Systems\)](#) on page 202

High Availability for Fibre Channel Process Termination (FCoE-FC Gateway Mode, QFX3500 Only)

In FCoE-FC gateway mode, the QFX3500 switch provides high availability to restore the FCoE sessions running on the switch in case the Fibre Channel (FC) process is terminated. A session is a fabric login (FLOGI) or fabric discovery (FDISC) login to the FC SAN fabric, not an end-to-end server-to-storage session.

The switch stores FCoE session data in a persistent storage module. If the FC process terminates, the switch restores the existing FCoE sessions on the same interfaces that they were on before the FC process terminated. Data traffic for existing sessions is not affected during session restoration.

For a brief time, the system does not process control traffic because of the FC process restart and session restoration. During this brief time, no new FCoE sessions can be established, and no existing sessions can log out.



NOTE: During the restoration process, if the FC process does not receive an *interface up* notification from a particular interface within a certain time, the switch times out the restore operation and discards the data on that interface. The previously existing FCoE sessions on that interface are not restored, and the ENodes must log in again.



NOTE: An FC process restart and session restoration resets the Fibre Channel statistics.

If the FC process terminates repeatedly, the operating system disables the process until you manually restart it. To restart the FC process manually, issue the **restart fibre-channel** command.

High Availability for FIP Snooping

You can configure the system to perform FIP snooping on Ethernet interfaces that are connected to FCoE devices that have ENodes. The high availability function restores running FIP snooping sessions in case the Ethernet switching process is terminated.



NOTE: Juniper Networks QFX10000 switches do not support FIP snooping. (Aggregation devices do not need to enable FIP snooping because FIP snooping is performed at the FCoE access edge.)

The Ethernet switching process stores the FIP snooping state in a persistent storage module. If the Ethernet switching process terminates, the switch restores the existing FIP snooping sessions on the same interfaces that they were on before the Ethernet switching process terminated. The high availability features preserve:

- Logged in ENodes
- Discovered FCFs
- Existing sessions
- Existing FIP snooping filters

The complete restoration process, including reconciling all valid states, takes a maximum of 8 seconds. During the restoration process, the switch can learn a new FCF or a new FC switch, and new ENodes can log in to the FC network. However, FDISC messages from an ENode that is already logged in to the network might be dropped if the ENode has not yet been restored.

When the Ethernet switching process terminates ungracefully, the FIP keepalive timer is reset to the normal initial value, not the value at the time of the Ethernet switching process termination.

In the event of an Ethernet switching process termination, ENodes remain logged in, and existing sessions are not interrupted.



NOTE: An Ethernet switching process restart and session restoration resets the FIP snooping statistics.

Nonstop Software Upgrade (QFabric Systems)

On QFabric system Node groups that have more than one Node device, nonstop software upgrade (NSSU) enables you to upgrade the Node devices with minimal packet loss and maximum uptime. NSSU automates software upgrades on the QFabric system components in an orderly and consistent manner to maximize system uptime.

The system upgrades components with redundant architectures, such as redundant server Node groups and network Node groups that have two or more members, in stages. While the system upgrades one component, the redundant component continues to function.

For example, while one member of a redundant server Node group is upgraded, the other member continues to forward traffic. When the first Node group member completes the upgrade, it comes online while the system upgrades the second member.

NSSU provides high availability for the lossless traffic forwarding required to support storage networks. If your system design includes redundancy (redundant Node devices in Node groups, LAGs, and so on) so that an alternate traffic path is available, when you upgrade a Node device, traffic is not impacted.

In fully redundant topologies, NSSU preserves FIP session, FIP snooping filter, VN2VF_Port session, and VN2VN_Port session information and prevents traffic loss in most cases. An exception is that Node devices that are directly connected to ENodes experience momentary traffic loss when the Node device reboots.

Related Documentation

- [Understanding FCoE on page 51](#)

Understanding FIP Functions

Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) performs four major functions:

- FIP VLAN discovery: FCoE device FCoE nodes (ENodes) discover the FCoE VLANs on which to transmit and receive FIP and FCoE traffic.
- FIP discovery: FCoE devices discover Fibre Channel (FC) switches to which they can connect.
- Initialization: FCoE devices perform fabric login (FLOGI) and fabric discovery (FDISC) to create a virtual link with an FC switch.
- Maintenance: The switch ensures that the virtual link between the FCoE device and the FC switch remains valid, and also that the link termination logout (LOGO) functions properly.

When you configure the switch as an FCoE-FC gateway (QFX3500 switch only, as a standalone switch or as a QFabric system Node device), it converts FIP requests and information from FCoE devices into FC requests and information and relays them to the FC switch. To FCoE devices, the gateway appears to be an FCoE forwarder (FCF) and presents virtual fabric port (VF_Port) interfaces to the server ENode. To FC switches, the gateway appears to be an FC device that supports N_Port ID virtualization (NPIV) and presents an N_Port interface to the FC switch F_Port interface. When you configure the switch as an FCoE transit switch, you do not configure FIP parameters on the switch.

FIP FLOGI, FDISC, and LOGO are similar to the same processes in the native FC protocol.

This topic describes:

- [FIP VLAN Discovery on page 204](#)
- [FIP Discovery on page 204](#)
- [FIP FLOGI on page 205](#)
- [FIP FDISC on page 206](#)
- [FIP Maintenance \(Keepalive Messages\) on page 206](#)
- [FIP LOGO on page 207](#)

FIP VLAN Discovery

The gateway supports FIP VLAN discovery. Host ENodes use FIP VLAN discovery to discover the FCoE VLANs on which they will send and receive FIP and FCoE traffic and on which they will establish a virtual link with the FC switch. This means FCoE devices do not need manually configured FCoE VLANs.

FIP VLAN discovery and notification takes place on the native VLAN that the FCoE device uses for Ethernet traffic:

1. The ENode sends a FIP VLAN discovery request to a multicast address called *ALL-FCF-MACs* to which all FC switches and FCFs on the VLAN listen.
2. The FC switches and FCFs respond on the native VLAN with a list of the FCoE VLANs that are available for login.
3. The ENode selects an FCoE VLAN and continues the FIP process on that VLAN.

Except for FIP VLAN discovery, all other FIP and FCoE traffic runs on an FCoE VLAN.



BEST PRACTICE: Only FCoE traffic is permitted on the FCoE VLAN. A native VLAN might need to carry untagged traffic of different types and protocols. Therefore, it is a good practice to keep the native VLAN separate from FCoE VLANs.

FIP Discovery

The FIP discovery process allows an FCoE device ENode MAC to locate (discover) the FC switches in the FCoE VLAN to which it belongs. The ENode selects an FC switch to log in to from the available FC switches. Either the ENode MAC or the FC switch can initiate the FIP discovery process.

Server ENode MACs initiate FIP discovery:

1. When an ENode MAC comes online, it sends a multicast discovery solicitation message on its FCoE VLAN to a multicast address called *ALL-FCF-MACs* to which all FCFs (including the FCF functionality of FC switches) on the VLAN listen. The discovery solicitation message includes the ENode's addressing mode and the maximum protocol data unit (PDU) size the ENode MAC uses for FCoE traffic.

The ENode uses the globally unique ENode MAC address assigned to it by the converged network adapter (CNA) manufacturer as an identifier in the FIP frame header.

2. The FCFs on the VLAN that have a similar supported addressing mode, match the maximum FCoE size, and can accept a login from the ENode reply to the discovery

solicitation message by sending a solicited unicast discovery advertisement message to the soliciting ENode MAC.

3. The ENode MAC compiles a list of FCFs that are available for login, selects an FCF (the FCF with the highest priority setting), and is then ready to log in to the FCF.

The FIP discovery process is similar when the FC switch or FCF initiates discovery:

1. FCF MACs periodically send unsolicited multicast discovery advertisements on the FCoE VLAN to the *ALL-ENode-MACs* multicast address, to which all ENode MACs on the VLAN listen. The FIP keepalive advertisement period timer (FKA_ADV_PERIOD) controls the interval between multicast discovery advertisements. The multicast discovery advertisements inform ENodes on the VLAN that FCF VF_Ports are available for establishing virtual links with ENode VN_Ports.
2. ENodes on the FCoE VLAN create an entry for the FCF-MAC in their FCF-MAC lists.
3. An ENode can respond to the unsolicited multicast discovery advertisement with a unicast discovery solicitation message to the FCF.
4. Upon receiving the ENode's unicast discovery solicitation, the FCF replies with a unicast discovery advertisement sent to the ENode MAC.

After the ENode MAC selects an FCF to log in to, FIP initialization begins. To proceed from discovery to initialization, the server ENode addressing mode must match the FCF addressing mode and maximum FCoE size. In addition, the FCF must be configured to allow FIP FLOGI from that ENode.

FIP FLOGI

FIP initialization is the server ENode login process to the FCF after the ENode discovers the FCFs (including FC switches) on the FCoE VLAN:

1. The ENode sends a fabric login (FLOGI) request message to the FCF.
2. The FCF replies to confirm the ENode login and provides the ENode a locally unique MAC address to use for FCoE frame transactions. The locally unique MAC address identifies the VN_Port interface of the ENode for the session the login establishes. (The ENode continues to use the globally unique ENode MAC address for FIP frame transactions.)

The locally unique ENode MAC address for FCoE operations depends on whether the ENode address mode is configured as a fabric-provided MAC address (FPMA) or as a server-provided MAC address (SPMA; the gateway does not support ENodes in SPMA mode and rejects login attempts from ENodes in SPMA mode):

- For FPMA mode, the FCF provides a MAC address to the ENode during the FIP FLOGI exchange. The FPMA MAC address is a 48-bit value that is unique to the local fabric and consists of a 24-bit FCoE mapped address prefix (FC-MAP) and a 24-bit FC identifier (FCID). You can configure the FC-MAP value on the FCF or use the default value of 0EFC00h. The FCoE device must use the same FC-MAP value as the FCF, or else discovery and login fail.
- For SPMA mode, the server provides its MAC address to the FCF. The FCF compares the server MAC address to a list of addresses approved for FCoE access. The gateway does not support ENodes in SPMA mode.

Successful login instantiates a secure virtual link between the ENode and the FCF and terminates the FIP virtual link instantiation phase. The initiating server behind the ENode can exchange FC payloads with storage devices in the FC SAN by sending FCoE frames over the virtual link.

FIP FDISC

After an ENode successfully logs in to an FCF and establishes a virtual link, the ENode can request more virtual links (sessions) over the same physical link by sending a FIP fabric discovery (FDISC) request. FDISC allows the creation of multiple separate secure VN_Port virtual links on one physical link. Each virtual link receives a locally unique identifier from the FCF to enable security and separation between the VN_Port virtual links sharing a physical ENode port. This is called N_Port ID virtualization (NPIV).

FDISC is similar to FLOGI in that it requests a login and a unique ID from the FCF. The difference is that FLOGI obtains the initial login and ID for the physical link, whereas FDISC obtains additional logins and IDs so that multiple virtual links can share one physical link securely.

After a VN_Port FDISC is complete, the application using that VN_Port can send FCoE frames over the virtual link.

FIP Maintenance (Keepalive Messages)

Although FCoE protocol handles the payload communication between the initiating ENode and the target FC device, FIP continues to run in the background. FIP constantly updates ENode FCF lists by listening to the periodic FCF multicast discovery advertisements, and it verifies the ability to reach the FCF by transmitting periodic FIP keepalive advertisements.

The ENode sends periodic ENode FIP keepalive advertisements to the FCF with the ENode MAC address as the identifier. The ENode also sends periodic VN_Port FIP keepalive advertisements on behalf of each VN_Port on the ENode, using the VN_Port MAC address as the source MAC. The VN_Port FIP keepalive advertisements occur every 90 seconds. The keepalive advertisements reset the session timer for the virtual link connection to

the FCF. If the FCF does not receive a keepalive advertisement for a logged-in ENode or VN_Port before the session timer expires, the virtual link is terminated.

The periodic unsolicited multicast discovery advertisements the FCF sends to the *ALL-ENode-MACs* address continuously verify that the FCF is still reachable. The ENode and the FCF periodic unsolicited multicast discovery advertisements occur at the configured FIP keepalive advertisement period interval (FKA_ADV_PERIOD) plus or minus a random offset to prevent a flood of simultaneous keepalive advertisements.

If the FCF does not receive the ENode keepalive advertisements before the FCF's FIP keepalive timer expires, the FCF considers the virtual link to the ENode as "down" and terminates the virtual link to the ENode. The keepalive timer expires in 2.5 times the configured timer value. This also terminates any VN_Port virtual links instantiated by that ENode.

If the FCF does not receive a VN_Port keepalive advertisement before the FCF's FIP keepalive timer expires, the FCF considers the virtual link to the VN_Port as "down" and terminates the virtual link to that VN_Port. The VN_Port keepalive timer expires in 2.5 times the configured timer value.

If the ENode does not receive the FCF unsolicited multicast discovery advertisement before the ENode's FIP keepalive timer expires, the ENode considers the virtual link to the FCF as "down" and all of the VN_Port virtual links to that FCF on the ENode are terminated.

FIP LOGO

FIP handles ENode and VN_Port logout when a session is finished.

Related Documentation

- [Overview of FIP on page 41](#)
- [Understanding FIP Implementation on an FCoE-FC Gateway on page 208](#)
- [Understanding FIP Parameters on an FCoE-FC Gateway on page 212](#)
- [Understanding Fibre Channel Virtual Links on page 225](#)
- [Understanding FCoE on page 51](#)

Understanding FIP Implementation on an FCoE-FC Gateway

In a network that converges Fibre Channel (FC) and Ethernet traffic, when you configure a QFX3500 switch as a Fibre Channel over Ethernet (FCoE)-FC gateway, it translates FCoE Initialization Protocol (FIP) frames from FCoE nodes (ENodes) into native FC frames for FC switches and translates native FC frames from FC switches into FIP frames for ENodes. To an FCoE device, the gateway appears to be an FCoE forwarder (FCF) and presents a fabric port (F_Port) interface to the FCoE device ENode. To an FC switch, the gateway appears to be an FC host capable of N_Port ID virtualization (NPIV) and presents a node port (N_Port) interface to the FC switch F_Port interface.



NOTE: The N_Ports that the gateway presents to the FC switch are called proxy N_Ports (NP_Ports). To the FC switch, the gateway NP_Ports appear to be native FC N_Ports that are capable of performing NPIV. The NP_Ports are proxies for the FCoE devices in the Ethernet network. The NP_Ports convert FCoE traffic from the FCoE devices into native FC traffic for the FC switch. The NP_Ports also convert native FC traffic from the FC switch into FCoE traffic for the FCoE devices on the Ethernet network.

- [FIP Basics on page 208](#)
- [Fabric Login and FIP Login Overview on page 209](#)
- [Proxy FIP Discovery on page 210](#)
- [Proxy FIP Initialization on page 211](#)
- [Proxy FIP Maintenance on page 212](#)
- [Proxy FIP Logout on page 212](#)

FIP Basics

FIP is enabled by default on all VLAN interfaces that belong to each FC fabric configured on the gateway. You can configure FIP parameters at a global level or on an individual interface. When you configure a parameter on an interface, it overrides the global configuration only for that interface. If you do not explicitly configure a FIP parameter, the gateway uses the default value.

In order for the gateway to connect FCoE devices with FCFs, the FIP parameters you configure on the gateway must be compatible with the parameters configured on the FC switch (for example, the FC-MAP values of the FC switch and of the FC fabric FIP configuration on the gateway must match, or the FC switch drops the frames).

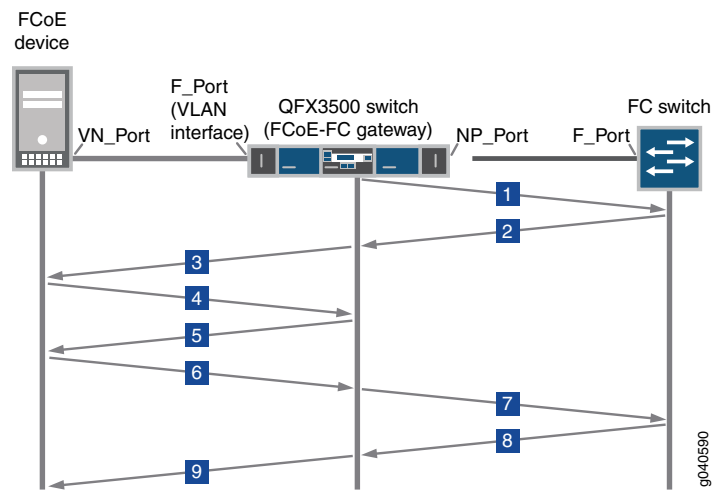
When the NP_Ports on the gateway come up, they perform an FC FLOGI to the connected FC switch. Successful login establishes communication between the gateway and the FC switch, and gateway NP_Ports are marked for sending FDISC messages. Successful login also creates a next-hop entry in the gateway for the FC switch. If the FC switch rejects the FLOGI request, no link is established. The gateway maintains a list of valid FCF-MACs with which ENodes can connect.

After establishing communication with an FC switch, the gateway can connect FCoE devices in the Ethernet network to the FC switch. All of the subsequent connections the gateway makes with FC switches as a proxy for ENodes (on behalf of ENodes) are virtualized (NPIV) connections.

Fabric Login and FIP Login Overview

Figure 13 on page 209 provides a brief overview of the FCoE-FC gateway fabric login to the FC switch and the FCoE device FIP login to the gateway.

Figure 13: FCoE-FC Gateway Fabric Login and FIP Login



The numbers in the following list correspond to the numbers in Figure 13 on page 209 and briefly describe each step of the login process:

1. The FCoE-FC gateway NP_Port sends an FC fabric login (FLOGI) request to the FC switch F_Port.
2. The FC switch accepts the gateway FLOGI.
3. The gateway sends FIP multicast discovery advertisements on the FCoE VLAN (the gateway F_Port interface) to all connected FCoE device ENodes.
4. The FCoE device ENode sends a discovery solicitation message to the gateway.
5. The gateway responds with a unicast discovery advertisement to the ENode.



.....

NOTE: The gateway limits the number of discovery solicitations it accepts from FCoE devices to a maximum of 100 outstanding requests at any given time. If the gateway has 100 discovery solicitations outstanding, the gateway does not respond to new discovery solicitations. Instead, the gateway drops new discovery solicitations and reports the number of dropped discovery solicitations in the **Dropped** field of the **show fibre-channel fip statistics** command output. When there are fewer than 100 outstanding discovery solicitations, the system responds to new requests as usual with a discovery advertisement.

.....

6. The FCoE device sends a FIP FLOGI or FIP FDISC message to the gateway.
7. The gateway converts the FIP FLOGI or FIP FDISC to an FC FDISC and forwards it to the FC switch to obtain a login for the FCoE device.
8. The FC switch responds to the FC FDISC by sending a new ID for the NPIV session to the gateway.
9. The gateway converts the FC FDISC response from the FC switch to a FIP FDISC response and forwards it to the FCoE device.

The following sections describe some of these steps in greater detail.

Proxy FIP Discovery

After the gateway establishes a connection with an FC switch:

1. The gateway sends periodic FIP multicast discovery advertisements on the FCoE VLAN so that ENodes can add the gateway to their FCF lists.
2. The ENode initializes and sends a multicast discovery solicitation message on the FCoE VLAN. If the ENode has already initialized and has a list of FCFs, it can send a unicast discovery solicitation message to a particular FCF such as the gateway.



.....

NOTE: The gateway limits the number of discovery solicitations it accepts from FCoE devices to a maximum of 100 outstanding requests at any given time. If the gateway has 100 discovery solicitations outstanding, the gateway does not accept new discovery solicitations until there are fewer than 100 discovery solicitations outstanding.

.....

3. When the gateway receives a multicast discovery solicitation from an ENode, it responds by sending a unicast discovery advertisement to that ENode.

When the gateway receives a unicast discovery solicitation from an ENode, it also responds with a unicast discovery advertisement to the ENode.

To the ENode, the gateway appears to be an FCF.

The FIP discovery process adds the ENode to the gateway ENode database.

Proxy FIP Initialization

1. If the ENode chooses to log in to the gateway, it responds to the gateway's unicast discovery advertisement by sending a login request in the form of a FIP FLOGI if it is the initial connection to the gateway. If the ENode already has an established session with the gateway and another application or virtual machine wants to connect to the gateway, the ENode sends a FIP FDISC to the gateway.
2. The gateway receives the FIP FLOGI or FIP FDISC from the ENode, converts it into an FC FDISC, and sends it through the least-loaded NP_Port to the FC switch on behalf of the ENode. The FC FDISC message requests an FCID for the new virtual link.



NOTE: The gateway converts both ENode FIP FLOGI and FIP FDISC messages into FC FDISC messages, because the gateway has already performed FC FLOGI with the FC switch, so all subsequent connection requests on the gateway NP_Port are FDISC requests for virtual (NPIV) connections. FDISC messages request a virtual N_Port connection over an existing physical N_Port connection.

3. The FC switch processes the request, accepts it, assigns a unique FCID for the connection, and then sends the response to the gateway. If the FC switch rejects the FDISC request, no virtual link is established.
4. The gateway maps the FC switch response to the ENode VN_Port, converts the FC acceptance message to a FIP FLOGI or FIP FDISC response, and sends it to the ENode VN_Port.
5. The ENode VN_Port accepts the FCID, and the virtual link is established.

If an ENode sends an FDISC, the proxy gateway switch checks whether the ENode has already performed a FLOGI to create the initial connection. If the ENode has not performed a FLOGI, the FDISC request is dropped.

The FC protocol does not recognize multipoint-to-point connections. Although the gateway can aggregate traffic from multiple FCoE servers on one NP_Port, each virtual link appears to be an individual point-to-point link between an FCoE ENode VN_Port and the FC switch, not as an aggregated multipoint-to-point link. The gateway is essentially invisible to the FC protocol, so the virtual link looks and acts like a point-to-point link from the FCoE device to the FC switch.

Proxy FIP Maintenance

The gateway sends and receives periodic FIP keepalive messages to and from ENode VN_Ports to maintain the connection between the gateway and the ENodes.

Proxy FIP Logout

As with FIP discovery and FIP FLOGI, the gateway represents the FCoE device in transactions with the FC switch and represents the FC switch in transactions with the FCoE device:

1. An ENode VN_Port sends a FIP LOGO message to log off and terminate the virtual link connection.
2. The gateway converts the FIP LOGO to an FC LOGO and relays it to the FC switch.
3. The FC switch responds to the LOGO request.
4. The gateway converts the FC LOGO response to a FIP LOGO response and relays it to the VN_Port, completing the logout and terminating the virtual link.

Related Documentation

- [Overview of FIP on page 41](#)
- [Understanding FIP Functions on page 203](#)
- [Understanding FIP Parameters on an FCoE-FC Gateway on page 212](#)
- [Understanding Fibre Channel Virtual Links on page 225](#)
- [Understanding FCoE on page 51](#)
- [Configuring FIP on an FCoE-FC Gateway on page 216](#)

Understanding FIP Parameters on an FCoE-FC Gateway

By default, FIP is enabled, and the default FIP settings are valid on all FCoE interfaces that are part of the gateway FC fabric. You can configure some FIP parameters at a global level or on a specific interface. Some FIP parameters can be configured only at the global level or only at the individual interface level. When you configure a parameter at the interface level, the configuration overrides the global setting for that interface only.

- [FIP Keepalive Advertisement Period on page 213](#)
- [Addressing Mode on page 213](#)
- [FC-MAP on page 214](#)
- [FCoE Trusted Fabric on page 214](#)
- [Maximum Number of FCoE Sessions Per ENode on page 215](#)
- [Priority on page 215](#)

FIP Keepalive Advertisement Period

The FIP keepalive advertisement period (*fka-adv-period*) is the time interval between messages that verify the connection is still valid and the device at the other end of the virtual link is still reachable. The ENode sends an ENode FIP keepalive advertisement to the gateway with the ENode MAC address as the source address to verify its reachability. The ENode also sends VN_Port FIP keepalive messages for every VN_Port on the ENode that is logged in to the gateway, with the VN_Port MAC address as the source address.

The FIP keepalive advertisement period also determines the time interval between unsolicited multicast discovery advertisements from the gateway to the *ALL-ENode-MACs* multicast address. Unsolicited multicast discovery advertisements serve as keepalive messages from the gateway to the ENodes and also advertise the gateway's presence on the network.

The gateway sends the periodic unsolicited multicast discovery advertisements to the ENodes. On the gateway, you can configure a global FIP keepalive advertisement period for an FC fabric and you can configure a FIP keepalive advertisement period for individual interfaces to override the global setting.

Addressing Mode

For FIP transactions, the ENode identifies itself using the globally unique MAC address assigned to the CNA by the manufacturer. After FIP has established a virtual link between an ENode VN_Port and the gateway, for FCoE transactions, the VN_Port identifies itself using a locally unique MAC address. The format of the locally unique MAC address depends on the addressing mode the fabric supports and the addressing mode the ENode is programmed to use.

The addressing mode is not a configurable parameter on the gateway. FC fabrics on the gateway support only the fabric provided MAC address (FPMA) addressing mode for FCoE transactions. The gateway does not support the server provided MAC address (SPMA) addressing mode. ENodes that use SPMA cannot log in to the gateway.

The FC switch assigns a locally unique FPMA to an ENode MAC through the FLOGI or FDISC process:

1. During the FIP discovery process, the ENode compiles a list of compatible FCFs (including the gateway) in the fabric. A compatible addressing mode is one of the criteria an FCF must meet to be added to an ENode's compatible FCFs list.
2. The ENode MAC transmits a FLOGI or FDISC to the FCF that includes the addressing modes the ENode supports.
3. If the FCF supports an addressing mode the ENode uses, the FCF accepts the FLOGI or FDISC and assigns the FPMA in the accept message (FIP FLOGI LS_ACC or FIP NPIV FDISC LS_ACC). If the ENode uses an addressing mode that is incompatible with the FCF, the FLOGI or FDISC is rejected.

The FPMA uniquely identifies a single VN_Port at that ENode MAC in FCoE transactions with the FCF. Each VN_Port connection receives its own unique FPMA to identify its virtual link connection. When an ENode uses NPIV to create multiple VN_Ports, each VN_Port virtual link receives its own unique FPMA to identify its traffic.

An FPMA consists of two concatenated 24-bit values:

1. The upper 24 bits are the FCF's FC-MAP value, which is a MAC address prefix that is unique to the fabric.
2. The lower 24 bits are the locally unique FCID that the FCF (FC switch) assigns to the VN_Port.

The combination of these values guarantees that each FPMA is unique within a fabric.

FC-MAP

The FCoE mapped address prefix (FC-MAP) value is a MAC address prefix used by the FCF that is unique within a given fabric. The FCF uses the FC-MAP for FCoE traffic within that fabric. The FCF rejects FCoE traffic that uses an FC-MAP value that does not match the FCF's FC-MAP value. In most cases, the FCF uses the default FC-MAP value (0EFC00), but a pool of 256 values is available (0EFC00 through 0EFCFF).

The gateway learns FC switches in the fabric that match the gateway fabric's FC-MAP value. To learn and communicate with an FC switch, the FC-MAP value for a fabric (or for the fabric's FCoE VLAN) on the gateway must match the FC switch's FC-MAP value. If the FC-MAP values do not match, no connection is established.



NOTE: Changing the FC-MAP value causes all logins to drop and forces the ENodes to log in again.

FCoE Trusted Fabric

By default, all interfaces are untrusted interfaces. You can globally configure all of the ports in a specified gateway FC fabric to be FCoE trusted. This reduces system overhead by eliminating the need for filters. The total number of FCoE sessions (ENode to FCF sessions) the system can support is 2500 sessions. Sessions are defined as the combined number of VN_Port to VF_Port sessions and VN_Port to VN_Port sessions. (Although VN2VF and VN2VN sessions run in different FCoE VLANs, the session limit is a system limit, not a per-VLAN limit.)



NOTE: A session is a FLOGI or FDISC login to the FC SAN fabric. Session does not refer to end-to-end server-to-storage sessions. There is no limit to the number of end-to-end server-to-storage sessions.



NOTE: Changing the fabric ports from untrusted to trusted removes any existing FIP snooping filters from the ports and terminates the existing sessions. Changing the fabric ports from trusted to untrusted forces all of the FCoE sessions on those ports to log out so that when the ENodes and VN_Ports log in again, the switch can build the appropriate FIP snooping filters.

Maximum Number of FCoE Sessions Per ENode

You can configure the maximum number of FCoE session logins from each ENode that are permitted on the gateway FC fabric. The number of sessions is the ENode FLOGI session plus the VN_Port FDISC sessions on that ENode. Regardless of whether the fabric is trusted or untrusted, the maximum number of FCoE sessions per ENode is 2500 sessions. The total number of sessions cannot exceed the gateway fabric's maximum limit of 2500 sessions.

The maximum number of FCoE sessions per ENode is a global configuration for all members of the gateway FC fabric and cannot be configured on a per-interface basis.



NOTE: Session does not refer to end-to-end server-to-storage sessions. There is no limit to the number of end-to-end server-to-storage sessions.

Priority

When the FIP discovery process offers an ENode the choice of more than one FCF-MAC on a given FCF to use for login, the ENode chooses the FCF-MAC to which to send a login request based on the FCF-MAC priority. The lower the priority number, the higher the FCF-MAC's priority. The ENode selects the highest-priority (lowest priority number) FCF-MAC for the login request.

An ENode can receive multiple FCF-MAC advertisements from the same FCF in two ways:

- During the FIP discovery process, an FCF can receive an ENode MAC's multicast discovery solicitation on multiple FCF-MACs. Each FCF-MAC replies with a unicast discovery advertisement to the ENode. The ENode determines that the advertisements are from the same FCF, because the value in the Name_Identifier descriptor is the same in each advertisement.
- During the FIP discovery process, an ENode MAC can receive unsolicited multicast discovery advertisements from multiple FCF-MACs on the same FCF. The ENode determines that the advertisements are from the same FCF, because the value in the Name_Identifier descriptor is the same in each advertisement.

On the gateway, you can configure the priority value for an entire fabric or for an individual interface. The default value for both the fabric and the individual interfaces is 128 (the highest priority is 0; the lowest priority is 255).

**Related
Documentation**

- [Overview of FIP on page 41](#)
- [Understanding FIP Functions on page 203](#)
- [Understanding FIP Implementation on an FCoE-FC Gateway on page 208](#)
- [Understanding Fibre Channel Virtual Links on page 225](#)
- [Understanding FCoE on page 51](#)
- [Configuring FIP on an FCoE-FC Gateway on page 216](#)

Configuring FIP on an FCoE-FC Gateway

Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) establishes and maintains Fibre Channel (FC) virtual links between pairs of FCoE devices. A virtual link emulates the physical point-to-point link that FC requires between two FC devices.

FIP is enabled by default and uses the default FIP settings on all FCoE interfaces that are part of the gateway FC fabric. You can use the default FIP parameter values, or you can configure FIP parameters globally or on a per-interface basis. Configuring FIP on an individual interface overrides the global FIP configuration.

You can configure the following parameters globally for the fabric and per interface:

- FIP keepalive message transmission interval—This interval is the time period between sending FIP keepalive messages.
- Priority—If an FCoE node (ENode) connects to more than one switch, the priority value determines the switch to which the ENode connects. The switch with the lowest priority number has the highest priority.

You can only configure the following parameters globally on an FC fabric:

- FC-MAP—The 24-bit FCoE mapped address prefix that identifies the attached FC switch in the SAN fabric. The FC-MAP value is used in the fabric provided MAC address (FPMA) created for each ENode that logs in. This value must be the same for the FC switch and the QFX Series.



NOTE: Changing the FC-MAP value causes all logins to drop and forces the ENodes to log in again.

- FCoE trusted—You can globally configure all of the Ethernet ports in a specified FC fabric to be FCoE trusted. You might want to configure interfaces as FCoE trusted if the interfaces are connected to a transit switch that is performing FIP snooping. For interfaces that are directly connected to FCoE hosts, FIP snooping should be enabled, and you should not configure the fabric as FCoE trusted.
-



NOTE: Do not configure interfaces with FIP snooping enabled as FCoE trusted.

Configuring interfaces as FCoE trusted reduces system overhead by eliminating the need for filters. The total number of sessions the system can support is 2500 sessions. Sessions are defined as the combined number of VN_Port to VF_Port sessions and VN_Port to VN_Port sessions. (Although VN2VF and VN2VN sessions run in different FCoE VLANs, the session limit is a system limit, not a per-VLAN limit.)



NOTE: A session is a FLOGI or FDISC login to the FC SAN fabric. Session does not refer to end-to-end storage sessions. There is no limit to the number of end-to-end storage sessions.



NOTE: Changing the fabric ports from untrusted to trusted removes any existing FIP snooping filters from the ports. Changing the fabric ports from trusted to untrusted forces all of the FCoE sessions on those ports to log out so that when the ENodes and VN_Ports log in again, the switch can build the appropriate FIP snooping filters.

- Maximum number of FCoE sessions per ENode—You can globally configure the maximum number of FCoE sessions (FLOGI plus FDISC) permitted from an ENode. The maximum number of sessions per ENode is 2000 sessions. The total number of sessions (VN2VF_Port sessions and VN2VN_Port sessions combined) cannot exceed the gateway fabric's maximum limit of 2500 sessions.

To configure FIP options globally using the CLI:

1. Specify the fabric on which you want to configure FIP:

```
[edit]
user@switch# set fc-fabrics fabric-name protocols fip
```

2. Configure the FIP keepalive message transmission interval in milliseconds to specify the amount of time between periodic FIP discovery advertisements for the fabric interfaces (the default is 8000 ms; the range is 250 through 90000 ms):

```
[edit fc-fabrics fabric-name protocols fip]
user@switch# set fka-adv-period milliseconds
```

3. Configure the priority value the switch advertises to ENodes in the range from 0 through 255; the default value is 128:

```
[edit fc-fabrics fabric-name protocols fip]
user@switch# set priority priority
```

4. Configure the FC-MAP value to match the FC-MAP value of the attached FC switch in the FC SAN fabric; the range of possible values is 0EFC00 through 0EFCFF, and the default value is 0EFC00:

```
[edit fc-fabrics fabric-name protocols fip]  
user@switch# set fc-map fc-map
```

5. Configure the interfaces in the FC fabric as FCoE trusted (in this example, we assume that the interfaces have not been enabled for FIP snooping):

```
[edit fc-fabrics fabric-name protocols fip]  
user@switch# set fcoe-trusted
```

6. Configure the maximum number of FCoE sessions for each ENode in the fabric:

```
[edit fc-fabrics fabric-name protocols fip]  
user@switch# set max-sessions-per-enode
```

For example, to configure all FCoE interfaces associated with an FC fabric called **movieco_san** with a FIP keepalive interval value of **25000** milliseconds, a priority of **70**, an FC-MAP value of **0EFC01**, as FCoE trusted, and with a maximum number of FCoE sessions per ENode of 200 sessions:

```
[edit fc-fabrics movieco_san protocols fip]  
user@switch# set fka-adv-period 25000  
user@switch# set priority 70  
user@switch# set fc-map 0EFC01  
user@switch# set fcoe-trusted  
user@switch# set max-sessions-per-enode 200
```

To override the global FC fabric FIP configuration for a specific FCoE interface using the CLI:

1. Specify the fabric and interface on which you want to configure FIP:

```
[edit fc-fabrics fabric-name protocols fip interface interface-name]
```

2. Configure the FIP keepalive message transmission interval and priority:

```
[edit fc-fabrics fabric-name protocols fip interface interface-name]  
user@switch# set fka-adv-period milliseconds  
user@switch# set priority priority
```

Related Documentation

- [Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195](#)
- [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
- [Understanding FIP Parameters on an FCoE-FC Gateway on page 212](#)

Setting the Maximum Number of FIP Login Sessions per ENode

When the switch acts as an FCoE-FC gateway, FCoE node (ENode) devices in the Ethernet network use the gateway to connect to the Fibre Channel (FC) storage area network (SAN). You can limit the maximum number of FIP login sessions permitted on each ENode. Limiting the number of login sessions can prevent login session rejections caused when the connected FC switch port configuration limits the number of FIP login sessions.

The maximum number of FIP sessions per ENode is 2000 sessions (FLOGI plus FDISC sessions). The limit you set applies to every ENode in the specified gateway fabric. Each ENode in the fabric can have up to the maximum number of sessions, but the total number of active sessions cannot exceed the session limits you apply to the fabric or the Node device.

There are also configurable FIP login session limits that you can apply to the gateway FC fabric, to the QFX3500 switch or QFabric system Node device, and to the interfaces in each FC fabric.

- To set a maximum number of FIP login sessions per ENode using the CLI:

```
[edit fc-fabrics fc-fabric-name protocols fip]
user@switch# set max-sessions-per-enode max-login-sessions
```

For example, to configure the ENodes on an FC fabric named **sanfab1** with a maximum FIP login session limit of **250** sessions:

```
[edit fc-fabrics sanfab1]
user@switch# set protocols fip max-sessions-per-enode 250
```

Related Documentation

- [Setting the Maximum Number of FIP Login Sessions per FC Interface on page 220](#)
- [Setting the Maximum Number of FIP Login Sessions per FC Fabric on page 221](#)
- [Setting the Maximum Number of FIP Login Sessions per Node Device on page 222](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

Setting the Maximum Number of FIP Login Sessions per FC Interface

When the switch acts as an FCoE-FC gateway, NP_Ports are the native FC interfaces the gateway uses to connect to the FC switch. You can limit the maximum number of FIP login sessions permitted on an NP_Port interface. Limiting the number of login sessions on an interface can prevent login session rejections caused when the connected FC switch port configuration limits the number of FIP login sessions.



TIP: A good practice is to configure a maximum number of login sessions on each NP_Port that is less than or equal to the maximum number of login sessions permitted on the connected FC switch port.

The maximum number of FIP sessions is 2500 sessions. (This is the combined total of all VN2VF_Port and VN2VN_Port sessions on the system.)

There are also configurable FIP login session limits that you can apply to the gateway FC fabric, to the QFX3500 switch or QFabric system Node device, and to the ENodes in each FC fabric. To prevent unexpected FIP login rejections, the sum of the maximum FIP login sessions on all of the NP_Port interfaces that belong to an FC fabric should not exceed the maximum number of sessions the FC fabric supports or the device supports.

- To set a maximum number of FIP login sessions on an NP_Port using the CLI:

```
[edit fc-fabrics fc-fabric-name interface interface-name]  
user@switch# set max-login-sessions max-login-sessions
```

For example, to configure NP_Port interface **fc-0/0/5** with a maximum FIP login session limit of **500** sessions on an FC fabric named **sanfab1**:

```
[edit fc-fabrics sanfab1]  
user@switch# set interface fc-0/0/5 max-login-sessions 500
```

Related Documentation

- [Setting the Maximum Number of FIP Login Sessions per ENode on page 219](#)
- [Setting the Maximum Number of FIP Login Sessions per FC Fabric on page 221](#)
- [Setting the Maximum Number of FIP Login Sessions per Node Device on page 222](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

Setting the Maximum Number of FIP Login Sessions per FC Fabric

When the QFX Series acts as an FCoE-FC gateway, you configure at least one local FC fabric on the gateway. A gateway FC fabric creates associations that connect FCoE devices on an Ethernet network to an FC switch on a Fibre Channel network. Each FC fabric on a gateway includes native FC interfaces (NP_Ports) that connect the gateway to the FC switch. When FCoE devices want to log in to the FC switch, the gateway sends the FIP login requests to the FC switch on the NP_Port links.

You can limit the maximum number of FIP login sessions permitted on a gateway FC fabric. If a QFX3500 switch or QFabric system Node device has more than one FC fabric, limiting the number of login sessions on an FC fabric can prevent one FC fabric from using all of the login sessions available on the device.

The maximum number of FIP sessions is 2500 sessions. (This is the combined total of all VN2VF_Port and VN2VN_Port sessions on the system.)

There are also configurable FIP login session limits that you can apply to the FC fabric NP_Port interfaces, to the QFX3500 switch or QFabric system Node device, and to the ENodes in each FC fabric. To prevent unexpected FIP login rejections:

- The sum of the maximum FIP login sessions on all of the NP_Port interfaces that belong to an FC fabric should not exceed the maximum number of sessions the FC fabric supports or the device supports.
- The sum of the maximum FIP login sessions on all of the FC fabrics on a device should not exceed the maximum number of sessions per device.
- To set a maximum number of FIP login sessions on an FC fabric using the CLI:

```
[edit fc-fabrics fc-fabric-name]
user@switch# set max-login-sessions max-login-sessions
```

For example, to configure an FC fabric named **sanfab1** with a maximum FIP login session limit of **2000** sessions:

```
[edit fc-fabrics sanfab1]
user@switch# set fc-fabrics sanfab1 max-login-sessions 2000
```

Related Documentation

- [Setting the Maximum Number of FIP Login Sessions per ENode on page 219](#)
- [Setting the Maximum Number of FIP Login Sessions per FC Interface on page 220](#)
- [Setting the Maximum Number of FIP Login Sessions per Node Device on page 222](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

Setting the Maximum Number of FIP Login Sessions per Node Device

When a QFX3500 switch or QFabric system Node device acts as an FCoE-FC gateway, it connects FCoE devices on an Ethernet network to an FC switch in a Fibre Channel network. You can limit the maximum number of FIP login sessions for the FCoE devices on each Node device.

For QFX3500 switches, the maximum limit means that the sum of the FIP login sessions on all of the local FC fabrics on that QFX3500 switch cannot exceed the device maximum.

For the QFabric system, the limit applies to each Node device in the QFabric system. For example, if you configure a maximum FIP login session value of 2000 sessions, each Node device in the QFabric system can have a total of up to 2000 FIP login sessions running on its FC fabrics.

The maximum number of FIP sessions a device can support is 2500 sessions. (This is the combined total of all VN2VF_Port and VN2VN_Port sessions on the system.)

There are also configurable FIP login session limits that you can apply to the FC fabrics on the devices, to the NP_Port interfaces in each FC fabric, and to the ENodes in each FC fabric. To prevent unexpected FIP login rejections:

- The sum of the maximum FIP login sessions for all of the FC fabrics on a device should not exceed the maximum number of sessions per device.
- The sum of the maximum FIP login sessions on all of the NP_Port interfaces that belong to an FC fabric should not exceed the maximum number of sessions the FC fabric supports or the device supports.
- To set a maximum number of FIP login sessions for Node devices using the CLI:

[edit **fc-options**]

```
user@switch# set max-login-sessions-per-node max-login-sessions-per-node
```

For example, to configure a maximum FIP login limit of **2000** sessions on a QFX3500 switch or on all Node devices in a QFabric system:

[edit **fc-options**]

```
user@switch# set max-login-sessions-per-node 2000
```

Related Documentation

- [Setting the Maximum Number of FIP Login Sessions per ENode on page 219](#)
- [Setting the Maximum Number of FIP Login Sessions per FC Interface on page 220](#)
- [Setting the Maximum Number of FIP Login Sessions per FC Fabric on page 221](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

Troubleshooting Dropped FIP Traffic

- Problem** **Description:** Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) traffic such as FIP VLAN discovery and notification frames is dropped.
- Cause** The interface on which the FIP traffic is dropped does not have a native VLAN configured. FIP VLAN discovery and notification messages are exchanged as untagged packets on the native VLAN. (After the FCoE session with the Fibre Channel switch is established, FCoE traffic uses the FCoE VLAN.)
- Solution** Check to ensure that every 10-Gigabit Ethernet interface that connects to an FCoE device includes a native VLAN. Configure a native VLAN on all 10-Gigabit Ethernet interfaces that connect to FCoE devices.



NOTE: Make sure that the native VLAN you are using is the same native VLAN that the FCoE devices use for Ethernet traffic.

The procedure for configuring a native VLAN on an interface is different on switches that use the original CLI than on switches that use the Enhanced Layer 2 Software (ELS) CLI. This topic provides the configuration procedure for each CLI.

Configuring a Native VLAN on Switches Using the Original CLI

To configure a native VLAN on an interface:

1. Set the interface port mode to **tagged-access** if you have not already done so:

```
[edit]
user@switch# set interfaces interface unit unit family ethernet-switching port-mode
tagged-access
```

For example, to set the port mode to **tagged-access** for interface **xe-0/0/6.0**:

```
[edit]
user@switch# set interfaces xe-0/0/6 unit 0 family ethernet-switching port-mode
tagged-access
```

2. Configure the native VLAN if it does not already exist:

```
[edit]
user@switch# set vlans vlan-name vlan-id vlan-id
```

For example, to name the native VLAN **native** and use the VLAN ID 1:

```
[edit]
```

```
user@switch# set vlans native vlan-id 1
```

3. Configure the native VLAN on the interface:

```
[edit]
user@switch# set interfaces interface unit unit family ethernet-switching native-vlan-id
vlan-id
```

For example, to configure a native VLAN with the VLAN ID 1 on interface **xe-0/0/6.0**:

```
[edit]
user@switch# set interfaces xe-0/0/6 unit 0 family ethernet-switching native-vlan-id 1
```

Configuring a Native VLAN on Switches Using the ELS CLI

To configure a native VLAN on an interface:

1. Set the interface mode to **trunk** if you have not already done so:

```
[edit]
user@switch# set interfaces interface unit unit family ethernet-switching interface-mode
trunk
```

For example, to set the interface mode to **trunk** for interface **xe-0/0/6.0**:

```
[edit]
user@switch# set interfaces xe-0/0/6 unit 0 family ethernet-switching interface-mode trunk
```

2. Configure the native VLAN if it does not already exist:

```
[edit]
user@switch# set vlans vlan-name vlan-id vlan-id
```

For example, to name the native VLAN **native** and use the VLAN ID 1:

```
[edit]
user@switch# set vlans native vlan-id 1
```

3. Configure the native VLAN on the physical Ethernet interface:

```
[edit]
user@switch# set interfaces interface native-vlan-id vlan-id
```

For example, to configure a native VLAN with the VLAN ID 1 on interface **xe-0/0/6.0**:

```
[edit]
user@switch# set interfaces xe-0/0/6 native-vlan-id 1
```

4. Configure the Ethernet interface as a member of the native VLAN:


```
[edit]
user@switch# set interfaces interface unit unit family ethernet-switching vlan members
vlan-name
```

For example, to configure an Ethernet interface as a member of a native VLAN with the VLAN ID 1 on interface **xe-0/0/6.0**:

```
[edit]
user@switch# set interfaces xe-0/0/6 unit 0 family ethernet-switching vlan members native
```

**Related
Documentation**

- [interfaces](#)
- [vlans](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)

Understanding Fibre Channel Virtual Links

A virtual link emulates a secure point-to-point connection between the virtual node port (VN_Port) of a Fibre Channel over Ethernet (FCoE) node (ENode) and the virtual fabric port (VF_Port) of an FCoE forwarder (FCF). The combination of the FCF media access control (MAC) address and the VN_Port MAC address uniquely identifies each virtual link. Uniquely identifying each virtual link enables the logical separation of traffic that belongs to each virtual link. A single physical link between an ENode and an FCF can carry multiple virtual links and maintain secure, separate transport of traffic on the different virtual links.

Virtual links are necessary because Fibre Channel protocol does not recognize multipoint-to-point connections. Even when multiple connections are aggregated on one physical port, FCoE Initialization Protocol (FIP) presents each virtual link as an individual point-to-point link between an ENode VN_Port and an FCF VF_Port.

**Related
Documentation**

- [Overview of FIP on page 41](#)
- [Understanding FIP Functions on page 203](#)
- [Understanding FIP Implementation on an FCoE-FC Gateway on page 208](#)
- [Understanding FIP Parameters on an FCoE-FC Gateway on page 212](#)
- [Understanding FCoE on page 51](#)

Understanding Interfaces on an FCoE-FC Gateway

When a QFX3500 switch functions as an FCoE-FC gateway to connect FCoE devices on an Ethernet network to a Fibre Channel (FC) switch in a storage area network (SAN), it handles FCoE traffic from hosts and native FC traffic from the FC switch. To support this architecture, each local FC fabric configured on the gateway (in the **fc-fabrics** configuration hierarchy) must have:

- An Ethernet-network-facing F_Port interface for the FCoE VLAN to connect to FCoE device VN_Ports in the form of an FCoE VLAN interface. Multiple VF_Ports are initiated on the F_Port interface, one VF_Port for each ENode that logs in to the FC network.
- One or two blocks of six proxy N_Port (NP_Port) interfaces to connect to FC switch fabric ports (F_Ports).

Each FC fabric is local to the gateway on which you configure it. This means that both the FC switch and the FCoE devices must be connected to the same gateway (QFX3500 switch or QFabric system Node device), and that all of the interfaces configured for the local fabric also must be on that gateway. FC fabric traffic does not flow between different Node devices in a QFabric system.

This topic describes:

- [Native FC Interfaces to the FC Switch on page 226](#)
- [FIP Login Session Limits on page 228](#)
- [Trusted and Untrusted Interfaces on page 232](#)
- [Buffer-to-Buffer Credit Recovery on page 233](#)
- [FCoE VLAN Interface to FCoE Devices on page 234](#)
- [Assigning Interfaces to a Fibre Channel Fabric on page 238](#)
- [Deleting a Fibre Channel Interface on page 238](#)

Native FC Interfaces to the FC Switch

You must configure either 6 or 12 of the physical interfaces on the gateway as native FC NP_Port interfaces to connect to FC switch F_Port interfaces. By default, all of the gateway interfaces are Ethernet interfaces, so you must explicitly configure the interfaces that you want to use as FC interfaces.

You can configure the FC-capable ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5, and ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47 to create blocks of native FC interfaces. You cannot individually configure a single port as a native FC interface. Within these port blocks, you cannot mix FC interfaces with Ethernet interfaces. All of the ports in a block must be either native FC interfaces or Ethernet interfaces.

You cannot configure ports xe-0/0/6 through xe-0/0/41 and ports xe-0/1/1 through xe-0/1/15 as native FC ports; they can only be Ethernet ports. Native FC ports do not handle Ethernet traffic (including FCoE traffic); they handle only native FC traffic and must connect to native FC ports.

You can configure:

- Six native FC interfaces by configuring either ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5 or ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47.
- Twelve native FC interfaces by configuring ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5 and ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47.
- No native FC interfaces by leaving ports xe-0/0/0 through xe-0/0/5 and ports xe-0/0/42 through xe-0/0/47 in their default state as Ethernet interfaces.

Each native FC interface can belong to only one local FC fabric configured on the gateway. You can configure up to 12 FC fabrics on a gateway, but each FC fabric must use different native FC interfaces to connect to an FCF. (Although the native FC ports are configured in blocks, each individual port can belong to a different FC fabric.) Native FC interfaces can be configured as loopback interfaces.

- [Port Mode on page 227](#)
- [NPIV on page 227](#)
- [Port Speed on page 228](#)

Port Mode

The gateway presents a proxy N_Port (NP_Port) interface to the FC switch. An NP_Port connects to a single FC switch F_Port using a point-to-point link (in other architectures an N_Port can also connect in a point-to-point link to another N_Port, but that is not a valid configuration on the gateway).

You must explicitly configure each native FC interface connected to an FC switch as an NP_Port. The gateway NP_Ports act as a proxy for the FCoE device virtual N_Ports (VN_Ports) when the VN_Ports attempt to connect to the FC switch.

When the FC switch is a trusted switch, configure the fabric as **fcoe-trusted** to reduce overhead caused by the VN_Port to VF_Port (VN2VF_Port) FIP snooping filters that are automatically installed on untrusted ports.

NPIV

FC requires a unique point-to-point link between the FC switch and each host N_Port. The gateway creates an independent virtual link for each FCoE device session by mapping each FCoE device to a virtualized N_Port through the gateway's proxy function. This process is called N_Port ID virtualization (NPIV).

NPIV makes each virtual link look like a dedicated point-to-point link to the FC switch. In this way, multiple FCoE devices, multiple applications, and multiple virtual machines on an FCoE device can connect to an FC switch using one physical port instead of using a physical port for each host connection. The virtual link creates a secure boundary between traffic from different sources that are on a single physical port.

FCoE-FC gateway mode implements NPIV as follows:

1. An NP_Port on the gateway comes up and logs in to the attached F_Port on the FC switch. The FC switch sees the gateway port as a physical FC device N_Port and assigns it a unique FCID. This establishes the physical point-to-point link between the gateway and the FC switch.
2. The gateway receives a FIP discovery message from an FCoE device that seeks to log in to the FC network. To the FCoE device, the gateway presents a virtual F_Port (VF_Port) interface and appears to be an FCF.
3. The gateway converts the FCoE device's message into an FC fabric discovery (FDISC) message and sends it through the least-loaded physical NP_Port to the FC switch. The FDISC message requests an FCID for the new virtual link.
4. The FC switch processes the request, accepts it, assigns a unique FCID for the connection, and sends the response.
5. The gateway maps the FC switch response to the host FCoE device's VN_Port and sends a FIP acceptance advertisement to the FCoE device.
6. The FCoE device accepts the FCID.

If the FC switch rejects the FDISC, the gateway relays the rejection to the FCoE device VN_Port.

Port Speed

The gateway supports configuring FC port speeds of 2 Gbps, 4 Gbps, or 8 Gbps. FC ports can also autonegotiate the port speed to 2, 4, or 8 Gbps.

FIP Login Session Limits

A FIP login session is a fabric login (FLOGI) or fabric discovery (FDISC) login to the FC SAN fabric. (A session here does not refer to an end-to-end server-to-storage session; there is no limit to the number of end-to-end server-to-storage sessions.) You can limit the maximum number of FIP login sessions on each gateway Node device (QFX3500 switch or QFabric system Node device configured in FCoE-FC gateway mode), on each local gateway FC fabric, and on each individual NP_Port interface in a local FC fabric:

- Gateway Node devices and Node groups—The total number of FIP login sessions on the gateway Node or Node group (the sum of the sessions on all of the NP_Port interfaces in all of the local FC fabrics on the gateway Node or Nodes) cannot exceed the limit. When a gateway reaches the maximum session limit, the gateway sends subsequent multicast discovery advertisements (MDAs) with the availability bit set to 0 (zero) to prevent additional ENode login attempts. If the maximum number of sessions is running on the gateway, ENodes cannot use the gateway to log in new sessions to the FC switch. When the number of sessions falls below the maximum, the gateway sets the availability bit in MDAs to 1 so that ENodes can again log in new

sessions. When a session slot becomes available, the system accepts the first session request to fill the slot.

- **FC fabric**—The total number of FIP login sessions on an FC fabric (the sum of the sessions on all of the NP_Port interfaces that belong to the fabric) cannot exceed the limit. When a fabric reaches the maximum session limit, the gateway sends MDAs associated with that fabric with the availability bit set to 0 to prevent additional ENode login attempts.



NOTE: Other FC fabrics on the same gateway can still accept ENode logins as long as the maximum session limit for those fabrics and the maximum session limit for the gateway (the Node device) have not been met.

- **NP_Port interfaces**—The total number of FIP login sessions cannot exceed the interface's limit. When an interface reaches the maximum session limit, the gateway removes it from the load-balancing list for that FC fabric to prevent the gateway from attempting to assign new sessions to the interface. Other interfaces in the FC fabric can still accept logins until the FC fabric or gateway reaches its maximum session limit. However, the interface that reached the maximum session limit cannot be assigned new sessions until the number of sessions on the interface falls below the limit.



BEST PRACTICE: Configure a maximum session limit for each NP_Port interface that is less than or equal to the number of FIP sessions the directly connected FC switch port is configured to support. This prevents the gateway from attempting to assign new login sessions to an interface when the connected FC switch port reaches its maximum number of sessions.

- [FCoE Trusted and Untrusted Interface Session Limits on page 229](#)
- [Configuring Consistent Session Limits on page 230](#)
- [Decreasing Session Limits on page 231](#)
- [Increasing Session Limits on page 231](#)
- [Effect of Deactivating and Then Reactivating the Configuration on Session Limits on page 231](#)

FCoE Trusted and Untrusted Interface Session Limits

The maximum number of VN2VF_Port FCoE login sessions that each gateway can support is 2500 sessions, regardless of whether interfaces are trusted or untrusted. (In software releases earlier than Junos OS Release 12.3, the session limit on untrusted interfaces and untrusted fabrics was 376 sessions.)



NOTE: If you configure an FCoE LAG on interfaces that are members of an FCoE-FC gateway fabric, the number of supported sessions depends on whether the FC fabric (fc-fabric) is an FCoE trusted fabric or an FCoE untrusted fabric. If the FC fabric is a trusted fabric, then 2,500 sessions are supported.

However, if the FC fabric is an untrusted fabric, you must disable FIP snooping session scaling on the gateway, which decreases the number of supported sessions to 376 sessions. (Disable FIP snooping scaling by including the `no-fip-snooping-scaling` option in the `[edit fc-options]` hierarchy.)

Configuring Consistent Session Limits

The system does not perform commit checks to enforce consistent session limit configuration. For example, the system does not prevent you from configuring a higher limit for ENode sessions than the total session limit for the gateway Node device, or from configuring a higher limit on an interface than on the fabric to which the interface belongs.

To prevent unexpected FIP login rejections, you should configure consistent Node device, fabric, and interface session limits. For example:

- The session limit of an interface should not exceed the session limit of the fabric to which it belongs.
- For interfaces that belong to the same fabric, the sum of the interface session limits should not exceed the fabric session limit.
- The fabric session limit should not exceed the session limit of the gateway Node device.
- For fabrics that belong to the same gateway Node device, the sum of the fabric session limits should not exceed the Node device session limit.

Session limit configuration considerations include:

- The fabric session limit restricts how many sessions can run on the NP_Port interfaces that belong to that fabric. If the combined session limits of the interfaces exceed the fabric session limit, the total number of sessions on the interfaces is the fabric limit.

For example, if a fabric has three NP_Port interfaces, and each NP_Port interface has a limit of 500 sessions (total of 1500 sessions for the three interfaces), but the fabric has a limit of 1000 sessions, the combined number of sessions on the three interfaces is limited to 1000 sessions.

- The gateway Node device session limit restricts how many sessions can run on the fabrics that belong to that gateway. If the combined session limits of the fabrics exceed the gateway Node device session limit, the total number of sessions on the fabrics is the gateway Node device limit.

For example, if a gateway has two fabrics, and each fabric has a limit of 1000 sessions (total of 2000 sessions for the two fabrics), but the gateway has a limit of 1500 sessions, the combined number of sessions on the two fabrics is limited to 1500 sessions.

Hierarchically, the gateway Node device session limit is the maximum limit for all sessions on the gateway, regardless of fabric and interface session limits. In the same way, the fabric session limit supersedes the interface session limit.

When session limits are exceeded, no new logins are accepted until a session slot becomes free.

Decreasing Session Limits

If you decrease the session limit, the currently logged in sessions are terminated as follows:

- Gateway Node devices and Node groups—Decreasing the session limit terminates all of the sessions on the Node device (all sessions on all interfaces on all fabrics). If the gateway Node device is part of a Node group, all sessions on all members of the Node group are terminated.
- Fabric—Decreasing the session limit terminates all of the sessions on all of the interfaces that belong to the fabric.
- NP_Port interfaces—Decreasing the session limit terminates all of the sessions on the interface and also terminates all of the sessions on any other interfaces that belong to the same fabric.

After you decrease a session limit, the sessions are terminated even if the new session limit is greater than the number of currently active sessions. For example:

- An interface has 300 active sessions.
- The current session limit is 1000 sessions.
- You decrease the session limit to 500 sessions and commit the new configuration.
- All 300 sessions are logged out, even though the new session limit is greater than the number of sessions running.

After the session limit change takes effect, the ENodes log in again and establish new sessions, up to the new session limits.

Increasing Session Limits

Increasing the session limits does not disrupt logged in sessions.

Effect of Deactivating and Then Reactivating the Configuration on Session Limits

If you decrease session limits, all ENodes are logged out. Deactivating and then reactivating the configuration can have the same effect as decreasing the session limit, which results in the ENodes being logged out.

The ENode logouts occur because when you deactivate the configuration, the system reverts to the default session limit of 2500 sessions (the maximum number of sessions). When you reactivate the configuration, the system uses the configured session limit. Unless the configured session limit is equal to the maximum session limit, reactivating the configuration decreases the session limit, which causes the ENodes to be logged out.

For example, if you:

1. Configure and commit a limit of 400 sessions.
2. Allow ENodes to log in and start sessions.
3. Deactivate the configuration.
4. Reactivate the configuration.
5. The ENode sessions are logged out because deactivating the session increased the session limit from 400 to 2500.

Because an increase in the session limit does not affect existing sessions, the running ENode sessions are not affected. However, reactivating the configuration decreased the session limit from 2500 back to 400. The session limit decrease causes the ENode sessions to be logged out.

Trusted and Untrusted Interfaces

By default, gateway fabric interfaces are untrusted interfaces. If you do not configure a gateway fabric as an FCoE trusted fabric to set all of the gateway fabric interfaces as trusted interfaces, the gateway installs VN2VF_Port FIP snooping filters on the fabric ports.

If you configure a gateway fabric as an FCoE trusted fabric, the gateway does not install VN2VF_Port FIP snooping filters on the fabric interfaces. This is usually done when the gateway is connected to an FCoE transit switch that has VN2VF_Port FIP snooping enabled.

Regardless of whether an interface is trusted or untrusted, the maximum session limit is 2500 sessions, unless the interface is a member of an FCoE LAG interface.



NOTE: If you configure an FCoE LAG on interfaces that are members of an FCoE-FC gateway fabric, the number of supported sessions depends on whether the FC fabric (fc-fabric) is an FCoE trusted fabric or an FCoE untrusted fabric. If the FC fabric is a trusted fabric, then 2,500 sessions are supported.

However, if the FC fabric is an untrusted fabric, you must disable FIP snooping session scaling on the gateway, which decreases the number of supported sessions to 376 sessions. (Disable FIP snooping scaling by including the `no-fip-snooping-scaling` option in the `[edit fc-options]` hierarchy.)



NOTE: The session limit for a Node group is the same as the session limit for an individual Node device, 2500 sessions. Even if more than one Node device in a Node group is acting as an FCoE-FC gateway, the total maximum number of sessions on all Node devices in the Node group is 2500 sessions.

The default maximum login session value for Node devices (on QFabric systems, the maximum applies to each Node device), FC fabrics, and interfaces in fabrics is 2500 sessions.

Buffer-to-Buffer Credit Recovery

Buffer-to-buffer credits represent the number of receive buffers an interface can use to store FC frames. Buffer-to-buffer credit determines buffer-to-buffer flow control. When an interface transmits a frame, it decrements its buffer-to-buffer credit count by one. When the destination interface forwards the frame and frees a buffer, it sends a receiver ready (R_RDY) primitive to the transmitting interface. Each R_RDY primitive the transmitting interface receives increments its buffer-to-buffer credit count by one.

Both interfaces on an FC link track buffer-to-buffer credits. As long as buffer-to-buffer credits are available, the transmitter continues to send frames. If the number of buffer-to-buffer credits reaches zero (0), transmission stops until buffer-to-buffer credits are available, as indicated by the reception of an R_RDY primitive. Buffer-to-buffer credits can compensate for long cable distances to limit throughput and prevent buffer overflow.

However, if frame corruption or errors transmitting R_RDY primitives occur, the buffer-to-buffer credit counters on the sending and receiving interfaces do not have the same values. This causes the permanent loss of buffer-to-buffer credits. When credits are lost, the buffer credit count can decrement to zero and indicate that there is no available buffer space even if buffer space is actually available. This can result in unnecessary link idle time.

To recover lost buffer-to-buffer credits, you can configure a buffer-to-buffer credit state change number (BB_SC_N). BB_SC_N must be configured on both ends of the connection. If only one end of the connection is configured for BB_SC_N, the feature is disabled. The two directly connected FC interfaces communicate the BB_SC_N value during fabric login (FLOGI).

When you enable BB_SC_N on the interfaces on both ends of an FC link, the interfaces exchange buffer-to-buffer state change send (BB_SCs) and buffer-to-buffer state change receive (BB_SCr) primitives to track the number of frames sent and the number of R_RDY primitives received. The state change number determines the number of frames and R_RDY primitives the interfaces exchange between consecutive BB_SCn primitives and between consecutive BB_SCr primitives. The state change primitives inform each interface of the other interface's frame count and R_RDY count states.

The state counters should match so that each interface knows and agrees with the other interface's state. If the interface at either end of the link detects a discrepancy, it knows that a frame or an R_RDY primitive was corrupted or dropped.

For example, if a receiving interface has sent two R_RDY primitives but the BB_SCr that the interface receives from the sending interface only counts one R_RDY primitive received, it reveals that one R_RDY primitive was not delivered successfully and that one buffer-to-buffer credit was lost. When one of the interfaces on the link detects a discrepancy, the interfaces can take corrective action and recover the lost buffer-to-buffer credits.

Enabling the buffer-to-buffer credit recovery feature does not impact buffer resources and has an insignificant impact on processing resources.

If buffer-to-buffer credit recovery is not used, then when there is no buffer credit on a port, a timeout and recovery mechanism prevents buffer overflow.

FCoE VLAN Interface to FCoE Devices

Each FC fabric configured on the gateway includes at least one FCoE VLAN interface to connect the FCoE devices on the FCoE VLAN to the FC switch. (Including the FCoE VLAN interface and the native FC interfaces in the FC fabric configuration connects them.) FCoE VLANs can include any Ethernet interface on the switch that is in tagged-access or trunk mode. The best practice is to configure Ethernet interfaces that belong to FCoE VLANs in **tagged-access** port mode.



NOTE: The Ethernet interfaces that connect to FCoE devices must include a native VLAN to transport FIP traffic, because FIP VLAN discovery and notification frames are exchanged as untagged packets.

FCoE VLANs should carry only FCoE traffic. You should not mix FCoE traffic and standard Ethernet traffic on the same VLAN.



NOTE: FCoE VLANs (any VLAN that carries FCoE traffic) support only Spanning Tree Protocol (STP) and link aggregation group (LAG) Layer 2 features.

FCoE traffic cannot use a standard LAG because traffic might be hashed to different physical LAG links on different transmissions. This breaks the (virtual) point-to-point link that Fibre Channel traffic requires. If you configure a standard LAG interface for FCoE traffic, FCoE traffic might be rejected by the FC SAN.

Beginning with Junos OS Release 13.2X52, QFabric systems support a special LAG called an FCoE LAG, which enables you to transport FCoE traffic and regular Ethernet traffic (traffic that is not FCoE traffic) across the same link aggregation bundle. An FCoE LAG ensures that FCoE traffic uses the same physical link in the LAG for requests and replies in order to preserve the virtual point-to-point link between the FCoE device converged network adapter (CNA) and the FC SAN switch across the QFabric system Node device. An FCoE LAG does not provide load balancing or link redundancy for FCoE traffic. However, regular Ethernet traffic uses the standard hashing algorithm and receives the usual LAG benefits of load balancing and link redundancy in an FCoE LAG.

On FCoE-FC gateway untrusted FC fabrics, you must disable FIP snooping session scaling on the gateway, which decreases the number of supported sessions from 2,500 to 376 sessions. (Disable FIP snooping scaling by including the `no-fip-snooping-scaling` option in the `[edit fc-options]` hierarchy.) On FCoE trusted FC fabrics, the session limit is 2,500 sessions.

Each FCoE VLAN interface can belong to only one FC fabric configured on the gateway. A gateway FC fabric can have more than one FCoE VLAN, but each FCoE VLAN in the FC fabric must belong only to that FC fabric. You can configure more than one FC fabric on a gateway; each FC fabric must use different FCoE VLAN interfaces to connect to FCoE devices.



NOTE: Storm control must be disabled on all Ethernet interfaces that belong to the FCoE VLAN to prevent FCoE traffic from being dropped.

- [Port Mode on page 235](#)
- [Disabling Storm Control on FCoE Interfaces on page 237](#)
- [NPIV Support on page 238](#)
- [VN2VF_Port FIP Snooping on page 238](#)

Port Mode

You must explicitly configure the FCoE VLAN interface in `F_Port` mode. All members of the FCoE VLAN use the FCoE VLAN interface as the connection to the gateway `NP_Port` interfaces and ultimately to the FC switch.

All of the 10-Gigabit Ethernet interfaces that are members of an FCoE VLAN should be configured as **tagged-access** port mode interfaces. However, the system also supports configuring these interfaces in **trunk** port mode.



BEST PRACTICE: Use **tagged-access** port mode for Ethernet interfaces that are connected to converged network adapters (CNAs) in FCoE access devices.

Use **trunk** port mode when an Ethernet interface is an interswitch link (ISL)—that is, when the port is connected to another switch. For example, if a port is connected to a transit switch that is performing VN2VF_Port FIP snooping, configure the port in **trunk** mode and as an FCoE trusted port.

The **tagged-access** port mode was not available in Junos OS Release 11.3 and earlier releases. In Release 11.3 and earlier, only **trunk** port mode was used for Ethernet interfaces that belong to an FCoE VLAN. Because **tagged-access** mode is now available, using **trunk** mode for interfaces connected to FCoE CNAs is not recommended.

If an existing configuration uses **trunk** mode for ports connected to FCoE CNAs, you can change the port mode to **tagged-access** without disrupting traffic. Although we recommend changing the port mode of these ports from **trunk** mode to **tagged-access** mode as a best practice, it is not mandatory. New configurations should use **tagged-access** mode for interfaces that connect to FCoE devices.

There are several advantages of configuring Ethernet ports connected to FCoE devices in **tagged-access** mode instead of in **trunk** mode:

- It is standard practice to configure ISL ports as **trunk** ports.
- It is standard practice not to configure ports that connect to servers as **trunk** ports.
- When an interface goes down, if that interface is in **trunk** mode, then the FCoE sessions on that interface are terminated only after the gateway stops receiving FIP keepalive messages from the ENode and exceeds 2.5 times the FIP keepalive timeout advertisement value. If the interface is in **tagged-access** mode and the interface goes down, the gateway sends a FIP message to terminate the sessions on the interface.
- Similarly, if an ENode session moves from one interface to another interface, if the original interface is in **trunk** mode, the session is not removed from the interface until the gateway stops receiving FIP keepalive messages and exceeds 2.5 times the FIP keepalive advertisement timeout value. But if the interface is in **tagged-access** mode, the gateway detects that the session is no longer on the interface, does not refresh the FIP keepalive timer, and thus ages out the session.



NOTE: FIP is enabled on the FCoE VLAN, which is a Layer 3 interface. As with other Layer 3 interfaces under Junos OS, when the last member (10-Gigabit Ethernet interface) of the FCoE VLAN is deleted, the FCoE VLAN interface is internally marked as “down.” When the Layer 3 FCoE VLAN interface is marked as “down”, FIP stops running on it. When the last member interface is deleted from an FCoE VLAN and FIP stops running, the result could be an immediate timeout for the VN_Ports that were connected on that interface, regardless of whether the port mode is **tagged-access** or **trunk**.

Disabling Storm Control on FCoE Interfaces

Storm control is not supported on the FCoE interfaces of an FCoE-FC gateway VLAN. Enabling storm control on an FCoE-FC gateway VLAN interface may cause FCoE packet loss. Storm control is disabled by default on all interfaces. However, if you enabled storm control globally on all switch interfaces or on any interfaces that are part of the FCoE VLAN interface, you must disable storm control on the Ethernet interfaces of the FCoE VLAN.

If storm control is enabled on only a few interfaces of the FCoE VLAN, you can disable storm control on individual interfaces by including the **delete ethernet-switching-options storm-control interface *interface-name*** statement in the configuration, where ***interface-name*** is the name of the interface on which you want to disable storm control.

If storm control is enabled globally on the switch when the switch is acting as an FCoE-FC gateway, it is often easiest to disable storm control on all interfaces, then enable storm control only on Ethernet interfaces that are not part of the FCoE VLAN interface.

If storm control is enabled globally, you can disable storm control in either of two ways:

- Disable storm control on all interfaces, then enable storm control on the interfaces you want to use storm control. (From the default configuration, you cannot disable storm control on individual interfaces because the default configuration enables storm control on **all** interfaces, not on individual interfaces.)

For example, if you want interfaces xe-0/0/20, xe-0/0/21, and xe-0/0/22 to use storm control, disable storm control on all interfaces, then enable storm control on those three interfaces:

1. Disable storm control on all interfaces:

```
user@switch# delete ethernet-switching-options storm-control interface all
```

2. Enable storm control on interfaces xe-0/0/20, xe-0/0/21, and xe-0/0/22:

```
user@switch# set ethernet-switching-options storm-control interface xe-0/0/20
user@switch# set ethernet-switching-options storm-control interface xe-0/0/21
user@switch# set ethernet-switching-options storm-control interface xe-0/0/22
```

- Disable storm control for all unknown unicast traffic on all interfaces by including the following statement in your configuration:

```
user@switch# set ethernet-switching-options storm-control interface all no-unknown-unicast
```

NPIV Support

The gateway supports FCoE device NPIV. For example, a single physical FCoE device can have multiple virtual machines running on it. Each virtual machine can instantiate a separate virtual connection to the gateway, which results in its own virtual link to the FC switch. In this way, an FCoE device can have multiple separate connections to the FC SAN on a single physical port.

This is similar to the NPIV function the gateway performs with the FC switch to support multiple virtual FCoE device connections on one physical NP_Port.

The gateway presents multiple VF_Port interfaces on each FCoE VLAN interface to support the requirement for unique, secure virtual links.

VN2VF_Port FIP Snooping

The FCoE-facing ports that belong to an FCoE VLAN on a gateway are enabled for VN2VF_Port FIP snooping automatically. You can disable VN2VF_Port FIP snooping on any individual interface by configuring it as a trusted interface.

Assigning Interfaces to a Fibre Channel Fabric

You assign at least one FCoE VLAN interface and at least one native FC interface to each FC fabric you configure on the gateway. All of the interfaces that belong to an FC fabric must reside on the same gateway device. Interfaces on different gateways cannot belong to the same FC fabric, because an FC fabric is local to a single gateway device.

Deleting a Fibre Channel Interface

To delete an FC interface or an FCoE VLAN interface, you must delete the interface from the fabric first and then delete the interface from the switch.

Related Documentation

- [Overview of Fibre Channel on page 26](#)
- [Understanding Fibre Channel on page 186](#)
- [Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267](#)
- [Understanding FCoE LAGs on page 57](#)
- [Configuring a Physical Fibre Channel Interface on page 254](#)
- [Converting an Ethernet Interface To a Fibre Channel Interface on page 255](#)
- [Configuring an FCoE LAG on page 63](#)
- [Disabling VN2VF_Port FIP Snooping on an FCoE-FC Gateway Switch Interface on page 265](#)
- [Assigning Interfaces to a Fibre Channel Fabric on page 262](#)
- [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
- [Disabling Storm Control on FCoE Interfaces on an FCoE-FC Gateway on page 266](#)

- [Disabling VN2VF_Port FIP Snooping on an FCoE-FC Gateway Switch Interface on page 265](#)
- [Deleting a Fibre Channel Interface on page 263](#)
- [Setting the Maximum Number of FIP Login Sessions per FC Interface on page 220](#)
- [Setting the Maximum Number of FIP Login Sessions per FC Fabric on page 221](#)
- [Setting the Maximum Number of FIP Login Sessions per Node Device on page 222](#)
- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
- [Understanding Fibre Channel Terminology on page 31](#)

Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric

To transmit Fibre Channel (FC) traffic between FCoE devices and a storage area network (SAN) FC switch, you configure a local FC fabric on the gateway. The gateway FC fabric includes FCoE and native FC interfaces, and a VLAN to carry FCoE traffic from FCoE-capable devices. The gateway FC fabric creates the path between the FCoE devices and the SAN.

This example describes how to configure the interfaces, VLAN, and FC fabric to connect FCoE devices to the FC switch and route traffic between the VLAN and FC interfaces:

- [Requirements on page 239](#)
- [Overview on page 239](#)
- [Configuration on page 243](#)
- [Verification on page 250](#)

Requirements

This example uses the following hardware and software components:

- A configured and provisioned Juniper Networks QFX3500 Switch to act as an FCoE-FC gateway
- FCoE-capable devices in an Ethernet network equipped with converged network adapters (CNAs)
- An FC switch to transmit and receive native FC traffic
- FC storage devices in the SAN
- Junos OS Release 11.1 or later for the QFX Series

Overview

No interfaces are configured for FC network connectivity by default. You need to configure the FC fabric and its interfaces explicitly. Each FC fabric consists of a combination of at

least one FCoE VLAN interface between the FCoE-FC gateway and the FCoE devices, and one or more native FC interfaces between the FCoE-FC gateway and the FC switch.

An FCoE VLAN interface connects the FCoE-FC gateway to FCoE devices. FCoE traffic between the devices and the FCoE-FC gateway requires a dedicated VLAN used only for FCoE traffic. You cannot mix standard Ethernet traffic and FCoE traffic on the FCoE VLAN.



NOTE: IGMP snooping is not supported on FCoE VLANs. IGMP snooping is enabled by default on all VLANs in all software versions before Junos OS Release 13.2. Disable IGMP snooping on FCoE VLANs if you are using software that is older than 13.2.

Storm control is not supported on Ethernet interfaces that belong to the FCoE VLAN. Ensure that storm control is disabled on all Ethernet interfaces that belong to the FCoE VLAN to prevent FCoE traffic from being dropped.

When FCoE frames enter the FCoE-FC gateway, the gateway:

1. Strips the Ethernet encapsulation from the FCoE frames.
2. Sends the resulting native FC frames to the FC switch through the gateway's native FC interfaces.

Each FC interface and FCoE VLAN interface can belong to only one FC fabric. Different FC fabrics must use different native FC interfaces and different FCoE VLAN interfaces. Multiple FC fabrics on the FCoE-FC gateway can connect to the same FC switch, but they must use different FC interfaces and different FCoE VLAN interfaces.

The Ethernet interfaces that belong to the FCoE VLAN should be configured in tagged-access port mode and must include the native VLAN because FIP VLAN discovery and notification frames are exchanged as untagged packets. These Ethernet interfaces require a maximum transmission unit (MTU) size of at least 2180 bytes to accommodate the FC payload and FCoE encapsulation. (Sometimes the MTU is rounded up to 2500 bytes. If larger frames are expected on the interface, set the MTU size accordingly.)

This example shows a simple configuration to illustrate the basic steps for creating:

- The FCoE-device-facing VLAN and its 10-Gigabit Ethernet interfaces
- The VLAN interface
- The FC-switch-facing native FC interfaces
- One FC fabric on the FCoE-FC gateway

Configuring these elements results in traffic being routed between the VLAN and FC interfaces, thus connecting the FCoE devices to the FC switch through the FCoE-FC gateway.

A VLAN called **blue** transports FCoE traffic between FCoE devices and the FCoE-FC gateway using an FCoE VLAN interface called **vlan.100**. The FCoE-FC gateway's **vlan.100**

interface presents an F_Port interface to the FCoE devices on the VLAN. For each FCoE device ENode that logs in to the FCoE-FC gateway, the gateway instantiates a virtual F_Port (VF_Port) interface. This creates a virtual link between the ENode VN_Port and the FCoE-FC gateway. The FCoE-FC gateway's native FC interfaces transport FC traffic between the gateway and the FC switch.

Configuring both the FCoE VLAN interface and the native FC interfaces as part of a gateway fabric associates them in the switch and makes the connection between the FCoE servers and the FC switch.

Topology

The topology for this example consists of one QFX3500 switch with FC-capable ports to connect to the FC switch and with Ethernet ports in tagged-access mode to connect to the FCoE devices. [Table 12 on page 241](#) and [Figure 14 on page 242](#) show the configuration components of this example.

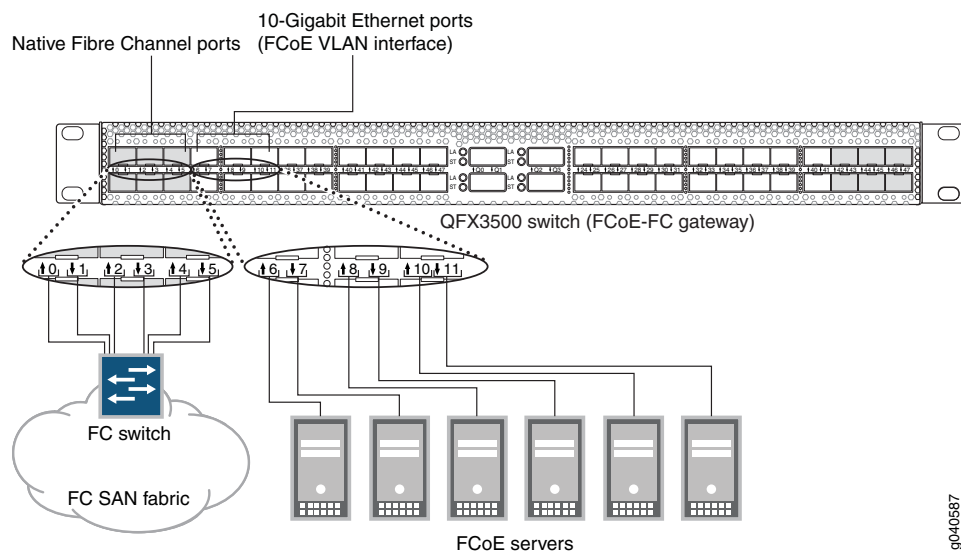
Table 12: Components of the Fibre Channel Interface Configuration Topology

Property	Settings
Switch hardware	QFX3500 switch in gateway mode
FCoE VLAN name and tag ID	blue , tag 100 IGMP snooping disabled on the FCoE VLAN.
Interfaces in VLAN blue	Interfaces: xe-0/0/6 , xe-0/0/7 , xe-0/0/8 , xe-0/0/9 , xe-0/0/10 , xe-0/0/11 Port mode: tagged-access MTU: 2180 Native VLAN: 1 NOTE: FCoE VLANs (any VLAN that carries FCoE traffic) support only Spanning Tree Protocol (STP) and link aggregation group (LAG) Layer 2 features. FCoE traffic cannot use a standard LAG because traffic might be hashed to different physical LAG links on different transmissions. This breaks the (virtual) point-to-point link that Fibre Channel traffic requires. If you configure a standard LAG interface for FCoE traffic, FCoE traffic might be rejected by the FC SAN. QFabric systems support a special LAG called an FCoE LAG, which enables you to transport FCoE traffic and regular Ethernet traffic across the same link aggregation bundle. An FCoE LAG ensures that FCoE traffic uses the same physical link in the LAG for requests and replies in order to preserve the virtual point-to-point link between the FCoE device converged network adapter (CNA) and the FC SAN switch across the QFabric system Node device. An FCoE LAG does not provide load balancing or link redundancy for FCoE traffic. However, regular Ethernet traffic receives the usual LAG benefits of load balancing and link redundancy in an FCoE LAG.
FCoE VLAN interface	vlan.100 Port mode: f-port

Table 12: Components of the Fibre Channel Interface Configuration Topology (continued)

Property	Settings
Native Fibre Channel interfaces	Interfaces: fc-0/0/0 , fc-0/0/1 , fc-0/0/2 , fc-0/0/3 , fc-0/0/4 , fc-0/0/5 Port mode: np-port Speed: 4 Gbps
Fibre Channel fabric fcproxy1	Fabric type: proxy Fabric ID: 1 FC interfaces: fc-0/0/0 , fc-0/0/1 , fc-0/0/2 , fc-0/0/3 , fc-0/0/4 , fc-0/0/5

Figure 14: Fibre Channel Interface Configuration Topology



9040587

This configuration example creates a VLAN for FCoE traffic and routes its traffic to an FCoE VLAN interface that is part of the FC fabric. It also creates the FC interfaces needed to connect to the FC switch.

To set up FC interfaces and FCoE VLAN interfaces:

- Configure a VLAN to use as a dedicated FCoE VLAN:
 - Configure the interfaces the FCoE VLAN uses as Ethernet switching interfaces in tagged-access port mode.
 - If storm control is enabled, disable it on the interfaces.
 - Configure the interfaces the FCoE VLAN uses with the native VLAN.
 - Configure the FCoE VLAN to use the desired Ethernet interfaces.
 - Disable IGMP snooping on the FCoE VLAN. (Before Junos OS Release 13.2, IGMP snooping was enabled by default on all VLANs, but is not supported on FCoE VLANs.

Starting with Junos OS Release 13.2, IGMP snooping is enabled by default only on the default VLAN.)

- Configure the FCoE VLAN interface.
- Define the interface for the FCoE VLAN (associate the VLAN with the FCoE VLAN interface).
- Configure the physical FC interfaces (either one or two 6-port blocks) that connect to the FC switch.
- Configure the logical FC interfaces that connect to the FC switch.
- Configure the FCoE-FC gateway fabric:
 - Configure the fabric ID.
 - Configure the fabric as a proxy fabric.
 - Add the FCoE VLAN interface and the native FC interfaces to the fabric.

To keep the example simple, the configuration steps show six Ethernet interfaces in the FCoE VLAN and six native FC interfaces in the FC fabric. Use the same configuration procedure to add more interfaces to the FCoE VLAN or to the FC fabric.

Configuration

CLI Quick Configuration

To quickly configure FCoE and native FC interfaces on an FCoE-FC gateway and route traffic between the FCoE VLAN and FC interfaces, copy the following commands and paste them into the switch terminal window:

```
[edit]
set vlans blue vlan-id 100
set vlans native vlan-id 1
set interfaces xe-0/0/6 unit 0 family ethernet-switching port-mode tagged-access vlan members blue
set interfaces xe-0/0/7 unit 0 family ethernet-switching port-mode tagged-access vlan members blue
set interfaces xe-0/0/8 unit 0 family ethernet-switching port-mode tagged-access vlan members blue
set interfaces xe-0/0/9 unit 0 family ethernet-switching port-mode tagged-access vlan members blue
set interfaces xe-0/0/10 unit 0 family ethernet-switching port-mode tagged-access vlan members blue
set interfaces xe-0/0/11 unit 0 family ethernet-switching port-mode tagged-access vlan members blue
set interfaces xe-0/0/6 unit 0 family ethernet-switching native-vlan-id 1
set interfaces xe-0/0/7 unit 0 family ethernet-switching native-vlan-id 1
set interfaces xe-0/0/8 unit 0 family ethernet-switching native-vlan-id 1
set interfaces xe-0/0/9 unit 0 family ethernet-switching native-vlan-id 1
set interfaces xe-0/0/10 unit 0 family ethernet-switching native-vlan-id 1
set interfaces xe-0/0/11 unit 0 family ethernet-switching native-vlan-id 1
set interfaces xe-0/0/6 mtu 2180
set interfaces xe-0/0/7 mtu 2180
set interfaces xe-0/0/8 mtu 2180
set interfaces xe-0/0/9 mtu 2180
set interfaces xe-0/0/10 mtu 2180
set interfaces xe-0/0/11 mtu 2180
```

```
set vlans blue interface xe-0/0/6.0
set vlans blue interface xe-0/0/7.0
set vlans blue interface xe-0/0/8.0
set vlans blue interface xe-0/0/9.0
set vlans blue interface xe-0/0/10.0
set vlans blue interface xe-0/0/11.0
set protocols igmp-snooping vlan blue disable
set interfaces vlan unit 100 family fibre-channel port-mode f-port
set vlans blue l3-interface vlan.100
set chassis fpc 0 pic 0 fibre-channel port-range 0 5
set interfaces fc-0/0/0 unit 0 family fibre-channel port-mode np-port
set interfaces fc-0/0/1 unit 0 family fibre-channel port-mode np-port
set interfaces fc-0/0/2 unit 0 family fibre-channel port-mode np-port
set interfaces fc-0/0/3 unit 0 family fibre-channel port-mode np-port
set interfaces fc-0/0/4 unit 0 family fibre-channel port-mode np-port
set interfaces fc-0/0/5 unit 0 family fibre-channel port-mode np-port
set interfaces fc-0/0/0 fibrechannel-options speed 4g
set interfaces fc-0/0/1 fibrechannel-options speed 4g
set interfaces fc-0/0/2 fibrechannel-options speed 4g
set interfaces fc-0/0/3 fibrechannel-options speed 4g
set interfaces fc-0/0/4 fibrechannel-options speed 4g
set interfaces fc-0/0/5 fibrechannel-options speed 4g
set fc-fabrics fcproxy1 fabric-id 1
set fc-fabrics fcproxy1 fabric-type proxy
set fc-fabrics fcproxy1 interface vlan.100
set fc-fabrics fcproxy1 interface fc-0/0/0.0
set fc-fabrics fcproxy1 interface fc-0/0/1.0
set fc-fabrics fcproxy1 interface fc-0/0/2.0
set fc-fabrics fcproxy1 interface fc-0/0/3.0
set fc-fabrics fcproxy1 interface fc-0/0/4.0
set fc-fabrics fcproxy1 interface fc-0/0/5.0
```

Step-by-Step Procedure Configure FCoE and FC interfaces in an FCoE-FC gateway FC fabric and set up traffic routing between the FCoE VLAN and FC interfaces:

1. Configure the VLAN for FCoE traffic:

```
[edit vlans]
user@switch# set blue vlan-id 100
```

2. Configure the native VLAN:

```
[edit vlans]
user@switch# set native vlan-id 1
```

3. Configure the Ethernet interfaces for the FCoE VLAN in tagged-access mode and as members of the FCoE VLAN (VLAN **blue**):

```
[edit interfaces]
user@switch# set xe-0/0/6 unit 0 family ethernet-switching port-mode tagged-access
vlan members blue
user@switch# set xe-0/0/7 unit 0 family ethernet-switching port-mode tagged-access
vlan members blue
user@switch# set xe-0/0/8 unit 0 family ethernet-switching port-mode tagged-access
vlan members blue
```

```

user@switch# set xe-0/0/9 unit 0 family ethernet-switching port-mode tagged-access
vlan members blue
user@switch# set xe-0/0/10 unit 0 family ethernet-switching port-mode tagged-access
vlan members blue
user@switch# set xe-0/0/11 unit 0 family ethernet-switching port-mode tagged-access
vlan members blue

```

4. Configure the native VLAN on the Ethernet interfaces in the FCoE VLAN:

```

[edit interfaces]
user@switch# set xe-0/0/6 unit 0 family ethernet-switching native-vlan-id 1
user@switch# set xe-0/0/7 unit 0 family ethernet-switching native-vlan-id 1
user@switch# set xe-0/0/8 unit 0 family ethernet-switching native-vlan-id 1
user@switch# set xe-0/0/9 unit 0 family ethernet-switching native-vlan-id 1
user@switch# set xe-0/0/10 unit 0 family ethernet-switching native-vlan-id 1
user@switch# set xe-0/0/11 unit 0 family ethernet-switching native-vlan-id 1

```

5. Set the MTU to 2180 for each Ethernet interface:

```

[edit interfaces]
user@switch# set xe-0/0/6 mtu 2180
user@switch# set xe-0/0/7 mtu 2180
user@switch# set xe-0/0/8 mtu 2180
user@switch# set xe-0/0/9 mtu 2180
user@switch# set xe-0/0/10 mtu 2180
user@switch# set xe-0/0/11 mtu 2180

```

6. Assign the Ethernet interfaces to the FCoE VLAN:

```

[edit vlans blue interface]
user@switch# set xe-0/0/6.0
user@switch# set xe-0/0/7.0
user@switch# set xe-0/0/8.0
user@switch# set xe-0/0/9.0
user@switch# set xe-0/0/10.0
user@switch# set xe-0/0/11.0

```

7. Disable IGMP snooping on the FCoE VLAN:

```

[edit protocols]
user@switch# set igmp-snooping vlan blue disable

```

8. Configure the FCoE VLAN interface and port mode for the FCoE traffic:

```

[edit interfaces]
user@switch# set vlan unit 100 family fibre-channel port-mode f-port

```

9. Define the FCoE VLAN interface as the interface for the FCoE VLAN:

```

[edit vlans]
user@switch# set blue l3-interface vlan.100

```

10. Configure the physical FC interfaces the fabric uses to connect to the FC switch:

```
[edit chassis fpc 0 pic 0]
user@switch# set fibre-channel port-range 0 5
```



NOTE: When you configure ports as FC ports, the port designation changes from xe-n/n/n.n format to fc-n/n/n.n format to indicate that the interface is an FC interface. FC interfaces do not support 10-Gbps interface speed but instead conform to FC interface speeds of 2 Gbps, 4 Gbps, or 8 Gbps.

11. Configure the native FC interfaces and port mode:

```
[edit interfaces]
user@switch# set fc-0/0/0 unit 0 family fibre-channel port-mode np-port
user@switch# set fc-0/0/1 unit 0 family fibre-channel port-mode np-port
user@switch# set fc-0/0/2 unit 0 family fibre-channel port-mode np-port
user@switch# set fc-0/0/3 unit 0 family fibre-channel port-mode np-port
user@switch# set fc-0/0/4 unit 0 family fibre-channel port-mode np-port
user@switch# set fc-0/0/5 unit 0 family fibre-channel port-mode np-port
```

12. Configure the native FC interface port speed:

```
[edit interfaces]
user@switch# set fc-0/0/0 fibrechannel-options speed 4g
user@switch# set fc-0/0/1 fibrechannel-options speed 4g
user@switch# set fc-0/0/2 fibrechannel-options speed 4g
user@switch# set fc-0/0/3 fibrechannel-options speed 4g
user@switch# set fc-0/0/4 fibrechannel-options speed 4g
user@switch# set fc-0/0/5 fibrechannel-options speed 4g
```

13. Configure the FC fabric name and unique ID:

```
[edit fc-fabrics]
user@switch# set fcproxy1 fabric-id 1
```

14. Define the FC fabric as an FCoE-FC gateway:

```
[edit fc-fabrics]
user@switch# set fcproxy1 fabric-type proxy
```

15. Assign the FCoE VLAN interface to the fabric:

```
[edit fc-fabrics]
user@switch# set fcproxy1 interface vlan.100
```

16. Assign the native FC interfaces to the fabric:

```
[edit fc-fabrics]
user@switch# set fcproxy1 interface fc-0/0/0.0
user@switch# set fcproxy1 interface fc-0/0/1.0
user@switch# set fcproxy1 interface fc-0/0/2.0
user@switch# set fcproxy1 interface fc-0/0/3.0
user@switch# set fcproxy1 interface fc-0/0/4.0
user@switch# set fcproxy1 interface fc-0/0/5.0
```

Results Display the results of the configuration:

```
user@switch> show configuration
fc-0/0/0 {
  fibrechannel-options {
    speed 4g;
  }
  unit 0 {
    family fibre-channel {
      port-mode np-port;
    }
  }
}
fc-0/0/1 {
  fibrechannel-options {
    speed 4g;
  }
  unit 0 {
    family fibre-channel {
      port-mode np-port;
    }
  }
}
fc-0/0/2 {
  fibrechannel-options {
    speed 4g;
  }
  unit 0 {
    family fibre-channel {
      port-mode np-port;
    }
  }
}
fc-0/0/3 {
  fibrechannel-options {
    speed 4g;
  }
  unit 0 {
    family fibre-channel {
      port-mode np-port;
    }
  }
}
fc-0/0/4 {
  fibrechannel-options {
```

```
        speed 4g;
    }
    unit 0 {
        family fibre-channel {
            port-mode np-port;
        }
    }
}
fc-0/0/5 {
    fibrechannel-options {
        speed 4g;
    }
    unit 0 {
        family fibre-channel {
            port-mode np-port;
        }
    }
}
xe-0/0/6 {
    mtu 2180;
    unit 0 {
        family ethernet-switching {
            port-mode tagged-access;
            vlan {
                members blue;
            }
            native-vlan-id 1;
        }
    }
}
xe-0/0/7 {
    mtu 2180;
    unit 0 {
        family ethernet-switching {
            port-mode tagged-access;
            vlan {
                members blue;
            }
            native-vlan-id 1;
        }
    }
}
xe-0/0/8 {
    mtu 2180;
    unit 0 {
        family ethernet-switching {
            port-mode tagged-access;
            vlan {
                members blue;
            }
            native-vlan-id 1;
        }
    }
}
xe-0/0/9 {
```



```
mtu 2180;
unit 0 {
    family ethernet-switching {
        port-mode tagged-access;
        vlan {
            members blue;
        }
        native-vlan-id 1;
    }
}
xe-0/0/10 {
    mtu 2180;
    unit 0 {
        family ethernet-switching {
            port-mode tagged-access;
            vlan {
                members blue;
            }
            native-vlan-id 1;
        }
    }
}
xe-0/0/11 {
    mtu 2180;
    unit 0 {
        family ethernet-switching {
            port-mode tagged-access;
            vlan {
                members blue;
            }
            native-vlan-id 1;
        }
    }
}
vlan {
    unit 100 {
        family fibre-channel {
            port-mode f-port;
        }
    }
}
fc-fabrics {
    fcproxy1 {
        fabric-id 1
        fabric-type proxy
        interface {
            vlan.100
            fc-0/0/0.0;
            fc-0/0/1.0;
            fc-0/0/2.0;
            fc-0/0/3.0;
            fc-0/0/4.0;
            fc-0/0/5.0;
        }
    }
}
```

```

    }
  }
  protocols {
    igmp-snooping {
      vlan blue {
        disable;
      }
    }
  }
}
vllans {
  blue {
    vlan-id 100
    interface {
      xe-0/0/6.0;
      xe-0/0/7.0;
      xe-0/0/8.0;
      xe-0/0/9.0;
      xe-0/0/10.0;
      xe-0/0/11.0;
    }
    l3-interface vllan.100
  }
  native {
    vlan-id 1;
  }
}
}

```



TIP: To quickly configure the interfaces, issue the **load merge terminal** command and then copy the hierarchy and paste it into the switch terminal window.

Verification

To verify that the native FC interfaces and FCoE VLAN interface have been created, added to the FC fabric, and are operating properly, perform these tasks:

- [Verifying That the Native FC Interfaces and the FCoE VLAN Interface Have Been Created on page 250](#)
- [Verifying That the FCoE VLAN Includes the Correct Ethernet Interfaces on page 251](#)
- [Verifying That the FC Fabric Includes the Correct Interfaces on page 252](#)
- [Verifying Native FC Interface Operation on page 252](#)
- [Verifying That IGMP Snooping Has Been Disabled on the FCoE VLAN on page 253](#)

Verifying That the Native FC Interfaces and the FCoE VLAN Interface Have Been Created

Purpose Verify that the six native FC interfaces and the FCoE VLAN interface have been created on the switch and are configured in the correct mode.

Action List all of the FC interfaces configured on the switch using the **show fibre-channel interfaces** command:

```
user@switch> show fibre-channel interfaces
```

Interface	Idx	Type	Native Fabric-id	NPIV	Config Mode	Oper Mode	State
fc-0/0/0.0	70	FC	1	YES	NP	NP	up
fc-0/0/1.0	71	FC	1	YES	NP	NP	up
fc-0/0/2.0	72	FC	1	YES	NP	NP	up
fc-0/0/3.0	73	FC	1	YES	NP	NP	up
fc-0/0/4.0	74	FC	1	YES	NP	NP	up
fc-0/0/5.0	75	FC	1	YES	NP	NP	up
vlan.100	67	FCOE	1	YES	F	F	up

Meaning The **show fibre-channel interfaces** command lists all native FC interfaces and FCoE VLAN interfaces configured on the switch. The command output shows that the FC interfaces **fc-0/0/0.0**, **fc-0/0/1.0**, **fc-0/0/2.0**, **fc-0/0/3.0**, **fc-0/0/4.0**, and **fc-0/0/5.0** have been created and that those six interfaces:

- Are native Fibre Channel interfaces (type **FC**).
- Belong to the FC fabric with a configured fabric ID of 1.
- Are capable of N_Port ID virtualization (NPIV).
- Have a configured mode and an operational mode of proxy N_Port (**NP**), which means that they should be connected to an FCF or an FC switch, not to an FCoE device, and that they carry native FC traffic.
- Show an operational state of **up**.

The command output also shows that the FCoE VLAN interface **vlan.100** has been created and that interface:

- Is an FCoE VLAN interface (type **FCOE**).
- Belongs to the FC fabric with a configured fabric ID of 1.
- Is capable of N_Port ID virtualization (NPIV).
- Has a configured mode and an operational mode of F_Port (**F**), which means that its interfaces connect to FCoE devices and carry FCoE traffic.
- Shows an operational state of **up**.

Verifying That the FCoE VLAN Includes the Correct Ethernet Interfaces

Purpose Verify that the FCoE VLAN **blue** has been created with the correct VLAN tag (**100**) and with the correct Ethernet interfaces.

Action List all of the interfaces configured on the switch in VLAN **blue** using the **show vlans** command:

```
user@switch> show vlans blue
```

Name	Tag	Interfaces
blue	100	xe-0/0/6.0, xe-0/0/7.0, xe-0/0/8.0, xe-0/0/9.0, xe-0/0/10.0 xe-0/0/11.0

Meaning The **show vlans blue** command lists the interfaces that are members of the FCoE VLAN **blue**. The command output shows that the **blue** VLAN has a tag ID of 100 and includes the interfaces **xe-0/0/6.0**, **xe-0/0/7.0**, **xe-0/0/8.0**, **xe-0/0/9.0**, **xe-0/0/10.0**, and **xe-0/0/11.0**.

Verifying That the FC Fabric Includes the Correct Interfaces

Purpose Verify that the FC fabric configuration is configured on the switch with the correct native FC and FCoE VLAN interfaces.

Action List all of the interfaces configured on FC fabrics on the switch using the **show fibre-channel fabric** command:

```
user@switch> show fibre-channel fabric
```

Name	Fabric-id	Type	Interfaces
fcproxy1	1	PROXY	fc-0/0/0.0 fc-0/0/1.0 fc-0/0/2.0 fc-0/0/3.0 fc-0/0/4.0 fc-0/0/5.0 vlan.100

Meaning The **show fibre-channel fabric** command lists the interfaces that are members of each FC fabric. The command output shows that the only fabric configured on the switch is named **fcproxy1**, has a fabric-id of 1, and is a **proxy** fabric in an FCoE-FC gateway. The command output also shows that the native FC interfaces **fc-0/0/0.0**, **fc-0/0/1.0**, **fc-0/0/2.0**, **fc-0/0/3.0**, **fc-0/0/4.0**, and **fc-0/0/5.0**, and the FCoE VLAN interface **vlan.100** belong to **fcproxy1**.

Verifying Native FC Interface Operation

Purpose Verify that the native FC interfaces are online and display the number of FC sessions on each interface.

Action List all of the native FC NP_Port interface states and sessions by FC fabric using the **show fibre-channel proxy np-port** command:

```
user@switch> show fibre-channel proxy np-port
```

```
Fabric: fcproxy1, Fabric-id: 1
NP-Port    State      Sessions    LB state    LB weight
fc-0/0/0.0  online     3           ON          4
fc-0/0/1.0  online     3           ON          4
fc-0/0/2.0  online     2           ON          4
fc-0/0/3.0  online     2           ON          4
fc-0/0/4.0  online     2           ON          4
fc-0/0/5.0  online     2           ON          4
```

Meaning The **show fibre-channel proxy np-port** command lists the interfaces that are configured as native FC proxy N_Port interfaces. The command output shows:

- The fabric name is **fcproxy1** and its fabric ID is 1.
- The interfaces are **online**.
- The number of FC sessions (virtual links) running on each interface.
- The load-balancing (LB) state is **ON** for all of the interfaces.
- The LB weight reflects the port speed of each interface, which is 4 Gbps.

Verifying That IGMP Snooping Has Been Disabled on the FCoE VLAN

Purpose Verify that IGMP snooping is disabled on the FCoE VLAN.

Action List the IGMP snooping protocol information for the FCoE VLAN using the **show configuration protocols igmp-snooping vlan blue** command:

```
user@switch> show configuration protocols igmp-snooping vlan blue
disable;
```

Meaning The **show configuration protocols igmp-snooping vlan blue** command lists the IGMP snooping configuration for the FCoE VLAN. The command output shows that IGMP snooping is disabled on the FCoE VLAN.

- Related Documentation**
- [Example: Configuring an FCoE LAG on a Redundant Server Node Group on page 66](#)
 - [Converting an Ethernet Interface To a Fibre Channel Interface on page 255](#)
 - [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
 - [Disabling Storm Control on FCoE Interfaces on an FCoE-FC Gateway on page 266](#)
 - [Assigning Interfaces to a Fibre Channel Fabric on page 262](#)

- [Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195](#)
- [Configuring FIP on an FCoE-FC Gateway on page 216](#)
- [Disabling VN2VF_Port FIP Snooping on an FCoE-FC Gateway Switch Interface on page 265](#)
- [Configuring an FCoE LAG on page 63](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

Configuring a Physical Fibre Channel Interface

When you configure the switch as an FCoE-FC gateway, you must configure either 6 or 12 of the physical interfaces as native FC interfaces. Native FC interfaces connect to the storage area network (SAN) FC switch.

You can configure ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5, and ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47 to create blocks of native FC interfaces. You cannot individually configure a single port as a native FC interface. Within these port blocks, you cannot mix FC interfaces with Ethernet interfaces. All of the ports in a block must be either native FC interfaces or Ethernet interfaces.

You can configure:

- Six native FC interfaces by configuring either ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5, or ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47.
- Twelve native FC interfaces by configuring ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5 and ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47.
- No native FC interfaces by leaving ports xe-0/0/0 through xe-0/0/5 and ports xe-0/0/42 through xe-0/0/47 in their default state as Ethernet interfaces.
- To configure physical FC interfaces using the CLI, specify the physical port block you want to configure on the switch as native FC interfaces:

```
[edit chassis]
user@switch# set fpc fpc pic pic fibre-channel port-range port-range-low port-range-high
```

For example, to configure six native FC interfaces, you can configure ports 0 through 5 as physical FC interfaces:

```
[edit chassis]
user@switch# set fpc 0 pic 0 fibre-channel port-range 0 5
```

To configure 12 native FC interfaces requires two separate statements:

```
[edit chassis]
user@switch# set fpc 0 pic 0 fibre-channel port-range 0 5
user@switch# set fpc 0 pic 0 fibre-channel port-range 42 47
```

Related Documentation

- [Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195](#)
- [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
- [Converting an Ethernet Interface To a Fibre Channel Interface on page 255](#)
- [Assigning Interfaces to a Fibre Channel Fabric on page 262](#)
- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

Converting an Ethernet Interface To a Fibre Channel Interface

When a QFX3500 acts as an FCoE-FC gateway, native Fibre Channel (FC) traffic flows between the switch and the storage area network (SAN) FC switch. When you configure a port as an FC interface, it transports only FC traffic. It does not transport Ethernet traffic.

You can configure ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5 and ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47 to create blocks of native FC interfaces.

Each of these blocks of ports must be configured either as all Ethernet ports or as all native FC ports. Within each block of ports, you cannot mix FC and Ethernet interfaces. This means that you can configure 0, 6, or 12 ports as native FC ports. “[Configuring a Physical Fibre Channel Interface](#)” on page 254 describes how to configure the port blocks as physical FC interfaces.



NOTE: Do not configure ports that you want to use for native FC traffic as part of an Ethernet VLAN or as Ethernet ports.

Configure a port as an FC interface when the port connects to the F_Port of an FC switch.

FC interface configuration includes:

- Explicitly specifying one or more ports as an FC family interface in NP_Port mode (mandatory).
- Configuring the FC interface options port speed and buffer-to-buffer credit state change number (BB_SC_N) (optional).
- Configuring the interface as a loopback interface (optional).

The buffer-to-buffer state change number feature prevents the loss of buffer-to-buffer credits between the two interfaces on either end of an FC link. The state change number determines the number of frames and receiver ready (R_RDY) primitives the interfaces exchange between the state change send (BB_SCs) and the state change receive (BB_SCr) primitives used to track these transactions.

Enabling BB_SC_N by configuring BB_SC_N on both of the FC link interfaces:

- Requests that $2^{BB_SC_N}$ number of frames be sent between two consecutive BB_SCs primitives, and
- Requests that $2^{BB_SC_N}$ number of R_RDY primitives be sent between two consecutive BB_SCr primitives.

When the number of R_RDY primitives received equals $2^{BB_SC_N}$, the R_RDY counter resets to zero. When the number of frames received equals $2^{BB_SC_N}$, the frame counter resets to zero. The interfaces calculate the number of buffer-to-buffer credits lost based on counter discrepancies and take corrective action to recover the lost credits.

If you enable BB_SC_N, the recommended BB_SC_N setting is eight. Setting the BB_SC_N number to zero (0) disables the feature. If either of the two connected FC interfaces is configured with zero as the BB_SC_N value, then both interfaces disable the feature. If the two connected FC interfaces have different nonzero BB_SC_N numbers configured, both interfaces use the higher number.

For the port to transport FC traffic, you must also set the physical port as an FC port using the **port-range** command.

To configure an FC interface using the CLI:

1. Specify the interface as family FC and set the port mode to NP_Port (setting the port mode to NP_Port is a mandatory configuration):

```
[edit]
user@switch# set interfaces interface-name unit unit family fibre-channel port-mode np-port
```

For example, to configure the interface **fc-0/0/3** as an FC interface and set the port mode to **np-port**:

```
[edit]
user@switch# set interfaces fc-0/0/3 unit 0 family fibre-channel port-mode np-port
```

2. Configure the FC interface speed option:

```
[edit]
user@switch: set interfaces interface-name fibrechannel-options speed (auto-negotiation | 2g | 4g | 8g)
```

For example, to set the FC interface speed option to **8g** for the interface **fc-0/0/3**:

```
[edit]
user@switch: set interfaces fc-0/0/3 fibrechannel-options speed 8g
```

The default port mode is **auto-negotiation**, which sets the port speed to match the speed of the attached FC F_Port interface (2 Gbps, 4 Gbps, or 8 Gbps).

3. Configure the optional buffer-to-buffer credit state change number:

```
[edit]
```



```
user@switch: set interfaces interface-name fibrechannel-options bb-sc-n 0..15
```

For example, to set the FC interface buffer-to-buffer credit state change number to 8 for the interface `fc-0/0/3`:

```
[edit]  
user@switch: set interfaces fc-0/0/3 fibrechannel-options bb-sc-n 8
```

After you configure one or more FC interfaces, assign them and an FCoE VLAN to an FC fabric.

**Related
Documentation**

- [Assigning Interfaces to a Fibre Channel Fabric on page 262](#)
- [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
- [Configuring a Physical Fibre Channel Interface on page 254](#)
- [Deleting a Fibre Channel Interface on page 263](#)
- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Understanding an FCoE-FC Gateway on page 190](#)

Configuring an FCoE VLAN Interface on an FCoE-FC Gateway

When you configure the switch as an FCoE-FC gateway, a Layer 3 FCoE VLAN interface transmits and receives Fibre Channel over Ethernet (FCoE) traffic between the gateway and FCoE-capable servers on the Ethernet network. Configuring a Layer 3 FCoE VLAN interface on the switch creates virtual fabric port (VF_Port) interfaces facing the FCoE server virtual node ports (VN_Ports).

The FCoE VLAN interface is the interface for the dedicated VLAN the FCoE servers use for FCoE traffic. Each FC fabric requires at least one dedicated FCoE VLAN and at least one Layer 3 FCoE VLAN interface to transport FCoE traffic. On QFabric systems, the FCoE VLAN interface, the FCoE VLAN, and the interfaces that are members of the FCoE VLAN must be on the same Node device.



NOTE: FCoE VLANs (any VLAN that carries FCoE traffic) support only Spanning Tree Protocol (STP) and link aggregation group (LAG) Layer 2 features.

FCoE traffic cannot use a standard LAG because traffic might be hashed to different physical LAG links on different transmissions. This breaks the (virtual) point-to-point link that Fibre Channel traffic requires. If you configure a standard LAG interface for FCoE traffic, FCoE traffic might be rejected by the FC SAN.

QFabric systems support a special LAG called an FCoE LAG, which enables you to transport FCoE traffic and regular Ethernet traffic (traffic that is not FCoE traffic) across the same link aggregation bundle. Standard LAGs use a hashing algorithm to determine which physical link in the LAG is used for a transmission, so communication between two devices might use different physical links in the LAG for different transmissions. An FCoE LAG ensures that FCoE traffic uses the same physical link in the LAG for requests and replies in order to preserve the virtual point-to-point link between the FCoE device converged network adapter (CNA) and the FC SAN switch across a QFabric system Node device. An FCoE LAG does not provide load balancing or link redundancy for FCoE traffic. However, regular Ethernet traffic uses the standard hashing algorithm and receives the usual LAG benefits of load balancing and link redundancy in an FCoE LAG.

If the member interfaces of an FCoE VLAN belong to an FCoE LAG and are part of an FCoE untrusted FC fabric on the gateway, you must disable FIP snooping scaling on the gateway. FCoE untrusted gateway fabrics that include FCoE LAGs do not support enhanced FIP snooping scaling.



NOTE: To configure an FCoE VLAN on a device that you are using as transit switch, you do not use an FCoE VLAN interface. Instead, use the procedure described in [“Configuring VLANs for FCoE Traffic on an FCoE Transit Switch” on page 85](#).

Before you configure an FCoE VLAN interface, create the FCoE VLAN and assign 10-Gigabit

Ethernet interfaces configured in tagged-access port mode to the VLAN. These 10-Gigabit Ethernet interfaces are the physical interfaces that transport the FCoE traffic to and from the FCoE devices in the Ethernet network.

Each Ethernet interface that connects to FCoE devices must also include the native VLAN to transport FIP traffic, because FIP VLAN discovery and notification frames are exchanged as untagged packets. The FCoE VLAN must carry only FCoE traffic. A VLAN cannot transport a mix of FCoE and standard Ethernet traffic.

FCoE VLAN interface configuration includes:

- Configuring a VLAN to use as a dedicated FCoE VLAN.
- Configuring a native VLAN for FIP traffic.
- Configuring member interfaces for the FCoE VLAN.
- Configuring the FCoE VLAN as a Fibre Channel (family) VLAN and setting the port mode value to **f-port**. Explicitly configuring the FCoE VLAN interface in F_Port mode is mandatory. The switch interface with which the FCoE server VN_Ports communicate must present a VF_Port to the servers.
- Configuring the FCoE VLAN interface as the Layer 3 interface for FCoE traffic.

To configure an FCoE VLAN interface:

1. Configure a dedicated FCoE VLAN:

```
[edit vlans]
user@switch# set vlan-name vlan-id vlan-id
```

For example, to configure a VLAN named **fcoe_vlan** with a VLAN ID of **100** as the FCoE VLAN:

```
[edit vlans]
user@switch# set fcoe_vlan vlan-id 100
```

2. Configure a native VLAN for FIP traffic:

```
[edit vlans]
user@switch# set native vlan-id vlan-id
```

For example, to configure the native VLAN with a VLAN ID of 1:

```
[edit vlans]
user@switch# set native vlan-id 1
```

3. Configure member interfaces for the FCoE VLAN (use **ethernet-switching** as the family and **tagged-access** as the port mode):

```
[edit interfaces]
user@switch# set interface-name unit unit family family port-mode mode vlan members
vlan-name
```

For example, to configure the interface **xe-0/0/10** as a member of the FCoE VLAN **fcoe_vlan**:

```
[edit interfaces]
user@switch# set xe-0/0/10 unit 0 family ethernet-switching port-mode tagged-access vlan
members fcoe_vlan
```

4. Configure the native VLAN on the FCoE VLAN member interfaces:

```
[edit interfaces]
user@switch# set interface-name unit unit family family native-vlan-id vlan-id
```

For example, to configure the interface **xe-0/0/10** as a member of the native VLAN with the native VLAN ID 1:

```
[edit interfaces]
user@switch# set xe-0/0/10 unit 0 family ethernet-switching native-vlan-id 1
```

5. Assign the Ethernet interfaces to the FCoE VLAN:

```
[edit vlans]
user@switch# set vlan-name interface interface-name
```

For example, to assign the interface **xe-0/0/10.0** to the FCoE VLAN named **fcoe_vlan**:

```
[edit vlans]
user@switch# set fcoe_vlan interface xe-0/0/10.0
```

6. Define an interface as an FCoE VLAN interface in F_Port mode (to present a VF_Port to the FCoE servers):

```
[edit interfaces]
user@switch# set vlan unit unit family fibre-channel port-mode f-port
```

For example, to configure VLAN unit **100** as an FCoE VLAN interface and set the port mode to **f-port**:

```
[edit interfaces]
user@switch# set vlan unit 100 family fibre-channel port-mode f-port
```

7. Define the Layer 3 FCoE VLAN interface:

```
[edit vlans]
user@switch# set vlan-name l3-interface vlan-interface-name
```

For example, to configure VLAN interface unit **100** (the FCoE VLAN interface defined earlier in this example) as the Layer 3 FCoE VLAN interface for FCoE VLAN **fcoe_vlan**:

```
[edit vlans]
user@switch# set fcoe_vlan l3-interface vlan.100
```

**Related
Documentation**

- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195](#)
- [Configuring a Physical Fibre Channel Interface on page 254](#)
- [Converting an Ethernet Interface To a Fibre Channel Interface on page 255](#)
- [Assigning Interfaces to a Fibre Channel Fabric on page 262](#)
- [Disabling VN2VF_Port FIP Snooping on an FCoE-FC Gateway Switch Interface on page 265](#)
- [Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85](#)
- [Configuring an FCoE LAG on page 63](#)
- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)

Assigning Interfaces to a Fibre Channel Fabric

When you configure the switch as an FCoE-FC gateway, you assign one or more (up to 12) native Fibre Channel (FC) interfaces and at least one FCoE VLAN interface to each FC fabric. FC interfaces transport native FC traffic between the proxy gateway and the storage area network (SAN) FC switch. FCoE VLAN interfaces transport FCoE traffic between FCoE-capable servers and the gateway.

Each FC fabric needs both types of interfaces to transport traffic between FCoE servers on the Ethernet network and FC storage devices in the core FC network behind the FC switch. FCoE traffic between the FCoE servers and the gateway must travel in a dedicated FCoE VLAN. Native FC traffic passes between the gateway and the FC switch on the native FC interfaces.

You must configure the FC interfaces and the FCoE VLAN interfaces that you assign to a particular fabric on the same Juniper Networks QFX3500 Switch. Traffic between an FCoE device and the FC switch must ingress and egress the same gateway.

To assign core-facing native FC interfaces and a server-facing FCoE VLAN interface to an FC fabric, configure a fabric and then specify the interfaces:

1. Assign the native FC interfaces to the FC fabric:

```
[edit fc-fabrics fabric-name]  
user@switch: set interface interface-name  
user@switch: set interface interface-name  
user@switch: set interface interface-name  
...
```

2. Assign an FCoE VLAN interface to the FC fabric:

```
[edit fc-fabrics fabric-name]  
user@switch: set interface vlan-name
```

For example, to assign the native FC interfaces **fc-0/0/0.0**, **fc-0/0/1.0**, and **fc-0/0/2.0** and the FCoE VLAN interface **vlan.100** to an FC fabric named **san_tana**:

```
user@switch: set fc-fabrics san_tana interface fc-0/0/0.0
user@switch: set fc-fabrics san_tana interface fc-0/0/1.0
user@switch: set fc-fabrics san_tana interface fc-0/0/2.0
user@switch: set fc-fabrics san_tana interface vlan.100
```

Related Documentation

- [Converting an Ethernet Interface To a Fibre Channel Interface on page 255](#)
- [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Understanding an FCoE-FC Gateway on page 190](#)

Deleting a Fibre Channel Interface

Before you delete a Fibre Channel (FC) interface, you must first delete the interface from the FC fabric configuration. This prevents configuration errors that would result if you deleted an FC interface from the **[edit interfaces]** hierarchy level but did not delete the interface from the FC fabric.

When you configure the switch as an FCoE-FC gateway, FC interfaces transmit and receive native FC traffic between the gateway and the FC switch. You can configure ports **xe-0/0/0** through **xe-0/0/5** as **fc-0/0/0** through **fc-0/0/5** and ports **xe-0/0/42** through **xe-0/0/47** as **fc-0/0/42** through **fc-0/0/47** to create one or two blocks of six native FC interfaces.

To delete an FC interface using the CLI:

1. Delete the FC interface from the FC fabric to which it belongs:

```
[edit]
user@switch# delete fc-fabrics fabric-name interface interface-name
```

For example, to delete the FC interface **fc-0/0/3.0** from an FC fabric named **sanfab1**:

```
[edit]
user@switch# delete fc-fabrics sanfab1 interface fc-0/0/3.0
```

2. Delete the FC interface from the switch **[edit interfaces]** hierarchy:

```
[edit]
user@switch: delete interfaces interface-name
```

For example, to delete the interface **fc-0/0/3.0** from the switch:

```
[edit]
user@switch: delete interfaces fc-0/0/3.0
```

The FC interface has been deleted from the FC fabric and from the switch.

- Related Documentation**
- [Assigning Interfaces to a Fibre Channel Fabric on page 262](#)
 - [Configuring a Physical Fibre Channel Interface on page 254](#)
 - [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)
 - [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

Troubleshooting Fibre Channel Interface Deletion

Problem **Description:** You deleted a Fibre Channel (FC) interface at the **[edit interfaces]** hierarchy level, but the commit check fails so the interface is not deleted.

Cause You must first delete the FC interface from the FC fabric on the QFX Series before you can delete the FC interface at the **[edit interfaces]** hierarchy level. You must perform both operations to delete a FC interface.

Solution First delete the interface from the FC fabric and then delete the interface from the QFX Series:

1. Delete the FC interface from the FC fabric to which it belongs:

```
[edit]
user@switch# delete fc-fabrics fabric-name interface interface-name
```

For example, to delete the FC interface **fc-0/0/3.0** from an FC fabric named **sanfab1**:

```
[edit]
user@switch# delete fc-fabrics sanfab1 interface fc-0/0/3.0
```

2. Delete the FC interface at the **[edit interfaces]** hierarchy level:

```
[edit]
user@switch: delete interfaces interface-name
```

For example, to delete the interface **fc-0/0/3.0** from the switch:

```
[edit]
user@switch: delete interfaces fc-0/0/3.0
```

- Related Documentation**
- [fc-fabrics on page 440](#)
 - [interface on page 449](#)
 - [interfaces](#)
 - [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

Disabling VN2VF_Port FIP Snooping on an FCoE-FC Gateway Switch Interface

When the switch acts as an FCoE-FC gateway, the FCoE-network-facing Ethernet interfaces in the FCoE VLAN are automatically enabled for VN_Port to VF_Port (VN2VF_Port) FIP snooping. You can disable VN2VF_Port FIP snooping on an individual Ethernet interface or you can disable VN2VF_Port FIP snooping globally for all Ethernet interfaces in a gateway Fibre Channel (FC) fabric.

Disable VN2VF_Port FIP snooping on an Ethernet interface by configuring it as an FCoE trusted interface. Disable VN2VF_Port FIP snooping on all Ethernet interfaces in an FC fabric by configuring the FC fabric as FCoE trusted.

Do not disable VN2VF_Port FIP snooping on an interface unless you are certain that the interface is connected to a trusted device. Do not disable VN2VF_Port FIP snooping on an FC fabric unless all of the FCoE-network-facing interfaces in the fabric are either connected to a transit switch that is performing VN2VF_Port FIP snooping on the FCoE devices as they log in to the FC network or all of the interfaces are connected to trusted devices.

VN2VF_Port FIP snooping installs firewall filters that block FIP and FCoE frames from sources that have not logged in to the switch and prevents unauthorized access to the network. Disabling VN2VF_Port FIP snooping disables these firewall filters and permits access to all FIP and FCoE frames transported on that interface.

- To disable VN2VF_Port FIP snooping on an FCoE-device-facing Ethernet interface in an FCoE VLAN, configure that interface as a trusted interface:

```
[edit ethernet-switching-options secure-access-port]
user@switch# set interface interface-name fcoe-trusted
```

For example, to configure interface *xe-0/0/7* as a trusted FC interface:

```
[edit ethernet-switching-options secure-access-port]
user@switch# set interface xe-0/0/7 fcoe-trusted
```

- To disable VN2VF_Port FIP snooping on all FCoE-device-facing interfaces in a gateway FC fabric, configure that fabric as a trusted fabric:

```
[edit]
user@switch# set fc-fabrics fabric-name protocols fip fcoe-trusted
```

For example, to configure an FC fabric named *santastic* as an FCoE trusted fabric:

```
[edit]
user@switch# set fc-fabrics santastic protocols fip fcoe-trusted
```

Related Documentation

- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch on page 101](#)

- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Understanding an FCoE-FC Gateway on page 190](#)

Disabling Storm Control on FCoE Interfaces on an FCoE-FC Gateway

Storm control is not supported on the FCoE interfaces of an FCoE-FC gateway VLAN. Enabling storm control on an FCoE-FC gateway VLAN interface may cause FCoE packet loss. Storm control is disabled by default on all interfaces. However, if you enabled storm control globally on all switch interfaces or on any interfaces that are part of the FCoE VLAN interface, you must disable storm control on the Ethernet interfaces of the FCoE VLAN.

If storm control is enabled on only a few interfaces of the FCoE VLAN, you can disable storm control on individual interfaces by including the **delete ethernet-switching-options storm-control interface *interface-name*** statement in the configuration, where *interface-name* is the name of the interface on which you want to disable storm control.

If storm control is enabled globally on the switch when the switch is acting as an FCoE-FC gateway, it is often easiest to disable storm control on all interfaces, then enable storm control only on Ethernet interfaces that are not part of the FCoE VLAN interface.

If storm control is enabled globally, you can disable storm control in either of two ways:

- Disable storm control on all interfaces, then enable storm control on the interfaces you want to use storm control. (From the default configuration, you cannot disable storm control on individual interfaces because the default configuration enables storm control on **all** interfaces, not on individual interfaces.)

For example, if you want interfaces xe-0/0/20, xe-0/0/21, and xe-0/0/22 to use storm control, disable storm control on all interfaces, then enable storm control on those three interfaces:

1. Disable storm control on all interfaces:

```
user@switch# delete ethernet-switching-options storm-control interface all
```

2. Enable storm control on interfaces xe-0/0/20, xe-0/0/21, and xe-0/0/22:

```
user@switch# set ethernet-switching-options storm-control interface xe-0/0/20
user@switch# set ethernet-switching-options storm-control interface xe-0/0/21
user@switch# set ethernet-switching-options storm-control interface xe-0/0/22
```

- Disable storm control for all unknown unicast traffic on all interfaces by including the following statement in your configuration:

```
user@switch# set ethernet-switching-options storm-control interface all no-unknown-unicast
```

Related Documentation

- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Understanding Storm Control](#)

- [Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239](#)

Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric

You can balance or rebalance the load on the ports in an FCoE-FC gateway proxy fabric in order to avoid overutilizing or underutilizing the links. Load balancing is distributing sessions across the available native Fibre Channel (FC) interfaces (NP_Ports) that belong to a local gateway FC fabric to create a relatively equal load on all the fabric links. Load rebalancing is redistributing the existing sessions across the available NP_Port links on a local gateway FC fabric.



NOTE: A session is a fabric login (FLOGI) or fabric discovery (FDISC) login to the FC SAN fabric. Session does not refer to end-to-end server-to-storage sessions.

The fabric-facing NP_Port links of an FCoE-FC gateway use different load-balancing methods than the FCoE-network-facing Ethernet links.

Balancing the load on FCoE-FC gateway NP_Port links consists of two steps:

1. Choosing the algorithm used to balance and rebalance the link load
2. Choosing whether to rebalance link loads automatically or only when you explicitly request a rebalance (load-rebalancing method)

You can configure a different load-balancing algorithm and use a different rebalancing method for each local FC fabric on the FCoE-FC gateway. The load-balancing algorithm and automated rebalancing, if configured, apply to all NP_Port interfaces in the local FC fabric.

This topic describes:

- [Load-Balancing Algorithms on page 268](#)
- [Load-Rebalancing Methods on page 272](#)
- [NP_Port Interface FIP Session Limit Effect on Load Balancing on page 273](#)
- [Load-Balancing Triggers and Timing on page 273](#)
- [Load Rebalancing Behavior When a Link Goes Down on page 275](#)
- [Interface Load Calculation Algorithm on page 276](#)
- [Load-Balancing Scenarios on page 277](#)

Load-Balancing Algorithms

You can choose one of three load-balancing algorithms to configure the way the switch balances the link loads. The switch uses the configured algorithm to balance the link loads when NP_Ports are initialized and whenever link loads are rebalanced. Regardless of whether you configure automated load rebalancing or use on-demand load rebalancing, the switch uses the configured algorithm to balance the link load:

- Simple load balancing—The switch assigns each ENode FLOGI session and VN_Port FDISC session to the least-loaded link. The switch can place FDISC sessions on a different link than the parent FLOGI session (an ENode FLOGI session and its subsequent FDISC sessions can be placed on different links). Simple load balancing is the default load-balancing algorithm. Rebalancing the link load disrupts only selected sessions to minimize the impact (the switch uses an algorithm to log out only the sessions that need to be moved to other links to balance the load when those sessions log in again).
- ENode-based load balancing—When an ENode logs in to the fabric, the switch places all subsequent VN_Port FDISC sessions associated with that ENode on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link. The switch calculates the link load based on the combined total of FLOGIs and FDISCs on each NP_Port link. Rebalancing the link load disrupts all sessions (all sessions log out and then log in again).
- FLOGI-based load balancing—Similar to ENode-based load balancing; when an ENode logs in to the fabric, the switch places all subsequent VN_Port FDISC sessions associated with that ENode on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link.

One difference between ENode-based load balancing and FLOGI-based load balancing is that the switch calculates the link load based only on the number of FLOGIs on each NP_Port link. The algorithm does not count FDISCs. Another difference is that instead of disrupting all sessions on a link load rebalance, the system disrupts only selected sessions to minimize the impact (the switch uses an algorithm to log out only the sessions that need to be moved to other links to balance the load when those sessions log in again).



NOTE: Changing the load-balancing algorithm when FCoE sessions are running forces the FCoE sessions to log out and then log in again.

If you do not explicitly configure the load-balancing algorithm, the switch uses simple load balancing by default on the all NP_Port interfaces that belong to a given local FC fabric.

The following sections describe how each algorithm works, its advantages and disadvantages, and what happens when NP_Port links come up for the first time, when an NP_Port link is added to existing links, and when you rebalance the link load:

- [Simple Load Balancing on page 269](#)
- [ENode-Based Load Balancing on page 270](#)
- [FLOGI-Based Load Balancing on page 270](#)
- [Load-Balancing Algorithm Comparison on page 271](#)

Simple Load Balancing

Simple load balancing provides the most equal load balancing across links because each VN_Port FDISC session can be assigned to the least-loaded link, regardless of whether the parent ENode FLOGI session is on that link. (The parent ENode is the ENode that originates the logins to the fabric. After the parent ENode logs in, the VN_Ports on that ENode can log in to the fabric using FDISC.)

The FCoE-FC gateway performs simple load balancing by default on the NP_Ports that connect the gateway to the FC SAN. When an ENode sends a FLOGI request to the gateway, the gateway checks the NP_Ports that connect it to the FC SAN and assigns the new session to the least-loaded link.

Every time an ENode sends a FLOGI or an FDISC request, the gateway assigns the new session to the least-loaded NP_Port link. After the gateway assigns an ENode FLOGI session to an NP_Port, subsequent FDISC requests by the same ENode can result in sessions being assigned to different NP_Ports, because the gateway always assigns the new session to the least-loaded interface.



NOTE: Because VN_Port sessions might be placed on a different link than their parent ENode, if the link that contains the ENode goes down, only the ENode session and any of its VN_Port sessions that are on that link go down. VN_Port sessions on other links remain active as long as the link is up and the VN_Port is not logged out.

When a new link comes up, the switch logs out enough sessions so that when the sessions log in again, they are placed on the new link and the link loads are balanced. The switch uses an algorithm to log out sessions in the least disruptive manner by first logging out FDISCs whose FLOGI is not on the same link, then the least-loaded FLOGIs (loaded in terms of related FDISC logins).

Similarly, when you rebalance an existing link load, the switch logs out only enough sessions so that when the sessions log in again, they balance the load on the existing links. In this case (rebalance without a new link up), the switch takes into account the dependencies between FLOGIs and FDISCs when selecting sessions to log out.

The simple load-balancing algorithm uses the sum of the FLOGI and FDISC sessions to determine the session load on each link for both initial load balancing and load rebalancing.

ENode-Based Load Balancing

ENode-based load balancing can result in a less balanced load across the NP_Port links because the VN_Port FDISC sessions are assigned to the same link as the parent ENode FLOGI session, regardless of how many FDISC sessions are associated with the ENode. However, ENode-based load balancing has the advantage of keeping all of the sessions associated with a particular ENode on one link, which provides better control and predictability.

When you use the ENode-based load-balancing algorithm, the gateway assigns the ENode to an NP_Port link when the ENode sends its FLOGI message to the gateway. The gateway places the ENode session on the least-loaded link at that time. The VN_Port FDISC sessions associated with an ENode are placed on the same link as the ENode FLOGI session, regardless of the link load. Essentially, the ENode sessions are load-balanced, but the VN_Port sessions are not.

ENode-based load balancing ensures that each ENode and its associated VN_Port sessions are assigned to the same NP_Port link. ENode-based load balancing provides more control and predictability and ensures that if the link carrying an ENode goes down, all of the ENodes associated VN_Port sessions also go down.

The disadvantage of ENode-based load balancing is that if one ENode has a large number of sessions and the other ENodes do not, the link that carries the ENode with the large number of sessions might have a much larger load than the other NP_Port links in the gateway proxy fabric.

For example, if a gateway fabric has two NP_Ports connected to the FC fabric, and two ENodes log in to the fabric, one ENode session is placed on each link. If two VN_Port sessions are initiated on one of the ENodes, those sessions are placed on the same link as the parent ENode. If 1000 VN_Port sessions are initiated on the other ENode, all of the 1000 VN_Port sessions are placed on the same link as that ENode. In this case, one link has 3 sessions (1 ENode FLOGI session and 2 VN_Port FDISC sessions) and the other link has 1001 sessions (1 ENode FLOGI session and 1000 VN_Port FDISC sessions).

When a new link comes up or when you rebalance an existing load, the switch logs out all sessions (FLOGIs and FDISCs) in the fabric. As the sessions log in again, the switch assigns them to NP_Ports in a balanced manner, with all FDISCs assigned to the same link as the parent FLOGI. A new link coming up or a rebalance disrupts all of the existing sessions.

The ENode-based load-balancing algorithm uses the sum of the FLOGI and FDISC sessions to determine the session load on each link for both initial load balancing and load rebalancing.

FLOGI-Based Load Balancing

FLOGI-based load balancing is similar to ENode-based load balancing in most ways:

- It can result in a less balanced load across the NP_Port links because the VN_Port FDISC sessions are assigned to the same link as the parent ENode FLOGI session, regardless of how many FDISC sessions are associated with the ENode.
- When an ENode logs in with a FLOGI, the gateway places the session on the least-loaded link, and the FDISC logins associated with the FLOGI are placed on the same link, regardless of link load.
- Provides control and predictability because each ENode and its associated VN_Port (FDISC) sessions are assigned to the same link, so if the link an ENode is on goes down, all of its associated sessions also go down.
- If one ENode has a large number of sessions and the other ENodes do not, the link that carries the ENode with the large number of sessions might have a much larger load than the other NP_Port links in the gateway proxy fabric.

FLOGI-based load balancing differs from ENode-based load balancing in two important ways:

1. The switch uses the sum of the FLOGI sessions on a link to determine the link load. The switch does not use FDISC sessions when calculating the number of sessions on a link. (ENode-based load balancing uses the sum of the FLOGI and FDISC sessions to calculate the number of sessions on a link.)
2. When a new link comes up or when you rebalance an existing load, the switch logs out enough FLOGI (and FDISC) sessions so that when the FLOGI sessions log in again, the load is balanced. The switch balances the load based only on the number of FLOGI sessions, not the sum of FLOGI and FDISC sessions. However, the FDISC sessions associated with a FLOGI follow the FLOGI to the new link if the FLOGI session is part of the rebalancing.

The FLOGI-based load-balancing algorithm uses only the FLOGI sessions to determine the session load on each link for both initial load balancing and load rebalancing.

Load-Balancing Algorithm Comparison

Table 13 on page 271 compares the three load-balancing algorithms and summarizes their differences, advantages, and disadvantages.

Table 13: Load-Balancing Algorithm Comparison

Load-Balancing Algorithm	Session Assignment	Session Disruption on Rebalance	Session Count Method	Advantages	Disadvantages
Simple (default algorithm)	FDISC sessions can be placed on different links than the parent FLOGI session	Minimum number of selected sessions logged out (FDISC sessions can be logged out independent of the parent FLOGI session)	Sum of FLOGI and FDISC sessions	<ul style="list-style-type: none"> • Most equal session distribution across links • Minimum number of sessions logged out when rebalancing • Least disruptive algorithm 	<ul style="list-style-type: none"> • Less session control and predictability

Table 13: Load-Balancing Algorithm Comparison (continued)

Load-Balancing Algorithm	Session Assignment	Session Disruption on Rebalance	Session Count Method	Advantages	Disadvantages
ENode-based	FDISC sessions are always placed on the same link as the parent FLOGI session	All sessions are logged out	Sum of FLOGI and FDISC sessions	<ul style="list-style-type: none"> Better session control and predictability (on link down, all sessions associated with an ENode go down) 	<ul style="list-style-type: none"> Most disruptive algorithm; all sessions logged out on rebalance Might result in less balanced link load because FDISCs are placed on the same link as parent FLOGI
FLOGI-based	FDISC sessions are always placed on the same link as the parent FLOGI session	Minimum number of selected sessions logged out (but FDISC sessions logged out when parent FLOGI session is logged out)	FLOGI sessions only (FDISC sessions not included in the session count)	<ul style="list-style-type: none"> Better session control and predictability (on link down, all sessions associated with an ENode go down) Minimum number of sessions logged out when rebalancing 	<ul style="list-style-type: none"> Might result in less balanced link load because FDISCs are placed on the same link as parent FLOGI

Load-Rebalancing Methods

The load-rebalancing method determines the way the system redistributes sessions to balance the load on the NP_Ports that belong to a local FC fabric on an FCoE-FC gateway.

You can rebalance the existing load on existing NP_Port links using either of two methods:

- Automated load rebalancing—When a load rebalancing trigger occurs, the switch automatically rebalances the link loads by redistributing the sessions across the active NP_Port links. There are three possible load rebalancing triggers:

- When you enable automated load rebalancing, the switch checks the load balance on the existing NP_Port links. If the links are already balanced, the switch does not rebalance the link load. If the links are not balanced, the switch rebalances the link loads using the configured load-balancing algorithm.

Enabling automated load rebalancing causes sessions to be logged out in accordance with the configured load-balancing algorithm if the link load is unbalanced. If the link load is already balanced when you enable automated load rebalancing, the links are not rebalanced. (Disabling automated load rebalancing is not disruptive because the link load is already balanced.)

- When a new NP_Port link comes up on a local FCoE-FC gateway fabric, the switch rebalances the link load using the configured load-balancing algorithm if automated load balancing is enabled.
- When the port speed is changed (unless the port speed change does not change the actual port speed, for example, changing the port speed from auto to 8 Gbps).

Use automated load rebalancing if you want link loads to be rebalanced automatically when a load-balancing trigger occurs, instead of at times of your choosing. Keep in mind that load rebalancing is a disruptive event (sessions are logged out).

- On-demand load rebalancing—You choose when to rebalance the NP_Port links by explicitly requesting a load rebalance using an operational command. The system rebalances the link load only when you issue the rebalancing command.

Use on-demand load rebalancing if you only want to rebalance the link load once or if you want to rebalance the link loads at controlled times instead of automatically.

You can also request a load rebalancing *dry run*. A dry run simulates rebalancing and lists the sessions that might be affected if you choose to perform an actual load-rebalancing operation. The link loads are not rebalanced when you request a dry run.

NP_Port Interface FIP Session Limit Effect on Load Balancing

The maximum number of FIP login sessions configured for each NP_Port interface affects load balancing. When an interface reaches its maximum number of FIP login sessions, that interface is removed from the list of interfaces used for load balancing. The other interfaces in the gateway fabric continue to accept ENode login sessions until they reach their configured maximum session limit. Only interfaces that have not reached their maximum session limit are included in the load-balancing calculations.



NOTE: If all NP_Port interfaces in a gateway fabric reach their FIP login session limits, the fabric sends subsequent multicast discovery advertisements (MDAs) with the availability bit set to 0 (zero) to prevent additional ENode login attempts. While the maximum number of sessions is running on the gateway fabric, ENodes cannot use that fabric to log in to the FC switch. When the number of sessions falls below the maximum, the gateway sets the availability bit in MDAs to 1 so that ENodes can log in to the fabric again.

Load-Balancing Triggers and Timing

Several events trigger load balancing. Some of the events trigger load balancing only when automated load balancing is enabled. Other events trigger load rebalancing whether or not automated rebalancing is enabled.

This section describes the load-balancing triggers, what happens when the trigger action occurs, and how the switch determines if and when to balance the link load:

- [Load-Balancing Triggers on page 273](#)
- [Load-Balancing Timer on page 274](#)

Load-Balancing Triggers

[Table 14 on page 274](#) describes the four different events can trigger load balancing or load rebalancing. In every case, link load rebalancing uses the configured load-balancing algorithm to determine the placement of sessions on links.

Table 14: Load-Balancing Triggers and Actions

Trigger Event	Action
New link comes up	<p>Triggers a load-rebalancing operation regardless of whether or not automated load rebalancing is enabled. (The new link has no sessions, so the sessions on other links must be redistributed to balance the load.)</p> <p>The link load is not rebalanced if there are no sessions on the existing links or if there are so few sessions on the existing links that they cannot be redistributed.</p>
On-demand load rebalancing request issued from CLI	<p>The switch checks the NP_Port link load. If the load is not balanced across the links, the switch rebalances the link load. If the load is already balanced, nothing happens.</p> <p>NOTE: Requesting a dry run displays sessions that might be disrupted if you rebalance the link load, but does not rebalance the link load.</p>
Automated load balancing configured for the first time	<p>The switch checks the NP_Port link load. If the load is not balanced across the links, the switch rebalances the link load. If the load is already balanced, nothing happens.</p>
NP_Port speed change	<p>If automated rebalancing is enabled, changing the port speed brings the port up and down (flaps the port) and causes the switch to rebalance the link loads. If the port speed change does not change the actual port speed (for example, changing the port speed from <i>auto</i> to 8 Gbps), the link loads are not rebalanced.</p> <p>If automated rebalancing is not enabled, port speed changes do not cause link load rebalancing.</p>



NOTE: When an NP_Port link goes down, it does not trigger load rebalancing. The loads on the remaining active links are already balanced, and as the sessions logged out from the down link log in again, they are they assigned to links in a balanced manner determined by the configured load-balancing algorithm.

Load-Balancing Timer

When you trigger load balancing from the CLI, the load-balancing action occurs immediately after you execute the command. However, when a load-balancing trigger occurs that is not a CLI command, the switch does not balance the link loads immediately. Instead, the switch follows an intelligent timer process:

1. The switch checks the current load balance on the NP_Port links in the local gateway FC fabric. If the load is already balanced, the switch does nothing, and there is no session disruption.

2. If the check shows that the link load is not balanced, the switch starts a 10-second timer. If no other load-balancing triggers occur during the 10-second interval, the switch rebalances the load.

If another load-balancing trigger occurs during the 10-second interval, the timer resets to 10 seconds. The 10-second timer prevents the switch from performing multiple disruptive load-rebalancing actions in a short period of time.



NOTE: The switch processes new sessions that log in after the timer starts in the normal manner. The new sessions are considered in the load-balancing evaluation and operation.

3. At a maximum of 30 seconds after the first load-balancing trigger occurs, the switch checks the link load balance again. If the links are already balanced, the switch cancels the load-rebalancing operation. If the links are not balanced, the switch rebalances the link loads.



NOTE: If the trigger event that started the load-rebalancing timer is no longer valid when the timer elapses, the switch cancels the rebalancing operation. For example, if a new NP_Port link comes up and triggers the timer, then goes down before the timer expires, the original link up event is no longer valid, and the switch cancels the rebalancing operation (unless another valid rebalancing trigger occurs in that time frame).

When a link load rebalancing operation is in progress, the switch defers any load-rebalancing triggers that occur until the load-rebalancing operation is complete. The new rebalancing operation begins after the current rebalancing operation finishes if a check shows that rebalancing is required.

If you explicitly request load rebalancing from the CLI using the **request fibre-channel proxy load-rebalance** operational command, the switch rejects the command and displays an error message stating that rebalancing is already in progress.

Load Rebalancing Behavior When a Link Goes Down

If an NP_Port link goes down, the ENode and VN_Port sessions on that link are logged out. The ENodes and VN_Port sessions log in again and are assigned to NP_Port links based on the link load and the load-balancing algorithm. If a link goes down, the switch does not rebalance the remaining load on the remaining links to avoid disrupting the existing ENode and VN_Port sessions. (Also, it is not necessary to rebalance the links in that manner because after a link goes down, the sessions on the remaining links are already balanced. As the logged out sessions log back in, the switch places them on the remaining active links in a balanced manner, according to the configured load-balancing algorithm.)



NOTE: When you use the simple load-balancing algorithm, an ENode and its associated VN_Port sessions might be on different links. In that case, if the NP_Port with the ENode goes down, only the VN_Ports on the same link are logged out. VN_Ports on other links remain up and running.

Interface Load Calculation Algorithm

A weighted round-robin (WRR) algorithm determines the interface load based on:

- The current number of sessions on the interface



NOTE: The configured load-balancing algorithm determines how the switch counts the number of sessions. For simple and ENode-based load balancing, the number of sessions is the sum of the FLOGI and FDISC sessions on each link. For FLOGI-based load balancing, the number of sessions is the sum of the FLOGI sessions on each link.

- The interface weight, which is the speed of the Fibre Channel link (2 Gbps, 4 Gbps, or 8 Gbps)

The interface load algorithm is:

$(\text{number-of-sessions} * \text{max-weight}) / \text{weight}$

where *max-weight* is an internal constant.

If the load on the FC interfaces is equal, the session is assigned to the interface with the highest link speed (the greatest weight).

For example, if the three FC interfaces have the characteristics shown in [Table 15 on page 276](#), the loads of the interfaces are not equal:

Table 15: FC Interface Session-Based Load-Balancing Characteristics for Unequal Loads

Interface	Number of Sessions	Weight (Speed)
fc-0/0/0	4	4 Gbps
fc-0/0/1	1	2 Gbps
fc-0/0/2	8	8 Gbps

In this example, interfaces fc-0/0/0 and fc-0/0/2 have a greater load than fc-0/0/1. For simple load balancing, the gateway assigns the next new FLOGI or FDISC to fc-0/0/1 because it is the least-loaded interface. For both ENode-based and FLOGI-based load balancing, the gateway assigns the next new FLOGI to fc-0/0/1 because it is the least-loaded interface. Then all VN_Port FDISCs from that ENode follow the ENode FLOGI and are also assigned to fc-0/0/1 regardless of the link load.

For another example, if the three FC interfaces have the characteristics shown in [Table 16 on page 277](#), the loads of the interfaces are equal:

Table 16: FC Interface Session-Based Load-Balancing Characteristics for Equal Loads

Interface	Number of Sessions	Weight (Speed)
fc-0/0/0	4	4 Gbps
fc-0/0/1	2	2 Gbps
fc-0/0/2	8	8 Gbps

In this case, all interfaces have the same relative load. For simple load balancing, the gateway assigns the next new FLOGI or FDISC to fc-0/0/2 because although the loads of the three interfaces are equal, fc-0/0/2 has the greatest weight. For both ENode-based and FLOGI-based load balancing, the gateway assigns the next new FLOGI to fc-0/0/2, and all VN_Port FDISCs from that ENode follow the ENode FLOGI and are also assigned to fc-0/0/2 regardless of the link load.

After the gateway establishes a session between an ENode or a VN_Port and an FC switch on an NP_Port, the session remains on that NP_Port until the ENode or VN_Port performs a LOGO.

If the physical FC interface link goes down, the FLOGI and FDISC sessions on the down link are logged out. The ENodes and VN_Ports log in again to start new sessions on other NP_Ports in the local gateway FC fabric in accordance with the configured load-balancing algorithm (assuming there is more than one NP_Port connected to the FC fabric).

Load-Balancing Scenarios

The configured load-balancing algorithm, the sequence in which ENodes log in to the FC network, the current session count (number of sessions per interface) and the interface speed determine the way the session load is balanced across the native FC interfaces (NP_Ports) in a gateway FC fabric. Whether you are balancing the link load for the first time or rebalancing an existing link load, the way the load is distributed across the active links is the same.



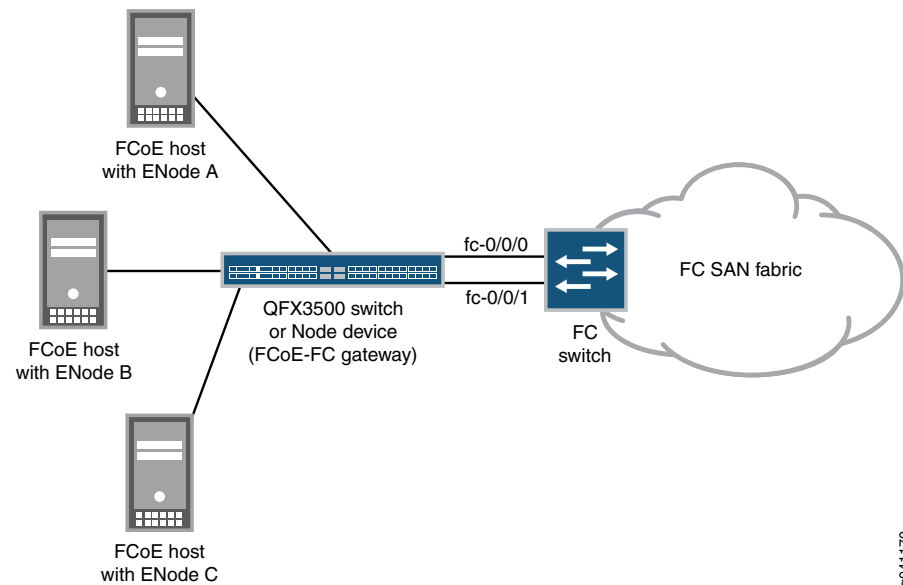
NOTE: The way the switch counts the number of sessions on a port depends on the load-balancing algorithm. For simple and ENode-based load balancing, the sum of the FLOGI and FDISC sessions equals the session count. For FLOGI-based load balancing, only the FLOGI sessions are counted in the total session count.

The following scenarios demonstrate how sessions are assigned to links for each load-balancing algorithm:

- [Simple Load-Balancing Algorithm Scenario on page 278](#)
- [ENode-Based Load-Balancing Algorithm Scenarios on page 279](#)
- [FLOGI-Based Load-Balancing Algorithm Scenarios on page 281](#)

All of the scenarios use the topology shown in [Figure 15 on page 278](#).

Figure 15: Sample Load-Balancing Topology



Simple Load-Balancing Algorithm Scenario

Simple load balancing results in the most equal load distribution among the NP_Ports connected to an FC SAN fabric because VN_Port FDISC sessions do not need to “follow” the parent ENode FLOGI session on the same link between the gateway and the FC fabric. When a new FLOGI or FDISC session is initiated, it is assigned to the least-loaded link.

The simple load-balancing algorithm example uses the topology shown in [Figure 15 on page 278](#) and has the following characteristics:

- QFX3500 switch configured as an FCoE-FC gateway
- Two gateway NP_Ports, **fc-0/0/0** and **fc-0/0/1**, connected to an FC SAN fabric switch at a speed of 8 Gbps
- Three ENodes, ENode_A, ENode_B, and ENode_C connected to the gateway
- NP_Ports **fc-0/0/0** and **fc-0/0/1**, and ENode_A, ENode_B, and ENode_C, belong to the same local FC fabric on the gateway

When the NP_Ports initialize, they send FLOGI messages to the FC switch and log in to the FC SAN fabric. The gateway then advertises the fabric to the ENodes on the Ethernet side of the network. At this point, the load on both of the NP_Ports is equal. Now the ENodes and VN_Ports start to log in to the fabric:

1. ENode_A sends a FLOGI to log in to the fabric. Because the loads on the two NP_Ports are equal, the session for ENode_A is randomly placed on one of the links. In this example, the ENode_A FLOGI session is placed on port **fc-0/0/0**.
2. ENode_B logs in. Because the load is less on port **fc-0/0/1**, the ENode_B FLOGI session is placed on port **fc-0/0/1**.
3. ENode_C logs in. Because the link loads are equal, the ENode_C login session is randomly placed on one of the links. In this example, the ENode_C login session is placed on port **fc-0/0/0**.
4. A VN_Port on ENode_A sends an FDISC to log in to the fabric. Because port **fc-0/0/1** currently is the least-loaded link, the VN_Port session is placed on port **fc-0/0/1**, even though its parent ENode session is on port **fc-0/0/0**.
5. As each new VN_Port session comes up, it is placed on the least-loaded link, regardless of the link on which its parent ENode session is placed.

ENode-Based Load-Balancing Algorithm Scenarios

ENode-based load balancing ensures that VN_Port FDISC sessions are placed on the same link as their parent ENode FLOGI sessions, regardless of the link load. ENode-based load balancing can result in a less-balanced load among the NP_Port links, but it provides the control and predictability of keeping ENodes and their VN_Port sessions on the same link.

The examples in this section use the topology shown in [Figure 15 on page 278](#).

- QFX3500 switch configured as an FCoE-FC gateway
- Two gateway NP_Ports, **fc-0/0/0** and **fc-0/0/1**, connected to an FC SAN fabric switch at a speed of 8 Gbps
- Three ENodes connected to the gateway:
 - ENode_A, which has 2 VN_Port FDISC sessions
 - ENode_B, which has 20 VN_Port FDISC sessions
 - ENode_C, which has 100 VN_Port FDISC sessions
- NP_Ports **fc-0/0/0** and **fc-0/0/1**, and ENode_A, ENode_B, and ENode_C, belong to the same local FC fabric on the gateway

When the NP_Ports initialize, they send FLOGI messages to the FC switch and log in to the FC SAN fabric. The gateway then advertises the fabric to the ENodes on the Ethernet

side of the network. At this point, the load on both of the NP_Ports is equal. Now the ENodes and VN_Ports start to log in to the fabric. As the following two scenarios show, how these sessions are placed on the links depends on the sequence in which they log in to the fabric.

Scenario 1:

1. ENode_A sends a FLOGI to log in to the fabric. Because the loads on the two NP_Ports are equal, the session for ENode_A is randomly placed on one of the links. In this example, the ENode_A FLOGI session is placed on port **fc-0/0/0**.
2. ENode_B logs in. Because the load is less on port **fc-0/0/1**, the ENode_B FLOGI session is placed on port **fc-0/0/1**.
3. The two VN_Ports on ENode_A log in to the fabric. Their sessions are placed on port **fc-0/0/0**, following ENode_A on the link. Now port **fc-0/0/0** has a greater load (one FLOGI session plus two FDISC sessions) than port **fc-0/0/1** (one FLOGI session).
4. The 20 VN_Ports on ENode_B log in to the fabric. Their sessions are placed on port **fc-0/0/1**, following ENode_B on the link. Now port **fc-0/0/0** has a lesser load (one FLOGI, two FDISC) than port **fc-0/0/1**.
5. ENode_C logs in. Because the load is less on port **fc-0/0/0**, the ENode_C FLOGI session is placed on port **fc-0/0/0**.
6. The 100 VN_Ports on ENode_C log in to the fabric. Their sessions follow the ENode_C session onto port **fc-0/0/0**.
7. If more VN_Ports come up, their FDISC sessions are placed on the same link as the corresponding parent ENode session.

Scenario 2:

1. ENode_A sends a FLOGI to log in to the fabric. Because the loads on the two NP_Ports are equal, the session for ENode_A is randomly placed on one of the links. In this example, the ENode_A FLOGI session is placed on port **fc-0/0/0**.
2. ENode_B logs in. Because the load is less on port **fc-0/0/1**, the ENode_B FLOGI session is placed on port **fc-0/0/1**.
3. The two VN_Ports on ENode_A log in to the fabric. Their sessions are placed on port **fc-0/0/0**, following ENode_A on the link. Now port **fc-0/0/0** has a greater load (one FLOGI session plus two FDISC sessions) than port **fc-0/0/1** (one FLOGI session).
4. In this step, the login sequence in Scenario 2 differs from the login sequence in Scenario 1, resulting in a different placement of sessions on the links, and therefore a

different load on the links. ENode_C logs in before the ENode_B VN_Ports log in, which changes the session count on the links compared to the first scenario. Because the load in this scenario is less on port **fc-0/0/1**, the ENode_C FLOGI session is placed on port **fc-0/0/1** (instead of port **fc-0/0/0** as in the first scenario).

5. The 20 VN_Ports on ENode_B log in to the fabric. Their sessions are placed on port **fc-0/0/1**, following ENode_B on the link. Now port **fc-0/0/0** carries one FLOGI and two FDISC sessions, and port **fc-0/0/1** carries two FLOGI and 20 FDISC sessions.
6. The 100 VN_Ports on ENode_C log in to the fabric. Their sessions follow the ENode_C session onto port **fc-0/0/1**. Now port **fc-0/0/1** carries 2 FLOGI and 120 FDISC sessions, whereas port **fc-0/0/0** carries one FLOGI and two FDISC sessions.
7. If more VN_Ports come up, their FDISC sessions are placed on the same link as the corresponding parent ENode session.

Because of the sequence of ENode logins in Scenario 2, port **fc-0/0/1** carries a greater load than port **fc-0/0/0**. If the simple load-balancing algorithm had been used, the FLOGI and FDISC sessions would be allocated to the two links evenly. However, because the FDISC sessions are placed on the same link as their parent FLOGI sessions, this example demonstrates how using the ENode-based load-balancing algorithm can lead to scenarios in which the link loads are not equal.

FLOGI-Based Load-Balancing Algorithm Scenarios

FLOGI-based load balancing is similar in many ways to ENode-based load balancing. An important difference that affects how the switch places sessions on links is that for FLOGI-based load balancing, only the FLOGI sessions are counted when the link load is calculated. FDISC sessions are not counted to determine the link load. Because ENode-based load balancing uses the sum of the FLOGI and FDISC sessions to determine the link load, an interface with exactly the same combination of FLOGI and FDISC sessions can have a different session count depending on the algorithm used. A different session count can change the interface to which the switch assigns the next session.

As with ENode-based load balancing, FLOGI-based load balancing ensures that VN_Port FDISC sessions are placed on the same link as their parent ENode FLOGI sessions, regardless of the link load. FLOGI-based load balancing can result in a less-balanced load among the NP_Port links, but it provides the control and predictability of keeping ENodes and their VN_Port sessions on the same link.

The examples in this section use the topology shown in [Figure 15 on page 278](#).

- QFX3500 switch configured as an FCoE-FC gateway
- Two gateway NP_Ports, **fc-0/0/0** and **fc-0/0/1**, connected to an FC SAN fabric switch at a speed of 8 Gbps
- Three ENodes connected to the gateway:
 - ENode_A, which has 2 VN_Port FDISC sessions

- ENode_B, which has 20 VN_Port FDISC sessions
- ENode_C, which has 100 VN_Port FDISC sessions
- NP_Ports **fc-0/0/0** and **fc-0/0/1**, and ENode_A, ENode_B, and ENode_C, belong to the same local FC fabric on the gateway

When the NP_Ports initialize, they send FLOGI messages to the FC switch and log in to the FC SAN fabric. The gateway then advertises the fabric to the ENodes on the Ethernet side of the network. At this point, the load on both of the NP_Ports is equal. Now the ENodes and VN_Ports start to log in to the fabric.

Because FLOGI-based load balancing does not count FDISC sessions when calculating the link load, how the sessions are placed on the link depends only on the number of FLOGI sessions per interface, not on the number of FLOGI sessions plus FDISC sessions. This means that an ENode with a FLOGI session and many FDISC sessions is counted as having the same load as an ENode with a FLOGI session and no FDISC sessions.

Scenario 1:

1. ENode_A sends a FLOGI to log in to the fabric. Because the loads on the two NP_Ports are equal, the session for ENode_A is randomly placed on one of the links. In this example, the ENode_A FLOGI session is placed on port **fc-0/0/0**.
2. ENode_B logs in. Because the load is less on port **fc-0/0/1**, the ENode_B FLOGI session is placed on port **fc-0/0/1**.
3. The two VN_Ports on ENode_A log in to the fabric. Their sessions are placed on port **fc-0/0/0**, following ENode_A on the link. However, unlike simple load balancing or ENode-based load balancing, the session count of the two ports is still equal (one session each) because the FDISC sessions are not used in the session count.
4. The 20 VN_Ports on ENode_B log in to the fabric. Their sessions are placed on port **fc-0/0/1**, following ENode_B on the link. Again, unlike simple load balancing or ENode-based load balancing, the session count of the two ports is still equal (one session each) because the FDISC sessions are not used in the session count.
5. ENode_C logs in. Because the link loads are counted as equal, the ENode_C login session is randomly placed on one of the links. In this example, the ENode_C login session is placed on port **fc-0/0/0**.
6. The 100 VN_Ports on ENode_C log in to the fabric. Their sessions follow the ENode_C session onto port **fc-0/0/0**.
7. If more VN_Ports come up, their FDISC sessions are placed on the same link as the corresponding parent ENode session.

If a fourth ENode, ENode_D, sends a FLOGI to log in to the fabric, it is placed on port **fc-0/0/1** because port **fc-0/0/0** has a session count of two (two FLOGIs from ENode_A and ENode_C, FDISCs not counted) and port **fc-0/0/1** has a session count of one (one FLOGI from ENode_B, FDISCs not counted), so port **fc-0/0/1** is the least-loaded port.

With FLOGI-based load balancing, it is possible for ENodes with many FDISC sessions to be placed on the same link, whereas ENodes with few FDISC sessions are placed on different links because only FLOGIs are used in the session count.

Related Documentation

- [Understanding an FCoE-FC Gateway on page 190](#)
- [Understanding FCoE-FC Gateway Functions on page 196](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)
- [Defining the Proxy Load-Balancing Algorithm on page 283](#)
- [Simulating On-Demand Fibre Channel Link Load Rebalancing \(Dry Run Test\) on page 285](#)
- [Example: Configuring Automated Fibre Channel Interface Load Rebalancing on page 285](#)
- [show fibre-channel proxy fabric-state on page 544](#)
- [request fibre-channel proxy load-rebalance on page 487](#)
- [Monitoring Fibre Channel Interface Load Balancing on page 474](#)

Defining the Proxy Load-Balancing Algorithm

When the QFX Series is configured as an FCoE-FC gateway, it balances the FCoE session load assigned to each NP_Port link between the gateway and the FC switch in the FC SAN to avoid overloading or underutilizing each link. The QFX Series supports three types of load-balancing mechanisms:

- **Simple load balancing**—Load balancing is based on the weighted utilization (session load) of the NP_Ports connected to an FC fabric. The session load is the sum of the FLOGI and FDISC sessions on each link. Each new ENode fabric login (FLOGI) or VN_Port fabric discovery (FDISC) session is assigned to the least-loaded link, so an FDISC session initiated by the VN_Port on an ENode might not be assigned to the same link as the parent ENode's FLOGI session. Simple load balancing is the default algorithm. Simple load balancing is the default load-balancing algorithm. Rebalancing the link load disrupts only selected sessions to minimize the impact (the switch uses an algorithm to log out only the sessions that need to be moved to other links to balance the load when those sessions log in again).
- **ENode-based load balancing**—Load balancing is based on the weighted utilization (session load) of the NP_Ports connected to an FC fabric. The session load is the sum of the FLOGI and FDISC sessions on each link. However, when an ENode logs in to the fabric, the switch places all subsequent VN_Port FDISC sessions associated with that ENode on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link. The switch calculates the link load

based on the combined total of FLOGIs and FDISCs on each NP_Port link. Rebalancing the link load disrupts all sessions (all sessions log out and then log in again).

- FLOGI-based load balancing—Load balancing is based on the weighted utilization (session load) of the NP_Ports connected to an FC fabric. The session load is the sum of the FLOGI sessions on each link. FDISC sessions are not counted. When an ENode logs in to the fabric, the switch places all subsequent VN_Port FDISC sessions associated with that ENode on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link. Rebalancing the link load disrupts only selected sessions to minimize the impact (the switch uses an algorithm to log out only the sessions that need to be moved to other links to balance the load when those sessions log in again).

To define the proxy load-balancing algorithm for a proxy fabric on the FCoE-FC gateway, set the algorithm as **enode-based**, **simple**, or **flogi-based**:

- `[edit fc-fabrics fabric-name proxy]`
`user@switch# set load-balance-algorithm (enode-based | simple | flogi-based)`

For example, to configure a gateway fabric named **san_fab1** to use **enode-based** load balancing:

```
user@switch# set fc-fabrics san_fab1 proxy load-balance-algorithm enode-based
```

Related Documentation

- [Example: Configuring Automated Fibre Channel Interface Load Rebalancing on page 285](#)
- [Simulating On-Demand Fibre Channel Link Load Rebalancing \(Dry Run Test\) on page 285](#)
- [Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267](#)
- [Monitoring Fibre Channel Interface Load Balancing on page 474](#)

Simulating On-Demand Fibre Channel Link Load Rebalancing (Dry Run Test)

On-demand Fibre Channel (FC) link load rebalancing on an FCoE-FC gateway is a disruptive action that causes sessions to log out of the network, then log back in to be placed on FC links (NP_Ports) in a balanced manner. The number of sessions logged out to rebalance the links depends on the load-balancing algorithm used (simple, ENode-based, or FLOGI-based) and whether or not the load is already balanced. (If the link load is already balanced, the switch does not rebalance the loads when you request on-demand load rebalancing.)

You can use the **dry-run** option to list the sessions that might be affected (logged out to be redistributed among the active FC interface links) by on-demand load rebalancing *before* you actually rebalance the link load. (Because new sessions might log in between the time you perform a dry run and the time you request on-demand load rebalancing, the affected sessions may change. Therefore, the sooner that you perform an on-demand load rebalance after you perform a dry run, the more accurate the dry run results are likely to be.)

To request a link load rebalancing dry run:

```
user@switch> request fibre-channel proxy load-rebalance dry-run fabric fabric-name
```

For example, to request a dry run on an FC fabric named *fc_fabric_100* to display a list of sessions that might be disrupted if you request an actual link load rebalance:

```
user@switch> request fibre-channel proxy load-rebalance dry-run fabric fc_fabric_100
```

```
Fabric: fc_fabric_100, Fabric-id: 100
F-Port      FCID      Port-WWN      NP-Port
vlan.100    0x8a013a  02:01:00:64:00:00:00:2a  fc-0/0/1.0
vlan.100    0x8a013c  02:01:00:64:00:00:00:2b  fc-0/0/1.0
vlan.100    0x8a0146  02:01:00:64:00:00:00:2e  fc-0/0/1.0
vlan.100    0x8a014c  02:01:00:64:00:00:00:2f  fc-0/0/1.0
```

Related Documentation

- [request fibre-channel proxy load-rebalance on page 487](#)
- [Defining the Proxy Load-Balancing Algorithm on page 283](#)
- [Example: Configuring Automated Fibre Channel Interface Load Rebalancing on page 285](#)
- [Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267](#)
- [Monitoring Fibre Channel Interface Load Balancing on page 474](#)

Example: Configuring Automated Fibre Channel Interface Load Rebalancing

Automated Fibre Channel (FC) interface (NP_Port) load rebalancing configures the switch to rebalance the session loads on the native FC interfaces automatically on a load-rebalancing trigger event. (Alternatively, you can rebalance the link load on the FC interfaces on demand so that you control when the link load is rebalanced.) Rebalancing

the FC link load is a disruptive action that causes some or all of the current sessions to log out, then log in again to be placed on the active FC links in a balanced manner.

This example shows you how to configure and verify automated FC link load rebalancing on an FCoE-FC gateway local FC fabric.

- [Requirements on page 286](#)
- [Overview on page 286](#)
- [Configuration on page 287](#)
- [Verification on page 288](#)

Requirements

This example uses the following hardware and software components:

- Juniper Networks QFX3500 Switch
- Junos OS Release 12.3 or later for the QFX Series

Overview

When a load rebalancing trigger occurs, the switch automatically rebalances the link loads by redistributing the sessions across the active NP_Port links.

There are three possible load-rebalancing triggers:

1. When you enable automated load rebalancing, the switch checks the load balance on the existing NP_Port links. If the links are already balanced, the switch does not rebalance the link load. If the links are not balanced, the switch rebalances the link loads using the configured load-balancing algorithm.
2. When a new NP_Port link comes up on a local FCoE-FC gateway fabric, the switch rebalances the link load using the configured load-balancing algorithm if automated load balancing is enabled.
3. When the port speed is changed (unless the port speed change does not change the actual port speed, for example, changing the port speed from auto to 8 Gbps).

Automated load rebalancing logs out sessions in accordance with the configured load-balancing algorithm. Disabling automated load rebalancing is not disruptive because the link load is already balanced.

Use automated load rebalancing if you want link loads to be rebalanced automatically instead of at times of your choosing. Keep in mind that load rebalancing is a disruptive event (sessions are logged out).

Topology

This example configures automated load rebalancing on a local FC fabric on an FCoE-FC gateway. This example does not show you how to configure the load-balancing algorithm or any other load-balancing characteristics. The load-balancing configuration for this example is:

- FC fabric name—fc_fabric_100
- FC fabric ID—100
- FC fabric type—Proxy
- FC fabric interfaces—fc-0/0/0, fc-0/0/1, fc-0/0/42, fc-0/0/43, vlan.100, vlan.20
- Load-balancing algorithm—Simple
- No fabric WWN verify—Configured
- Traceoptions—Configured to log in file fc_fabric_100_proxy.log

Configuration

To configure automated load balancing on a local FC fabric, perform this task:

- [\[xref target has no title\]](#)
- [Results on page 287](#)

CLI Quick Configuration

To quickly configure automated load balancing, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level:

```
[edit]
set fc-fabrics fc_fabric_100 proxy auto-load-rebalance
```

Step-by-Step Procedure

- Configure automated load balancing on FC fabric fc_fabric_100:

```
user@switch# set fc-fabrics fc_fabric_100 proxy auto-load-rebalance
```

Results

Display the results of the configuration:

```
user@switch> show configuration fc-fabrics
fc_fabric_100 {
  fabric-id 100;
  fabric-type proxy;
  interface {
    fc-0/0/0.0;
    fc-0/0/1.0;
    vlan.100;
    vlan.20;
    fc-0/0/42.0;
    fc-0/0/43.0;
  }
  proxy {
    traceoptions {
      file fc_fabric_100_proxy.log size 20m;
      flag all;
    }
  }
}
```

```
load-balance-algorithm simple;  
auto-load-rebalance;  
no-fabric-wnn-verify;  
}  
}
```

Verification

Verifying That Automated Load Rebalancing Is Enabled

Purpose Verify that automated load rebalancing is configured on local FC fabric **fc_fabric_100**.

Action Verify the results of the automated load-rebalancing configuration using the operational mode command **show fibre-channel proxy fabric-state fabric fc_fabric_100**:

```
user@switch> show fibre-channel proxy fabric-state fabric fc_fabric_100  
  
Fabric: fc_fabric_100, Fabric-id: 100  
Proxy load balance algorithm: Simple, Fabric WNN verification: No  
Auto load rebalance enabled : Yes  
Last rebalance start-time   : Never  
Last rebalance end-time     : Never  
Last rebalance trigger      : None  
Last rebalance trigger-time  : Mon Sep 10 21:42:30 2012 usec: 814602  
Last rebalance trigger-result: None
```

Meaning The **show fibre-channel proxy fabric-state fabric fc_fabric_100** operational command displays information about the specified local FC fabric. The output shows that the **Auto load rebalance enabled** field value is **Yes**, which indicates that automated load rebalancing is enabled on fabric **fc_fabric_100**.

Related Documentation

- [Defining the Proxy Load-Balancing Algorithm on page 283](#)
- [Simulating On-Demand Fibre Channel Link Load Rebalancing \(Dry Run Test\) on page 285](#)
- [Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267](#)
- [Monitoring Fibre Channel Interface Load Balancing on page 474](#)

PART 3

Data Center Bridging (DCBX, PFC)

- [Using Data Center Bridging \(DCBX, PFC\) on page 291](#)

CHAPTER 4

Using Data Center Bridging (DCBX, PFC)

- [Understanding DCB Features and Requirements on page 292](#)
- [Understanding DCBX on page 295](#)
- [Configuring the DCBX Mode on page 304](#)
- [Configuring DCBX Autonegotiation on page 305](#)
- [Disabling the ETS Recommendation TLV on page 308](#)
- [Understanding DCBX Application Protocol TLV Exchange on page 309](#)
- [Defining an Application for DCBX Application Protocol TLV Exchange on page 313](#)
- [Configuring an Application Map for DCBX Application Protocol TLV Exchange on page 314](#)
- [Applying an Application Map to an Interface for DCBX Application Protocol TLV Exchange on page 315](#)
- [Example: Configuring DCBX Application Protocol TLV Exchange on page 316](#)
- [Understanding CoS Flow Control \(Ethernet PAUSE and PFC\) on page 327](#)
- [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)

Understanding DCB Features and Requirements

Data center bridging (DCB) is a set of enhancements to the IEEE 802.1 bridge specifications. DCB modifies and extends Ethernet behavior to support I/O convergence in the data center. I/O convergence includes but is not limited to the transport of Ethernet LAN traffic and Fibre Channel (FC) storage area network (SAN) traffic on the same physical Ethernet network infrastructure.



Video: [What is Data Center Bridging?](#)

A converged architecture saves cost by reducing the number of networks and switches required to support both types of traffic, reducing the number of interfaces required, reducing cable complexity, and reducing administration activities.

The Juniper Networks QFX Series and EX4600 switches support the DCB features required to transport converged Ethernet and FC traffic while providing the class-of-service (CoS) and other characteristics FC requires for transmitting storage traffic. To accommodate FC traffic, DCB specifications provide:

- A flow control mechanism called priority-based flow control (PFC, described in IEEE 802.1Qbb) to help provide lossless transport.
- A discovery and exchange protocol for conveying configuration and capabilities among neighbors to ensure consistent configuration across the network, called Data Center Bridging Capability Exchange protocol (DCBX), which is an extension of Link Layer Data Protocol (LLDP, described in IEEE 802.1AB).
- A bandwidth management mechanism called enhanced transmission selection (ETS, described in IEEE 802.1Qaz).
- A congestion management mechanism called quantized congestion notification (QCN, described in IEEE 802.1Qau).

The switch supports the PFC, DCBX, and ETS standards but does not support QCN. The switch also provides the high-bandwidth interfaces (10-Gbps minimum) required to support DCB and converged traffic.

This topic describes the DCB standards and requirements the switch supports:

- [Lossless Transport on page 292](#)
- [ETS on page 293](#)
- [DCBX on page 294](#)

Lossless Transport

FC traffic requires lossless transport (defined as no frames dropped because of congestion). Standard Ethernet does not support lossless transport, but the DCB extensions to Ethernet along with proper buffer management enable an Ethernet network

to provide the level of class of service (CoS) necessary to transport FC frames encapsulated in Ethernet over an Ethernet network.

This section describes these factors in creating lossless transport over Ethernet:

- [PFC on page 293](#)
- [Buffer Management on page 293](#)
- [Physical Interfaces on page 293](#)

PFC

PFC is a link-level flow control mechanism similar to Ethernet PAUSE (described in IEEE 802.3x). Ethernet PAUSE stops all traffic on a link for a period of time. PFC enables you to divide traffic on a link into eight priorities and stop the traffic of a selected priority without stopping the traffic assigned to other priorities on the link.

Pausing the traffic of a selected priority enables you to provide lossless transport for traffic assigned that priority and at the same time use standard lossy Ethernet transport for the rest of the link traffic.

Buffer Management

Buffer management is critical to the proper functioning of PFC, because if buffers are allowed to overflow, frames are dropped and transport is not lossless.

For each lossless flow priority, the switch requires sufficient buffer space to:

- Store frames sent during the time it takes to send the PFC pause frame across the cable between devices.
- Store the frames that are already on the wire when the sender receives the PFC pause frame.

The propagation delay due to cable length and speed, as well as processing speed, determines the amount of buffer space needed to prevent frame loss due to congestion.

The switch automatically sets the threshold for sending PFC pause frames to accommodate delay from cables as long as 150 meters (492 feet) and to accommodate large frames that might be on the wire when the switch sends the pause frame. This ensures that the switch sends pause frames early enough to allow the sender to stop transmitting before the receive buffers on the switch overflow.

Physical Interfaces

QFX Series switches support 10-Gbps or faster, full-duplex interfaces. The switch enables DCB capability only on 10-Gbps or faster Ethernet interfaces.

ETS

PFC divides traffic into up to eight separate streams (priorities, configured on the switch as forwarding classes) on a physical link. ETS enables you to manage the link bandwidth by:

- Grouping the priorities into priority groups (configured on the switch as forwarding class sets).
- Specifying the bandwidth available to each of the priority groups as a percentage of the total available link bandwidth.
- Allocating the bandwidth to the individual priorities in the priority group.

The available link bandwidth is the bandwidth remaining after servicing strict-high priority queues. On QFX5200, QFX5100, EX4600, QFX3500, and QFX3600 switches, and on QFabric systems, we recommend that you always configure a shaping rate to limit the amount of bandwidth a strict-high priority queue can consume by including the **shaping-rate** statement in the **[edit class-of-service schedulers]** hierarchy on the strict-high priority scheduler. This prevents a strict-high priority queue from starving other queues on the port. (On QFX10000 switches, configure a transmit rate on strict-high priority queues to set a maximum amount of bandwidth for strict-high priority traffic.)

Managing link bandwidth with ETS provides several advantages:

- There is uniform management of all types of traffic on the link, both congestion-managed traffic and standard Ethernet traffic.
- When a priority group does not use all of its allocated bandwidth, other priority groups on the link can use that bandwidth as needed.

When a priority in a priority group does not use all of its allocated bandwidth, other priorities in the group can use that bandwidth.

The result is better bandwidth utilization, because priorities that consist of bursty traffic can share bandwidth during periods of low traffic transmission instead of consuming their entire bandwidth allocation when traffic loads are light.

- You can assign traffic types with different service needs to different priorities so that each traffic type receives appropriate treatment.
- Strict priority traffic retains its allocated bandwidth.

DCBX

DCB devices use DCBX to exchange configuration information with directly connected peers (switches and endpoints such as servers). DCBX is an extension of LLDP. If you disable LLDP on an interface, that interface cannot run DCBX. If you attempt to enable DCBX on an interface on which LLDP is disabled, the configuration commit fails.

DCBX can:

- Discover the DCB capabilities of peers.
- Detect DCB feature misconfiguration or mismatches between peers.
- Configure DCB features on peers.

You can configure DCBX operation for PFC, ETS, and for Layer 2 and Layer 4 applications such as FCoE and iSCSI. DCBX is enabled or disabled on a per-interface basis.

- Related Documentation**
- [Understanding FCoE on page 51](#)
 - [Understanding CoS Hierarchical Port Scheduling \(ETS\)](#)
 - [Understanding CoS Flow Control \(Ethernet PAUSE and PFC\) on page 327](#)
 - [Understanding DCBX on page 295](#)
 - [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)

Understanding DCBX

Data Center Bridging Capability Exchange protocol (DCBX) is an extension of Link Layer Data Protocol (LLDP). If you disable LLDP on an interface, that interface cannot run DCBX. If you attempt to enable DCBX on an interface on which LLDP is disabled, the configuration commit operation fails. Data center bridging (DCB) devices use DCBX to exchange configuration information with directly connected peers.



Video: [What is DCBX Protocol?](#)

This topic describes:

- [DCBX Basics on page 295](#)
- [DCBX Modes and Support on page 296](#)
- [DCBX Attribute Types on page 299](#)
- [DCBX Application Protocol TLV Exchange on page 300](#)
- [DCBX and PFC on page 301](#)
- [DCBX and ETS on page 302](#)

DCBX Basics

DCBX can:

- Discover the DCB capabilities of peers.
- Detect DCB feature misconfiguration or mismatches between peers.
- Configure DCB features on peers.

You can configure DCBX operation for priority-based flow control (PFC), Layer 2 and Layer 4 applications such as FCoE and iSCSI, and ETS. DCBX is enabled or disabled on a per-interface basis.



NOTE: QFX5200 and QFX5210 switches do not support enhanced transmission selection (ETS) hierarchical scheduling. Use port scheduling to manage bandwidth on these switches.

By default, for PFC and ETS, DCBX automatically negotiates administrative state and configuration with each interface's connected peer. To enable DCBX negotiation for applications, you must configure the applications, map them to IEEE 802.1p code points in an application map, and apply the application map to interfaces.

The FCoE application only needs to be included in an application map when you want an interface to exchange type, length, and values (TLVs) for other applications in addition to FCoE. If FCoE is the only application you want an interface to advertise, then you do not need to use an application map. For ETS, DCBX pushes the switch configuration to peers if they are set to learn the configuration from the switch (unless you disable sending the ETS recommendation TLV on interfaces in IEEE DCBX mode).

You can override the default behavior for PFC, for ETS, or for all applications mapped to an interface by turning off autonegotiation to force an interface to enable or disable that feature. You can also disable DCBX autonegotiation for applications on an interface by excluding those applications from the application map you apply to that interface or by deleting the application map from the interface.

The default autonegotiation behavior for applications that are mapped to an interface is:

- DCBX is enabled on the interface if the connected peer device also supports DCBX.
- DCBX is disabled on the interface if the connected peer device does not support DCBX.

During negotiation of capabilities, the switch can push the PFC configuration to an attached peer if the peer is configured as “willing” to learn the PFC configuration from other peers. The Juniper Networks switch does not support self autoprovisioning and does not change its configuration during autonegotiation to match the peer configuration. (The Juniper switch is not “willing” to learn the PFC configuration from peers.)



NOTE: When a port with DCBX enabled begins to exchange type, length, and value (TLV) entries, optional LLDP TLVs on that port are not advertised to neighbors, so that the switch can interoperate with a wider variety of converged network adapters (CNAs) and Layer 2 switches that support DCBX.

DCBX Modes and Support

This section describes DCBX support:

- [DCBX Modes \(Versions\) on page 296](#)
- [Autonegotiation on page 298](#)
- [CNA Support for DCBX Modes on page 299](#)
- [Interface Support for DCBX on page 299](#)

DCBX Modes (Versions)

The two most common DCBX modes are supported:

- IEEE DCBX—The newest DCBX version. Different TLVs have different subtypes (for example, the subtype for the ETS configuration TLV is 9); the IEEE DCBX Organizationally Unique Identifier (OUI) is 0x0080c2.
- DCBX version 1.01—The Converged Enhanced Ethernet (CEE) version of DCBX. It has a subtype of 2 and an OUI of 0x001b21.

IEEE DCBX and DCBX version 1.01 differ mainly in frame format. DCBX version 1.01 uses one TLV that includes all DCBX attribute information, which is sent as sub-TLVs. IEEE DCBX uses a unique TLV for each DCB attribute.



NOTE: The switch does not support pre-CEE (pre-DCB) DCBX versions. Unsupported older versions of DCBX have a subtype of 1 and an OUI of 0x001b21. The switch drops LLDP frames that contain pre-CEE DCBX TLVs.

Table 17 on page 297 summarizes the differences between IEEE DCBX and DCBX version 1.01, including show command output:

Table 17: Summary of Differences Between IEEE DCBX and DCBX Version 1.01

Characteristic	IEEE DCBX	DCBX Version 1.01
OUI	0x0080c2	0x001b21
Frame Format	Sends a separate, unique TLV for each DCBX attribute. For example, IEEE DCBX uses separate TLVs for ETS, PFC, and each application. Configuration and Recommendation information is sent in different TLVs	Sends one TLV that includes all DCBX attribute information organized in sub-TLVs. The “willing” bit determines whether or not an interface can change its configuration to match the connected peer.
Symmetric/asymmetric configuration with peer	Asymmetric or symmetric	Symmetric only
Differences in the show dcbx interface interface-name operational command	<ul style="list-style-type: none"> • Synchronization information is not shown because symmetric configuration is not required. • Operational state information is not shown because the operational states do not have to be symmetric. • TLV type is shown because unique TLVs are sent for each DCBX attribute. • ETS peer Configuration TLV and Recommendation TLV information is shown separately because they are different TLVs. 	<ul style="list-style-type: none"> • Synchronization information is shown because symmetric configuration is required. • Operational state information is shown because the operational states do have to be symmetric. • TLV type is not shown because one TLV is used for all attribute information. • Recommendation TLV is not sent (DCBX Version 1.01 uses the “willing” bit to determine whether or not an interface uses the peer interface configuration).

You can configure interfaces to use the following DCBX modes:

- IEEE DCBX—The interface uses IEEE DCBX regardless of the configuration on the connected peer.
- DCBX version 1.01—The interface uses DCBX version 1.01 regardless of the configuration on the connected peer.
- Autonegotiation—The interface automatically negotiates with the connected peer to determine the DCBX version the peers use. Autonegotiation is the default DCBX mode.

If you configure a DCBX mode on an interface, the interface ignores DCBX protocol data units (PDUs) it receives from the connected peer if the PDUs do not match the DCBX version configured on the interface. For example, if you configure an interface to use IEEE DCBX and the connected peer sends DCBX version 1.01 LLDP PDUs, the interface ignores the version 1.01 PDUs. If you configure an interface to use DCBX version 1.01 and the peer sends IEEE DCBX LLDP PDUs, the interface ignores the IEEE DCBX PDUs.



NOTE: On interfaces that use the IEEE DCBX mode, the `show dcbx neighbors interface interface-name` operational command does not include application, PFC, or ETS operational state in the output.

Autonegotiation

Autonegotiation is the default DCBX mode. Each interface automatically negotiates with its connected peer to determine the DCBX version that both interfaces use to exchange DCBX information.

When an interface connects to its peer interface, the interface advertises IEEE DCBX TLVs to the peer. If the interface receives one IEEE DCBX PDU from the peer, the interface sets the DCBX mode as IEEE DCBX. If the interface receives three DCBX version 1.01 TLVs from the peer, the interface sets DCBX version 1.01 as the DCBX mode.

Autonegotiation works slightly differently on standalone switches compared to QFabric systems:

- Standalone switches—When an interface connects to its peer interface, the interface advertises IEEE DCBX TLVs to the peer. If the interface receives an IEEE DCBX TLV from the peer, the interface sets IEEE DCBX as the DCBX mode. If the interface receives three consecutive DCBX version 1.01 TLVs from the peer, the interface sets DCBX version 1.01 as the DCBX mode.
- QFabric system—When an interface connects to its peer interface, the interface advertises DCBX version 1.01 TLVs to the peer. If the interface receives an IEEE DCBX TLVs from the peer, the interface sets IEEE DCBX as the DCBX mode. If the interface receives three consecutive DCBX version 1.01 TLVs from the peer, the interface retains DCBX version 1.01 as the DCBX mode.



NOTE: If the link flaps or the LLDP process restarts, the interface starts the autonegotiation process again. The interface does not use the last received DCBX communication mode.

CNA Support for DCBX Modes

Different CNA vendors support different versions and capabilities of DCBX. The DCBX configuration you use on switch interfaces depends on the DCBX features that the CNAs in your network support.

Interface Support for DCBX

You can configure DCBX on 10-Gigabit Ethernet interfaces and on link aggregation group (LAG) interfaces whose member interfaces are all 10-Gigabit Ethernet interfaces.

DCBX Attribute Types

DCBX has three attribute types:

- **Informational**—These attributes are exchanged using LLDP, but do not affect DCBX state or operation; they only communicate information to the peer. For example, application priority TLVs are informational TLVs.
- **Asymmetric**—The values for these types of attributes do not have to be the same on the connected peer interfaces. Peers exchange asymmetric attributes when the attribute values can differ on each peer interface. The peer interface configurations might match or they might differ. For example, ETS Configuration and Recommendation TLVs are asymmetric TLVs.
- **Symmetric**—The intention is that the values for these types of attributes should be the same on both of the connected peer interfaces. Peer interfaces exchange symmetric attributes to ensure symmetric DCBX configuration for those attributes. For example, PFC Configuration TLVs are symmetric TLVs.

The following sections describe asymmetric and symmetric DCBX attributes:

- [Asymmetric Attributes on page 299](#)
- [Symmetric Attributes on page 300](#)

Asymmetric Attributes

DCBX passes asymmetric attributes between connected peer interfaces to communicate parameter information about those attributes (features). The resulting configuration for an attribute might be different on each peer, so the parameters configured on one interface might not match the parameters on the connected peer interface.

There are two types of asymmetric attribute TLVs:

- **Configuration TLV**—Configuration TLVs communicate the current operational state and the state of the “willing” bit. The “willing” bit communicates whether or not the interface is willing to accept and use the configuration from the peer interface. If an interface is “willing,” the interface uses the configuration it receives from the peer

interface. (The peer interface configuration can override the configuration on the “willing” interface.) If an interface is “not willing”, the configuration on the interface cannot be overridden by the peer interface configuration.

- **Recommendation TLV**—Recommendation TLVs communicate the parameters the interface recommends that the connected peer interface should use. When an interface sends a Recommendation TLV, if the connected peer is “willing,” the connected peer changes its configuration to match the parameters in the Recommendation TLV.

Symmetric Attributes

DCBX passes symmetric attributes between connected peer interfaces to communicate parameter information about those attributes (features), with the objective that both interfaces should use the same configuration. The intent is that the parameters configured on one interface should match the parameters on the connected peer interface.

There is one type of symmetric attribute TLV, the Configuration TLV. As with asymmetric attributes, symmetric attribute Configuration TLVs communicate the current operational state and the state of the “willing” bit. “Willing” interfaces use the peer interface parameter values for the attribute. (The attribute configuration of the peer overrides the configuration on the “willing” interface.)

DCBX Application Protocol TLV Exchange

DCBX advertises the switch’s capabilities for Layer 2 applications such as FCoE and Layer 4 applications such as iSCSI:

- [Application Protocol TLV Exchange on page 300](#)
- [FCoE Application Protocol TLV Exchange on page 300](#)
- [Disabling Application Protocol TLV Exchange on page 301](#)

Application Protocol TLV Exchange

For all applications, DCBX advertises the application’s state and IEEE 802.1p code points on the interfaces to which the application is mapped. If an application is not mapped to an interface, that interface does not advertise the application’s TLVs. There is an exception for FCoE application protocol TLV exchange when FCoE is the only application you want DCBX to advertise on an interface.

FCoE Application Protocol TLV Exchange

Protocol TLV exchange for the FCoE application depends on whether FCoE is the only application you want the interface to advertise or whether you want the interface to exchange other application TLVs in addition to FCoE TLVs.

If FCoE is the only application you want DCBX to advertise on an interface, DCBX exchanges FCoE application protocol TLVs by default if the interface:

- Carries FCoE traffic (traffic mapped by CoS configuration to the FCoE forwarding class)
- Has a congestion notification profile with PFC enabled on the FCoE priority (IEEE 802.1p code point)

- Does *not* have an application map



NOTE: If no CoS configuration for FCoE is mapped to an interface, that interface does not exchange FCoE application protocol TLVs.

If you want DCBX to advertise FCoE and other applications on an interface, you must specify all of the applications, including FCoE, in an application map, and apply the application map to the desired interfaces.



NOTE: If an application map is applied to an interface, the FCoE application must be explicitly configured in the application map, or the interface does not exchange FCoE TLVs.

When DCBX advertises the FCoE application, it advertises the FCoE state and IEEE 802.1p code points. If a peer device connected to a switch interface does not support FCoE, DCBX uses autonegotiation to mark the interface as “FCoE down,” and FCoE is disabled on that interface.

Disabling Application Protocol TLV Exchange

To disable DCBX application protocol exchange for all applications on an interface, issue the **set protocols dcbx interface *interface-name* applications no-auto-negotiation** command.

You can also disable DCBX application protocol exchange for applications on an interface by deleting the application map from the interface, or by deleting a particular application from the application map. However, when you delete an application from an application map, the application protocol is no longer exchanged on any interface which uses that application map.

DCBX and PFC

After you enable PFC on a switch interface, DCBX uses autonegotiation to control the operational state of the PFC functionality.

If the peer device connected to the interface supports PFC and is provisioned compatibly with the switch, DCBX sets the PFC operational state to enabled. If the peer device connected to the interface does not support PFC or is not provisioned compatibly with the switch, DCBX sets the operational state to disabled. (PFC must be symmetrical.)

If the peer advertises that it is “willing” to learn its PFC configuration from the switch, DCBX pushes the switch’s PFC configuration to the peer and does not check the peer’s administrative state.

You can manually override DCBX control of the PFC operational state on a per-interface basis by disabling autonegotiation. If you disable autonegotiation on an interface on which you have configured PFC, then PFC is enabled on that interface regardless of the peer configuration. To disable PFC on an interface, do not configure PFC on that interface.

DCBX and ETS

This section describes:

- [Default DCBX ETS Advertisement on page 302](#)
- [ETS Advertisement and Peer Configuration on page 302](#)
- [ETS Recommendation TLV on page 303](#)

Default DCBX ETS Advertisement

If you do not configure ETS on an interface, the switch automatically creates a default priority group that contains all of the priorities (forwarding classes, which represent output queues) and assigns 100 percent of the port output bandwidth to that priority group. The default priority group is transparent. It does not appear in the configuration and is used for DCBX advertisement. DCBX advertises the default priority group, its priorities, and the assigned bandwidth.

If you configure ETS on an interface, DCBX advertises:

- Each priority group on the interface
- The priorities in each priority group
- The bandwidth properties of each priority group and priority

Any priority on that interface that is not part of an explicitly configured priority group (forwarding class set) is assigned to the automatically generated default priority group and receives no bandwidth. If you configure ETS on an interface, every forwarding class (priority) on that interface for which you want to forward traffic must belong to a forwarding class set (priority group).

ETS Advertisement and Peer Configuration

DCBX does not control the switch's ETS (hierarchical scheduling) operational state. If the connected peer is configured as "willing," DCBX pushes the switch's ETS configuration to the switch's peers if the ETS Recommendation TLV is enabled (it is enabled by default). If the peer does not support ETS or is not consistently provisioned with the switch, DCBX does not change the ETS operational state on the switch. The ETS operational state remains enabled or disabled based only on the switch hierarchical scheduling configuration and is enabled by default.

When ETS is configured, DCBX advertises the priority groups, the priorities in the priority groups, and the bandwidth configuration for the priority groups and priorities. Any priority (essentially a forwarding class or queue) that is not part of a priority group has no scheduling properties and receives no bandwidth.

You can manually override whether DCBX advertises the ETS state to the peer on a per-interface basis by disabling autonegotiation. This does not affect the ETS state on the switch or on the peer, but it does prevent the switch from sending the Recommendation TLV or the Configuration TLV to the connected peer. To disable ETS on an interface, do not configure priority groups (forwarding class sets) on the interface.

ETS Recommendation TLV

The ETS Recommendation TLV communicates the ETS settings that the switch wants the connected peer interface to use. If the peer interface is “willing,” it changes its configuration to match the configuration in the ETS Recommendation TLV. By default, the switch interfaces send the ETS Recommendation TLV to the peer. The settings communicated are the egress ETS settings defined by configuring hierarchical scheduling on the interface.

We recommend that you use the same ETS settings on the connected peer that you use on the switch interface and that you leave the ETS Recommendation TLV enabled. However, on interfaces that use IEEE DCBX as the DCBX mode, if you want an asymmetric configuration between the switch interface and the connected peer, you can disable the ETS Recommendation TLV by including the **no-recommendation-tlv** statement at the **[edit protocols dcbx interface *interface-name* enhanced-transmission-selection]** hierarchy level.



NOTE: You can disable the ETS Recommendation TLV only when the DCBX mode on the interface is IEEE DCBX. Disabling the ETS Recommendation TLV has no effect if the DCBX mode on the interface is DCBX version 1.01. (IEEE DCBX uses separate application attribute TLVs, but DCBX version 1.01 sends all application attributes in the same TLV and uses sub-TLVs to separate the information.)

If you disable the ETS Recommendation TLV, the switch still sends the ETS Configuration TLV to the connected peer. The result is that the connected peer is informed about the switch DCBX ETS configuration, but even if the peer is “willing,” the peer does not change its configuration to match the switch configuration. This is asymmetric configuration—the two interfaces can have different parameter values for the ETS attribute.

For example, if you want a CNA connected to a switch interface to have different bandwidth allocations than the switch ETS configuration, you can disable the ETS Recommendation TLV and configure the CNA for the desired bandwidth. The switch interface and the CNA exchange configuration parameters, but the CNA does not change its configuration to match the switch interface configuration.

Related Documentation

- [Understanding DCBX Application Protocol TLV Exchange on page 309](#)
- [Understanding DCB Features and Requirements on page 292](#)
- [Understanding CoS Flow Control \(Ethernet PAUSE and PFC\) on page 327](#)
- [Understanding CoS Hierarchical Port Scheduling \(ETS\)](#)
- [Understanding CoS Port Schedulers on QFX Switches](#)
- [Understanding FCoE on page 51](#)
- [Configuring the DCBX Mode on page 304](#)
- [Configuring DCBX Autonegotiation on page 305](#)

- [Disabling the ETS Recommendation TLV on page 308](#)
- [Example: Configuring DCBX Application Protocol TLV Exchange on page 316](#)

Configuring the DCBX Mode

You can configure the DCBX mode that an interface uses to communicate with the connected peer. Three DCBX modes are supported:

- **Autonegotiation**—The interface negotiates with the connected peer to determine the DCBX mode. This is the default DCBX mode.
- **IEEE DCBX**—The interface uses IEEE DCBX type, length, and value (TLV) to exchange DCBX information with the connected peer. QFX3500 Node devices come up with IEEE DCBX enabled by default and then autonegotiate with the connected peer to determine the final DCBX mode.
- **DCBX Version 1.01**—The interface uses Converged Enhanced Ethernet (CEE) DCBX version 1.01 TLVs to exchange DCBX information with the connected peer. QFabric system Node devices other than QFX3500 switches come up with DCBX version 1.01 enabled by default and then autonegotiate with the connected peer to determine the final DCBX mode.



NOTE: Pre-CEE (pre-DCB) versions of DCBX such as DCBX version 1.00 are not supported. If an interface receives an LLDP frame with pre-CEE DCBX TLVs, the system drops the frame.

Configure the DCBX mode by specifying the mode for one interface or for all interfaces.

- To configure the DCBX mode, specify the interface and the mode:

```
[edit protocols dcbx]
user@switch# set interface interface-name dcbx-version (auto-negotiate | ieee-dcbx |
dcbx-version-1.01)
```

For example, to configure DCBX version 1.01 on interface **xe-0/0/21**:

```
user@switch# set protocols dcbx interface xe-0/0/21 dcbx-version dcbx-version-1.01
```

To configure IEEE DCBX on all interfaces:

```
user@switch# set protocols dcbx interface all dcbx-version ieee-dcbx
```

Related Documentation

- [Configuring DCBX Autonegotiation on page 305](#)
- [Disabling the ETS Recommendation TLV on page 308](#)
- [Understanding DCBX on page 295](#)
- [Understanding DCBX Application Protocol TLV Exchange on page 309](#)

- [show dcbx neighbors on page 404](#)

Configuring DCBX Autonegotiation

Data Center Bridging Capability Exchange protocol (DCBX) discovers the data center bridging (DCB) capabilities of peers by exchanging feature configuration information. DCBX also detects feature misconfiguration and mismatches, and can configure DCB on peers. DCBX is an extension of the Link Layer Discovery Protocol (LLDP), and LLDP must remain enabled on every interface for which you want to use DCBX. If you attempt to enable DCBX on an interface on which LLDP is disabled, the configuration commit operation fails.



NOTE: LLDP and DCBX are enabled by default on all interfaces.

The switch supports DCBX autonegotiation for:

- Priority-based flow control (PFC) configuration
- Layer 2 and Layer 4 applications such as Fibre Channel over Ethernet (FCoE) and Internet Small Computer System Interface (iSCSI)
- Enhanced transmission selection (ETS) advertisement

DCBX autonegotiation is configured on a per-interface basis for each supported feature or application. The PFC and application DCBX exchanges use autonegotiation by default. The default autonegotiation behavior is:

- DCBX is enabled on the interface if the connected peer device also supports DCBX.
- DCBX is disabled on the interface if the connected peer device does not support DCBX.

You can override the default behavior for each feature by turning off autonegotiation to force an interface to enable or disable the feature.

Autonegotiation of ETS means that when ETS is enabled on an interface (priority groups are configured), the interface advertises its ETS configuration to the peer device. In this case, priorities (forwarding classes) that are not part of a priority group (forwarding class set) receive no bandwidth and are advertised in an automatically generated default forwarding class. If ETS is not enabled on an interface (no priority groups are configured), all of the priorities are advertised in one automatically generated default priority group that receives 100 percent of the port bandwidth.

Disabling ETS autonegotiation prevents the interface from sending the Recommendation TLV or the Configuration TLV to the connected peer.

On interfaces that use IEEE DCBX mode to exchange DCBX parameters, you can disable autonegotiation of the ETS Recommendation TLV to the peer if you want an asymmetric ETS configuration between the peers. DCBX still exchanges the ETS Configuration TLV if you disable the ETS Recommendation TLV.

Autonegotiation of PFC means that when PFC is enabled on an interface, if the peer device connected to the interface supports PFC and is provisioned compatibly with the switch, DCBX sets the PFC operational state to enabled. If the peer device connected to the interface does not support PFC or is not provisioned compatibly with the switch, DCBX sets the operational state to disabled.

In addition, if the peer advertises that it is “willing” to learn its PFC configuration from the switch, DCBX pushes the switch’s PFC configuration to the peer and does not check the peer’s administrative state. The switch does not learn PFC configuration from peers (the switch does not advertise its state as “willing”).

Disabling PFC autonegotiation prevents the interface from exchanging PFC configuration information with the peer. It forces the interface to enable PFC if PFC is configured on the interface or to disable PFC if PFC is not configured on the interface. If you disable PFC autonegotiation, the assumption is that the peer is also configured manually.

Autonegotiation of applications depends on whether or not you apply an application map to an interface. If you apply an application map to an interface, the interface autonegotiates DCBX for each application in the application map. PFC must be enabled on the FCoE priority (the FCoE IEEE 802.1p code point) for the interface to advertise the FCoE application. The interface only advertises applications that are included in the application map.

For example, if you apply an application map to an interface and the application map does not include the FCoE application, then that interface does not perform DCBX advertisement of FCoE.

If you do not apply an application map to an interface, DCBX does not advertise applications on that interface, with the exception of FCoE, which is handled differently than other applications.



NOTE: If you do not apply an application map to an interface, the interface performs autonegotiation of FCoE if the interface carries traffic in the FCoE forwarding class and also has PFC enabled on the FCoE priority. On such interfaces, if DCBX detects that the peer device connected to the interface supports FCoE, the switch advertises its FCoE capability and IEEE 802.1p code point on that interface. If DCBX detects that the peer device connected to the interface does not support FCoE, DCBX marks that interface as “FCoE down” and disables FCoE on the interface.

When DCBX marks an interface as “FCoE down,” the behavior of the switch depends on how you use it in the network:

- When the switch acts as an FCoE transit switch, the interface drops all of the FIP packets it receives. In addition, FIP packets received from an FCoE forwarder (FCF) are not forwarded to interfaces marked as “FCoE down.”
- When the switch acts as an FCoE-FC gateway (only switches that support native Fibre Channel interfaces), it does not send or receive FCoE Initialization Protocol (FIP) packets.

Disabling autonegotiation prevents the interface from exchanging application information with the peer. In this case, the assumption is that the peer is also configured manually.

To disable DCBX autonegotiation of PFC, applications (including FCoE), and ETS using the CLI:

1. Turn off autonegotiation for PFC.

```
[edit]
user@switch# set protocols dcbx interface interface-name priority-flow-control
no-auto-negotiation
```

2. Turn off autonegotiation for applications.

```
[edit]
user@switch# set protocols dcbx interface interface-name applications no-auto-negotiation
```

3. Turn off autonegotiation for ETS.

```
[edit]
user@switch# set protocols dcbx interface interface-name enhanced-transmission-selection
no-auto-negotiation
```

To disable autonegotiation of the ETS Recommendation TLV so that DCBX exchanges only the ETS Configuration TLV:

```
[edit protocols dcbx interface interface-name]
user@switch# set enhanced-transmission-selection no-recommendation-tlv
```

Related Documentation

- [Example: Configuring DCBX Application Protocol TLV Exchange on page 316](#)
- [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)
- [Disabling the ETS Recommendation TLV on page 308](#)
- [Understanding DCBX Application Protocol TLV Exchange on page 309](#)

Disabling the ETS Recommendation TLV

The enhanced transmission selection (ETS) Recommendation TLV communicates the ETS settings that the switch wants the connected peer interface to use. If the peer interface is “willing,” the peer interface changes its configuration to match the configuration in the ETS Recommendation TLV. By default, the switch interfaces send the ETS Recommendation TLV to the peer. The settings communicated are the egress ETS settings defined by configuring hierarchical scheduling on the interface.

We recommend that you use the same ETS settings on the connected peer that you use on the switch interface and that you leave the ETS Recommendation TLV enabled. However, on interfaces that use IEEE DCBX as the DCBX mode, if you want an asymmetric configuration between the switch interface and the connected peer, you can disable the ETS Recommendation TLV.



NOTE: Disabling the ETS Recommendation TLV on interfaces that use DCBX version 1.01 as the DCBX mode has no effect and does not change DCBX behavior.

If you disable the ETS Recommendation TLV, the switch still sends the ETS Configuration TLV to the connected peer. The result is that the connected peer is informed about the switch DCBX ETS configuration, but even if the peer is “willing,” the peer does not change its configuration to match the switch configuration. This is asymmetric configuration—the two interfaces can have different parameter values for the ETS attribute.

To disable the ETS Recommendation TLV:

- [edit protocols dcbx interface *interface-name*]
user@switch# **set enhanced-transmission-selection no-recommendation-tlv**

Related Documentation

- [Configuring the DCBX Mode on page 304](#)
- [Configuring DCBX Autonegotiation on page 305](#)
- [Understanding DCBX on page 295](#)
- [Understanding Data Center Bridging Capability Exchange Protocol for EX Series Switches](#)

Understanding DCBX Application Protocol TLV Exchange

Data Center Bridging Capability Exchange protocol (DCBX) discovers the data center bridging (DCB) capabilities of connected peers. DCBX also advertises the capabilities of applications on interfaces by exchanging application protocol information through application type, length, and value (TLV) elements. DCBX is an extension of Link Layer Discovery Protocol (LLDP). LLDP must remain enabled on every interface on which you want to use DCBX.



NOTE: LLDP and DCBX are enabled by default on all interfaces.

Setting up application protocol exchange consists of:

- Defining applications
- Mapping the applications to IEEE 802.1p code points in an *application map*
- Configuring classifiers to prioritize incoming traffic and map the incoming traffic to the application by the traffic code points
- Applying the application maps and classifiers to interfaces

You need to explicitly define the applications that you want an interface to advertise. The FCoE application is a special case (see [“Applications” on page 309](#)) and only needs to be defined on an interface if you want DCBX to exchange application protocol TLVs for other applications in addition to FCoE on that interface.

You also need to explicitly map all of the defined applications that you want an interface to advertise to IEEE 802.1p code points in an application map. The FCoE application is a special case that only requires inclusion in an application map when you want an interface to use DCBX for other applications in addition to FCoE, as described later in this topic (see [“Application Maps” on page 310](#)).

This topic describes:

- [Applications on page 309](#)
- [Application Maps on page 310](#)
- [Classifying and Prioritizing Application Traffic on page 311](#)
- [Enabling Interfaces to Exchange Application Protocol Information on page 312](#)
- [Disabling DCBX Application Protocol Exchange on page 312](#)

Applications

Before an interface can exchange application protocol information, you need to define the applications that you want to advertise. The exception is the FCoE application. If FCoE is the only application that you want the interface to advertise, then you do not need to define the FCoE application. You need to define the FCoE application only if you want interfaces to advertise other applications in addition to FCoE.



NOTE: If FCoE is the only application that you want DCBX to advertise on an interface, DCBX exchanges FCoE application protocol TLVs by default if the interface:

- Carries FCoE traffic (traffic mapped by CoS configuration to the FCoE forwarding class and applied to the interface)
- Has a congestion notification profile with PFC enabled on the FCoE priority (IEEE 802.1p code point)
- Does *not* have an application map

If you apply an application map to an interface, then all applications that you want DCBX to advertise must be defined and configured in the application map, including the FCoE application.

If no CoS configuration for FCoE is mapped to an interface, that interface does not exchange FCoE application protocol TLVs.

You can define:

- Layer 2 applications by EtherType
- Layer 4 applications by a combination of protocol (TCP or UDP) and destination port number

The EtherType is a two-octet field in the Ethernet frame that denotes the protocol encapsulated in the frame. For a list of common EtherTypes, see <http://standards.ieee.org/develop/regauth/ethertype/eth.txt> on the IEEE standards organization website. For a list of port numbers and protocols, see the *Service Name and Transport Protocol Port Number Registry* at <http://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xml> on the Internet Assigned Numbers Authority (IANA) website.

You must explicitly define each application that you want to advertise, except FCoE. The FCoE application is defined by default (EtherType 0x8906).

Application Maps

An application map maps defined applications to one or more IEEE 802.1p code points. Each application map contains one or more applications. DCBX includes the configured application code points in the protocol TLVs exchanged with the connected peer.

To exchange protocol TLVs for an application, you must include the application in an application map. The FCoE application is a special case:

- If you want DCBX to exchange application protocol TLVs for more than one application on a particular interface, you must configure the applications, define an application map to map the applications to code points, and apply the application map to the interface. In this case, you must also define the FCoE application and add it to the application map.

This is the same process and treatment required for all other applications. In addition, for DCBX to exchange FCoE application TLVs, you must enable priority-based flow control (PFC) on the FCoE priority (the FCoE IEEE 802.1p code point) on the interface.

- If FCoE is the only application that you want DCBX to advertise on an interface, then you do not need to configure an application map and apply it to the interface. By default, when an interface has no application map, and the interface carries traffic mapped to the FCoE forwarding class, and PFC is enabled on the FCoE priority, the interface advertises FCoE TLVs (autonegotiation mode). DCBX exchanges FCoE application protocol TLVs by default until you apply an application map to the interface, remove the FCoE traffic from the interface (you can do this by removing the or editing the classifier for FCoE traffic), or disable PFC on the FCoE priority.

If you apply an application map to an interface that did not have an application map and was exchanging FCoE application TLVs, and you do not include the FCoE application in the application map, the interface stops exchanging FCoE TLVs. Every interface that has an application map must have FCoE included in the application map (and PFC enabled on the FCoE priority) in order for DCBX to exchange FCoE TLVs.

Mapping an application to code points does two things:

- Maps incoming traffic with the same code points to that application
- Allows you to configure classifiers that map incoming application traffic, by code point, to a forwarding class and a loss priority, in order to apply class of service (CoS) to application traffic and prioritize application traffic

You apply an application map to an interface to enable DCBX application protocol exchange on that interface for each application specified in the application map. All of the applications that you want an interface to advertise must be configured in the application map that you apply to the interface, with the previously noted exception for the FCoE application when FCoE is the only application for which you want DCBX to exchange protocol TLVs on an interface.

Classifying and Prioritizing Application Traffic

When traffic arrives at an interface, the interface classifies the incoming traffic based on its code points. Classifiers map code points to loss priorities and forwarding classes. The loss priority prioritizes the traffic. The forwarding class determines the traffic output queue and CoS service level.

When you map an application to an IEEE 802.1p code point in an application map and apply the application map to an interface, incoming traffic on the interface that matches the application code points is mapped to the appropriate application. The application receives the loss priority and the CoS associated with the forwarding class for those code points, and is placed in the output queue associated with the forwarding class.

You can use the default classifier or you can configure a classifier to map the application code points defined in the application map to forwarding classes and loss priorities.

Enabling Interfaces to Exchange Application Protocol Information

Each interface with the **fcoe** forwarding class and PFC enabled on the FCoE code point is enabled for FCoE application protocol exchange by default until you apply an application map to the interface. If you apply an application map to an interface and you want that interface to exchange FCoE application protocol TLVs, you must include the FCoE application in the application map. (In all cases, to achieve lossless transport, you must also enable PFC on the FCoE code point or code points.)

Except when FCoE is the only protocol you want DCBX to advertise on an interface, interfaces on which you want to exchange application protocol TLVs must include the following two items:

- The application map that contains the application(s)
- A classifier



NOTE: You must also enable PFC on the code point of any traffic for which you want to achieve lossless transport.

Disabling DCBX Application Protocol Exchange

To disable DCBX application protocol exchange for all applications on an interface, issue the **set protocols dcbx interface *interface-name* applications no-auto-negotiation** command.

You can also disable DCBX application protocol exchange for applications on an interface by deleting the application map from the interface, or by deleting a particular application from the application map. However, when you delete an application from an application map, the application protocol is no longer exchanged on any interface which uses that application map.

On interfaces that use IEEE DCBX mode to exchange DCBX parameters, you can disable sending the enhanced transmission selection (ETS) Recommendation TLV to the peer if you want an asymmetric ETS configuration between the peers.

Related Documentation

- [Understanding DCBX on page 295](#)
- [Configuring DCBX Autonegotiation on page 305](#)
- [Disabling the ETS Recommendation TLV on page 308](#)
- [Defining an Application for DCBX Application Protocol TLV Exchange on page 313](#)
- [Configuring an Application Map for DCBX Application Protocol TLV Exchange on page 314](#)
- [Applying an Application Map to an Interface for DCBX Application Protocol TLV Exchange on page 315](#)
- [Example: Configuring DCBX Application Protocol TLV Exchange on page 316](#)

Defining an Application for DCBX Application Protocol TLV Exchange

Define each application for which you want DCBX to exchange application protocol information. You can define Layer 2 and Layer 4 applications. After you define applications, you map them to IEEE 802.1p code points, and then apply the application map to the interfaces on which you want DCBX to exchange application protocol information with connected peers. (See *Related Documentation* for how to configure application maps and apply them to interfaces, and for an example of the entire procedure that also includes classifier configuration.)



NOTE: In Junos OS Release 12.1, the FCoE application was configured by default, so you did not need to configure it in an application map. In Junos OS Release 12.2, if you want DCBX to advertise the FCoE application on an interface and you apply an application map to that interface, you must explicitly configure FCoE in the application map. You also must enable priority-based flow control (PFC) on the FCoE code point on all interfaces that you want to advertise FCoE. If you apply an application map to an interface, the interface sends DCBX TLVs only for the applications configured in the application map.

Define Layer 2 applications by mapping an application name to an EtherType. Define Layer 4 applications by mapping an application name to a protocol (TCP or UDP) and a destination port.

- To define a Layer 2 application, specify the name of the application and its EtherType:

```
[edit applications]
user@switch# set application application-name ether-type ether-type
```

For example, to configure an application named **PTP** (for Precision Time Protocol) that uses the EtherType **0x88F7**:

```
user@switch# set applications application ptp ether-type 0x88F7
```

- To define a Layer 4 application, specify the name of the application, its protocol (TCP or UDP), and its destination port:

```
[edit]
user@switch# set applications application application-name protocol (tcp | udp)
destination-port port-value
```

For example, to configure an application named **iscsi** (for Internet Small Computer System Interface) that uses the protocol **TCP** and the destination port **3260**:

```
user@switch# set applications application iscsi protocol tcp destination-port 3260
```

**Related
Documentation**

- [Configuring an Application Map for DCBX Application Protocol TLV Exchange on page 314](#)

- [Applying an Application Map to an Interface for DCBX Application Protocol TLV Exchange on page 315](#)
- [Configuring DCBX Autonegotiation on page 305](#)
- [Example: Configuring DCBX Application Protocol TLV Exchange on page 316](#)
- [Example: Configuring DCBX to Support an iSCSI Application](#)
- [Understanding DCBX Application Protocol TLV Exchange on page 309](#)
- [show dcbx neighbors on page 404](#)

Configuring an Application Map for DCBX Application Protocol TLV Exchange

After you define applications for which you want to exchange DCBX application protocol information, map the applications to IEEE 802.1p code points. The IEEE 802.1p code points identify incoming traffic and allow you to map that traffic to the desired application. You then apply the application map to the interfaces on which you want DCBX to exchange application protocol information with connected peers. (See *Related Documentation* for how to define applications and apply the application map to interfaces, and for an example of the entire procedure that also includes classifier configuration.)



NOTE: In Junos OS Release 12.1, the FCoE application was configured by default, so you did not need to configure it in an application map. In Junos OS Release 12.2, if you want DCBX to advertise the FCoE application on an interface and you apply an application map to that interface, you must explicitly configure FCoE in the application map. You also must enable priority-based flow control (PFC) on the FCoE code point on all interfaces that you want to advertise FCoE. If you apply an application map to an interface, the interface sends DCBX TLVs only for the applications configured in the application map.

Configure an application map by creating an application map name and mapping an application to one or more IEEE 802.1p code points.

- To define an application map, specify the name of the application map, the name of the application, and the IEEE 802.1p code points of the incoming traffic that you want to associate with the application in the application map:

```
[edit policy-options]
user@switch# set application-maps application-map-name application application-name
code-points [ aliases ] [ bit-patterns ]
```

For example, to configure an application map named **ptp-app-map** that includes an application named **PTP** (for Precision Time Protocol) and map the application to IEEE 802.1p code points **001** and **101**:

```
user@switch# set policy-options application-maps ptp-app-map application ptp code points
[ 001 101 ]
```

Related Documentation

- [Defining an Application for DCBX Application Protocol TLV Exchange on page 313](#)
- [Applying an Application Map to an Interface for DCBX Application Protocol TLV Exchange on page 315](#)
- [Configuring DCBX Autonegotiation on page 305](#)
- [Example: Configuring DCBX Application Protocol TLV Exchange on page 316](#)
- [Example: Configuring DCBX to Support an iSCSI Application](#)
- [show dcbx neighbors on page 404](#)

Applying an Application Map to an Interface for DCBX Application Protocol TLV Exchange

After you define applications and map them to IEEE 802.1p code points in an application map, apply the application map to the interfaces on which you want DCBX to exchange the application protocol information with connected peers. (See *Related Documentation* for how to define applications and configure application maps to interfaces, and for an example of the entire procedure that also includes classifier configuration.)



NOTE: In Junos OS Release 12.1, the FCoE application was configured by default, so you did not need to configure it in an application map. In Junos OS Release 12.2, if you want DCBX to advertise the FCoE application on an interface and you apply an application map to that interface, you must explicitly configure FCoE in the application map. You also must enable priority-based flow control (PFC) on the FCoE code point on all interfaces that you want to advertise FCoE. If you apply an application map to an interface, the interface sends DCBX TLVs only for the applications configured in the application map.

- To apply an application map to a DCBX interface, specify the DCBX interface and the application map name:

```
[edit protocols]
user@switch# set dcbx interface interface-name application-map application-map-name
```

For example, to apply an application map named **ptp-app-map** on interface **xe-0/0/11**:

```
user@switch# set protocols dcbx interface xe-0/0/11 application-map ptp-app-map
```

Related Documentation

- [Defining an Application for DCBX Application Protocol TLV Exchange on page 313](#)
- [Configuring an Application Map for DCBX Application Protocol TLV Exchange on page 314](#)
- [Configuring DCBX Autonegotiation on page 305](#)
- [Example: Configuring DCBX Application Protocol TLV Exchange on page 316](#)

- *Example: Configuring DCBX to Support an iSCSI Application*
- [show dcbx neighbors on page 404](#)

Example: Configuring DCBX Application Protocol TLV Exchange

Data Center Bridging Capability Exchange protocol (DCBX) discovers the data center bridging (DCB) capabilities of connected peers by exchanging application configuration information. DCBX detects feature misconfiguration and mismatches and can configure DCB on peers. DCBX is an extension of the Link Layer Discovery Protocol (LLDP). LLDP must remain enabled on every interface on which you want to use DCBX.



NOTE: LLDP and DCBX are enabled by default on all interfaces.

The switch supports DCBX application protocol exchange for Layer 2 and Layer 4 applications such as the Internet Small Computer System Interface (iSCSI). You specify applications by EtherType (for Layer 2 applications) or by the destination port and protocol (for Layer 4 applications; the protocol can be either TCP or UDP).

The switch handles Fibre Channel over Ethernet (FCoE) application protocol exchange differently than other protocols in some cases:

- If FCoE is the only application for which you want to enable DCBX application protocol TLV exchange on an interface, you do not have to explicitly configure the FCoE application or an application map. By default, the switch exchanges FCoE application protocol TLVs on all interfaces that carry FCoE traffic (traffic mapped to the **fcoe** forwarding class) and have priority-based flow control (PFC) enabled on the FCoE priority (the FCoE IEEE 802.1p code point). The default priority mapping for the FCoE application is IEEE 802.1p code point 011 (the default **fcoe** forwarding class code point).
- If you want an interface to use DCBX to exchange application protocol TLVs for any other applications in addition to FCoE, you must configure the applications (including FCoE), define an application map (including FCoE), and apply the application map to the interface. If you apply an application map to an interface, you must explicitly configure the FCoE application, or the interface does not exchange FCoE application protocol TLVs.

This example shows how to configure interfaces to exchange both Layer 2 and Layer 4 applications by configuring one interface to exchange iSCSI and FCoE application protocol information and configuring another interface to exchange iSCSI and Precision Time Protocol (PTP) application protocol information.

- [Requirements on page 317](#)
- [Overview on page 317](#)
- [Configuration on page 320](#)
- [Verification on page 322](#)

Requirements

This example uses the following hardware and software components:

- Juniper Networks QFX Series device
- Junos OS Release 12.1 or later for the QFX Series

Overview

The switch supports DCBX application protocol exchange for:

- Layer 2 applications, defined by EtherType
- Layer 4 applications, defined by destination port and protocol



NOTE: DCBX also advertises PFC and enhanced transmission selection (ETS) information. See [“Configuring DCBX Autonegotiation” on page 305](#) for how DCBX negotiates and advertises configuration information for these features and for the applications.

DCBX is configured on a per-interface basis for each supported feature or application. For applications that you want to enable for DCBX application protocol exchange, you must:

- Define the application name and configure the EtherType or the destination port and protocol (TCP or UDP) of the application. Use the EtherType for Layer 2 applications, and use the destination port and protocol for Layer 4 protocols.
- Map the application to an IEEE 802.1p code point in an application map.
- Add the application map to DCBX interface.

In addition, for all applications (including FCoE, even when you do not use an application map), you either must create an IEEE 802.1p classifier and apply it to the appropriate ingress interfaces or use the default classifier. A classifier maps the code points of incoming traffic to a forwarding class and a loss priority so that ingress traffic is assigned to the correct class of service (CoS). The forwarding class determines the output queue on the egress interface.

If you do not create classifiers, trunk and tagged-access ports use the unicast IEEE 802.1 default trusted classifier. [Table 18 on page 318](#) shows the default mapping of IEEE 802.1 code-point values to unicast forwarding classes and loss priorities for ports in trunk mode or tagged-access mode. [Table 19 on page 318](#) shows the default untrusted classifier IEEE 802.1 code-point values to unicast forwarding class mapping for ports in access mode.

Table 18: Default IEEE 802.1 Classifiers for Trunk Ports and Tagged-Access Ports (Default Trusted Classifier)

Code Point	Forwarding Class	Loss Priority
be (000)	best-effort	low
be1 (001)	best-effort	low
ef (010)	best-effort	low
ef1 (011)	fcoe	low
af11 (100)	no-loss	low
af12 (101)	best-effort	low
nc1 (110)	network-control	low
nc2 (111)	network-control	low

Table 19: Default IEEE 802.1 Unicast Classifiers for Access Ports (Default Untrusted Classifier)

Code Point	Forwarding Class	Loss Priority
000	best-effort	low
001	best-effort	low
010	best-effort	low
011	best-effort	low
100	best-effort	low
101	best-effort	low
110	best-effort	low
111	best-effort	low

Topology

This example shows how to configure DCBX application protocol exchange for three protocols (iSCSI, PTP, and FCoE) on two interfaces. One interface exchanges iSCSI and FCoE application protocol information, and the other interface exchanges iSCSI and PTP application protocol information.



NOTE: You must map FCoE traffic to the interfaces on which you want to forward FCoE traffic. You must also enable PFC on the FCoE interfaces and create an ingress classifier for FCoE traffic, or else use the default classifier.

Table 20 on page 319 shows the configuration components for this example.

Table 20: Components of DCBX Application Protocol Exchange Configuration Topology

Component	Settings
Hardware	QFX Series device
LLDP	Enabled by default on Ethernet interfaces
DCBX	Enabled by default on Ethernet interfaces
iSCSI application (Layer 4)	Application name— iscsi protocol— TCP destination-port— 3260 code-points— 111
PTP application (Layer 2)	Application name— ptp ether-type— 0x88F7 code-points— 001, 101
FCoE application (Layer 2)	Application name— fcoe ether-type— 0x8906 code-points— 011 NOTE: You explicitly configure the FCoE application because you are applying an application map to the interface. When you apply an application map to an interface, all applications must be explicitly configured and included in the application map.
Application maps	dcbx-iscsi-fcoe-app-map —Maps the iSCSI and FCoE applications to IEEE 802.1p code points dcbx-iscsi-ptp-app-map —Maps iSCSI and PTP applications to IEEE 802.1p code points
Interfaces	xe-0/0/10 —Configured to exchange FCoE and iSCSI application TLVs (uses application map dcbx-iscsi-fcoe-app-map , carries FCoE traffic, and has PFC enabled on the FCoE priority) xe-0/0/11 —Configured to exchange iSCSI and PTP application TLVs (uses application map dcbx-iscsi-ptp-app-map)

Table 20: Components of DCBX Application Protocol Exchange Configuration Topology (continued)

Component	Settings
PFC congestion notification profile for FCoE application exchange	fcoe-cnp: <ul style="list-style-type: none"> Code point—011 Interface—xe-0/0/10
Behavior aggregate classifiers (map forwarding classes to incoming packets by the packet's IEEE 802.1 code point)	fcoe-iscsi-cl1: <ul style="list-style-type: none"> Maps the fcoe forwarding class to the IEEE 802.1p code point used for the FCoE application (011) and a loss priority of high Maps the network-control forwarding class to the IEEE 802.1p code point used for the iSCSI application (111) and a loss priority of high Applied to interface xe-0/0/10 iscsi-ntp-cl2: <ul style="list-style-type: none"> Maps the network-control forwarding class to the IEEE 802.1p code point used for the iSCSI application (111) and a loss priority of low Maps the best-effort forwarding class to the IEEE 802.1p code points used for the PTP application (001 and 101) and a loss priority of low Applied to interface xe-0/0/11



NOTE: This example does not include scheduling (bandwidth allocation) configuration or lossless configuration for the iSCSI forwarding class.

Configuration

CLI Quick Configuration

To quickly configure DCBX application protocol exchange, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set applications application iSCSI protocol tcp destination-port 3260
set applications application FCoE ether-type 0x8906
set applications application PTP ether-type 0x88F7
set policy-options application-maps dcbx-iscsi-fcoe-app-map application iSCSI code-points 111
set policy-options application-maps dcbx-iscsi-fcoe-app-map application FCoE code-points 011
set policy-options application-maps dcbx-iscsi-ntp-app-map application iSCSI code-points 111
set policy-options application-maps dcbx-iscsi-ntp-app-map application PTP code-points [001 101]
set protocols dcbx interface xe-0/0/10 application-map dcbx-iscsi-fcoe-app-map
set protocols dcbx interface xe-0/0/11 application-map dcbx-iscsi-ntp-app-map
set class-of-service congestion-notification-profile fcoe-cnp input ieee-802.1 code-point 011 pfc
set class-of-service interfaces xe-0/0/10 congestion-notification-profile fcoe-cnp
set class-of-service classifiers ieee-802.1 fcoe-iscsi-cl1 import default forwarding-class fcoe
loss-priority high code-points 011
```



```

set class-of-service classifiers ieee-802.1 fcoe-iscsi-cl1 import default forwarding-class
network-control loss-priority high code-points 111
set class-of-service classifiers ieee-802.1 iscsi-ntp-cl2 import default forwarding-class
network-control loss-priority low code-points 111
set class-of-service classifiers ieee-802.1 iscsi-ntp-cl2 import default forwarding-class best-effort
loss-priority low code-points [001 101]
set class-of-service interfaces xe-0/0/10 unit 0 classifiers ieee-802.1 fcoe-iscsi-cl1
set class-of-service interfaces xe-0/0/11 unit 0 classifiers ieee-802.1 iscsi-ntp-cl2

```

Configuring DCBX Application Protocol TLV Exchange

Step-by-Step Procedure

To define the applications, map the applications to IEEE 802.1p code points, apply the applications to interfaces, and create classifiers for DCBX application protocol exchange:

1. Define the iSCSI application by specifying its protocol and destination port, and define the FCoE and PTP applications by specifying their EtherTypes.

```

[edit applications]
user@switch# set application iSCSI protocol tcp destination-port 3260
user@switch# set application FCoE ether-type 0x8906
user@switch# set application PTP ether-type 0x88F7

```

2. Define an application map that maps the iSCSI and FCoE applications to IEEE 802.1p code points.

```

[edit policy-options]
user@switch# set application-maps dcbx-iscsi-fcoe-app-map application iSCSI code-points
111
user@switch# set application-maps dcbx-iscsi-fcoe-app-map application FCoE code-points
011

```

3. Define the application map that maps the iSCSI and PTP applications to IEEE 802.1p code points.

```

[edit policy-options]
user@switch# set application-maps dcbx-iscsi-ntp-app-map application iSCSI code-points
111
user@switch# set application-maps dcbx-iscsi-ntp-app-map application PTP code-points
[001 101]

```

4. Apply the iSCSI and FCoE application map to interface **xe-0/0/10**, and apply the iSCSI and PTP application map to interface **xe-0/0/11**.

```

[edit protocols dcbx]
user@switch# set interface xe-0/0/10 application-map dcbx-iscsi-fcoe-app-map
user@switch# set interface xe-0/0/11 application-map dcbx-iscsi-ntp-app-map

```

5. Create the congestion notification profile to enable PFC on the FCoE code point (**011**), and apply the congestion notification profile to interface **xe-0/0/10**.

```

[edit class-of-service]

```

```
user@switch# set congestion-notification-profile fcoe-cnp input ieee-802.1 code-point 011 pfc
user@switch# set interfaces xe-0/0/10 congestion-notification-profile fcoe-cnp
```

6. Configure the classifier to apply to the interface that exchanges iSCSI and FCoE application information.

```
[edit class-of-service classifiers]
user@switch# set ieee-802.1 fcoe-iscsi-cl1 import default forwarding-class fcoe loss-priority high code-points 011
user@switch# set ieee-802.1 fcoe-iscsi-cl1 import default forwarding-class network-control loss-priority high code-points 111
```

7. Configure the classifier to apply to the interface that exchanges iSCSI and PTP application information.

```
[edit class-of-service classifiers]
user@switch# set ieee-802.1 iscsi-ntp-cl2 import default forwarding-class network-control loss-priority low code-points 111
user@switch# set ieee-802.1 iscsi-ntp-cl2 import default forwarding-class best-effort loss-priority low code-points [001101]
```

8. Apply the classifiers to the appropriate interfaces.

```
[edit class-of-service]
user@switch# set interfaces xe-0/0/10 unit 0 classifiers ieee-802.1 fcoe-iscsi-cl1
user@switch# set interfaces xe-0/0/11 unit 0 classifiers ieee-802.1 iscsi-ntp-cl2
```

Verification

To verify that DCBX application protocol exchange configuration has been created and is operating properly, perform these tasks:

- [Verifying the Application Configuration on page 322](#)
- [Verifying the Application Map Configuration on page 323](#)
- [Verifying DCBX Application Protocol Exchange Interface Configuration on page 324](#)
- [Verifying the PFC Configuration on page 324](#)
- [Verifying the Classifier Configuration on page 325](#)

Verifying the Application Configuration

Purpose Verify that DCBX applications have been configured.

Action List the applications by using the configuration mode command **show applications**:

```
user@switch# show applications
```

```

application iSCSI {
    protocol tcp;
    destination-port 3260;
}

application fcoe {
    ether-type 0x8906;
}

application ptp {
    ether-type 0x88F7;
}

```

Meaning The **show applications** configuration mode command lists all of the configured applications and either their protocol and destination port (Layer 4 applications) or their EtherType (Layer 2 applications). The command output shows that the iSCSI application is configured with the **tcp** protocol and destination port **3260**, the FCoE application is configured with the EtherType **0x8906**, and that the PTP application is configured with the EtherType **0x88F7**.

Verifying the Application Map Configuration

Purpose Verify that the application maps have been configured.

Action List the application maps by using the configuration mode command **show policy-options application-maps**:

```

user@switch# show policy-options application-maps

dcbx-iscsi-fcoe-app-map {
    application iSCSI code-points 111;
    application FCoE code-points 011;
}

dcbx-iscsi-ptp-app-map {
    application iSCSI code-points 111;
    application PTP code-points [001 101];
}

```

Meaning The **show policy-options application-maps** configuration mode command lists all of the configured application maps and the applications that belong to each application map. The command output shows that there are two application maps, **dcbx-iscsi-fcoe-app-map** and **dcbx-iscsi-ptp-app-map**.

The application map **dcbx-iscsi-fcoe-app-map** consists of the iSCSI application, which is mapped to IEEE 802.1p code point **111**, and the FCoE application, which is mapped to IEEE 802.1p code point **011**.

The application map **dcbx-iscsi-ntp-app-map** consists of the iSCSI application, which is mapped to IEEE 802.1p code point 111, and the PTP application, which is mapped to IEEE 802.1p code points 001 and 101.

Verifying DCBX Application Protocol Exchange Interface Configuration

Purpose Verify that the application maps have been applied to the correct interfaces.

Action List the application maps by using the configuration mode command **show protocols dcbx**:

```
user@switch# show protocols dcbx

interface xe-0/0/10.0 {
    application-map dcbx-iscsi-fcoe-app-map;
}

interface xe-0/0/11.0 {
    application-map dcbx-iscsi-ntp-app-map;
}
```

Meaning The **show protocols dcbx** configuration mode command lists whether the interfaces are enabled for DCBX and lists the application map applied to each interface. The command output shows that interfaces **xe-0/0/10.0** and **xe-0/0/11.0** are enabled for DCBX, and that interface **xe-0/0/10.0** uses application map **dcbx-iscsi-fcoe-app-map**, and interface **xe-0/0/11.0** uses application map **dcbx-iscsi-ntp-app-map**.

Verifying the PFC Configuration

Purpose Verify that PFC has been enabled on the FCoE code point and applied to the correct interface.

Action Display the PFC configuration to verify that PFC is enabled on the FCoE code point (011) in the congestion notification profile **fcoe-cnp** by using the configuration mode command **show class-of-service congestion-notification-profile**:

```
user@switch# show class-of-service congestion-notification-profile

fcoe-cnp {
    input {
        ieee-802.1 {
            code-point 011 {
                pfc;
            }
        }
    }
}
```

Display the class-of-service (CoS) interface information to verify that the correct interface has PFC enabled for the FCoE application by using the configuration mode command **show class-of-service interfaces**:

```
user@switch# show class-of-service interfaces
xe-0/0/10 {
    congestion-notification-profile fcoe-cnp;
}
```



NOTE: The sample output does not include all of the information this command can show. The output is abbreviated to focus on verifying the PFC configuration.

Meaning The **show class-of-service congestion-notification-profile** configuration mode command lists the configured congestion notification profiles. The command output shows that the congestion notification profile **fcoe-cnp** has been configured and has enabled PFC on the IEEE 802.1p code point 011 (the default FCoE code point).

The **show class-of-service interfaces** configuration mode command shows the interface CoS configuration. The command output shows that the congestion notification profile **fcoe-cnp**, which enables PFC on the FCoE code point, is applied to interface **xe-0/0/10**.

Verifying the Classifier Configuration

Purpose Verify that the classifiers have been configured and applied to the correct interfaces.

Action Display the classifier configuration by using the configuration mode command **show class-of-service**:

```
user@switch# show class-of-service
classifiers {
    ieee-802.1 fcoe-iscsi-cl1 {
        import default;
        forwarding-class network-control {
            loss-priority high code-points 111;
        }
        forwarding-class fcoe {
            loss-priority high code-points 011;
        }
    }
    ieee-802.1 iscsi-ptp-cl2 {
        import default;
        forwarding-class network-control {
            loss-priority low code-points 111;
        }
        forwarding-class best-effort {
            loss-priority low code-points [ 001 101 ];
        }
    }
}
```

```

    }
  }
  interfaces {
    xe-0/0/10 {
      congestion-notification-profile fcoe-cnp;
      unit 0 {
        classifiers {
          ieee-802.1 fcoe-iscsi-cl1;
        }
      }
    }
    xe-0/0/11 {
      unit 0 {
        classifiers {
          ieee-802.1 iscsi-ntp-cl2;
        }
      }
    }
  }
}

```



NOTE: The sample output does not include all of the information this command can show. The output is abbreviated to focus on verifying the classifier configuration.

Meaning The **show class-of-service** configuration mode command lists the classifier and CoS interface configuration, as well as other information not shown in this example. The command output shows that there are two classifiers configured, **fcoe-iscsi-cl1** and **iscsi-ntp-cl2**.

Classifier **fcoe-iscsi-cl1** uses the **default** classifier as a template and edits the template as follows:

- The forwarding class **network-control** is set to a loss priority of **high** and is mapped to code point **111** (the code point mapped to the iSCSI application).
- The forwarding class **fcoe** is set to a loss priority of **high** and is mapped to code point **011** (the code point mapped by default to the FCoE application).

Classifier **iscsi-ntp-cl2** uses the **default** classifier as a template and edits the template as follows:

- The forwarding class **network-control** is set to a loss priority of **low** and is mapped to IEEE 802.1p code point **111** (the code point mapped to the iSCSI application).
- The forwarding class **best-effort** is set to a loss priority of **low** and is mapped to IEEE 802.1p code points **001** and **101** (the code points mapped by default to the PTP application).

The command output also shows that classifier **fcoe-iscsi-cl1** is mapped to interface **xe-0/0/10.0** and that classifier **iscsi-ntp-cl2** is mapped to interface **xe-0/0/11.0**.

Related Documentation

- [Defining an Application for DCBX Application Protocol TLV Exchange on page 313](#)
- [Configuring an Application Map for DCBX Application Protocol TLV Exchange on page 314](#)
- [Applying an Application Map to an Interface for DCBX Application Protocol TLV Exchange on page 315](#)
- [Configuring DCBX Autonegotiation on page 305](#)
- [show dcbx on page 376](#)
- [show dcbx neighbors on page 404](#)
- [Understanding DCBX Application Protocol TLV Exchange on page 309](#)

Understanding CoS Flow Control (Ethernet PAUSE and PFC)

Flow control supports lossless transmission by regulating traffic flows to avoid dropping frames during periods of congestion. Flow control stops and resumes the transmission of network traffic between two connected peer nodes on a full-duplex Ethernet physical link. Controlling the flow by pausing and restarting it prevents buffers on the nodes from overflowing and dropping frames. You configure flow control on a per-interface basis.

Two methods of peer-to-peer flow control are supported:

- IEEE 802.3X Ethernet PAUSE



NOTE: QFX10000 switches do not support Ethernet PAUSE. Information about Ethernet PAUSE does not apply to QFX10000 switches.

OCX Series switches support symmetric Ethernet PAUSE flow control on Layer 3 tagged interfaces. OCX Series switches do not support asymmetric Ethernet PAUSE flow control. Information about asymmetric flow control does not apply to OCX Series switches.

- IEEE 802.1Qbb priority-based flow control (PFC)



NOTE: OCX Series switches do not support PFC or lossless Layer 2 transport. Information about PFC, lossless transport, and congestion notification profiles do not apply to OCX Series switches.



[Video: Why Use PFC in a Data Center Network?](#)

- [General Information about Ethernet PAUSE and PFC and When to Use Them on page 328](#)
- [Ethernet PAUSE on page 328](#)

- [PFC on page 333](#)
- [Lossless Transport Support Summary on page 337](#)

General Information about Ethernet PAUSE and PFC and When to Use Them

Ethernet PAUSE and PFC are link-level flow control mechanisms.



NOTE: For end-to-end congestion control for best-effort traffic, see *Understanding CoS Explicit Congestion Notification*.

Ethernet PAUSE pauses transmission of all traffic on a physical Ethernet link.

PFC decouples the pause function from the physical Ethernet link and enables you to divide traffic on one link into eight priorities. You can think of the eight priorities as eight “lanes” of traffic that are mapped to forwarding classes and output queues. Each priority maps to a 3-bit IEEE 802.1p CoS code point value in the VLAN header. You can enable PFC on one or more priorities (IEEE 802.1p code points) on a link. When PFC-enabled traffic is paused on a link, traffic that is not PFC-enabled continues to flow (or is dropped if congestion is severe enough).

Use Ethernet PAUSE when you want to prevent packet loss on all of the traffic on a link. Use PFC to prevent traffic loss only on a specified type of traffic that require lossless treatment, for example, Fibre Channel over Ethernet (FCoE) traffic.



NOTE: Depending on the amount of traffic on a link or assigned to a priority, pausing traffic can cause ingress port congestion and spread congestion through the network.

Ethernet PAUSE and PFC are mutually exclusive configurations on an interface. Attempting to configure both Ethernet PAUSE and PFC on a link causes a commit error.

By default, all forms of flow control are disabled. You must explicitly enable flow control on interfaces to pause traffic.

Ethernet PAUSE

Ethernet PAUSE is a congestion relief feature that works by providing link-level flow control for all traffic on a full-duplex Ethernet link. Ethernet PAUSE works in both directions on the link. In one direction, an interface generates and sends Ethernet PAUSE messages to stop the connected peer from sending more traffic. In the other direction, the interface responds to Ethernet PAUSE messages it receives from the connected peer to stop sending traffic.



NOTE: QFX10000 switches do not support Ethernet PAUSE. Information about Ethernet PAUSE does not apply to QFX10000 switches.

OCX Series switches support symmetric Ethernet PAUSE flow control on Layer 3 tagged interfaces. OCX Series switches do not support asymmetric Ethernet PAUSE flow control. Information about asymmetric flow control does not apply to OCX Series switches.

Ethernet PAUSE also works on aggregated Ethernet interfaces. For example, if the connected peer interfaces are called Node A and Node B:

- When the receive buffers on interface Node A reach a certain level of fullness, the interface generates and sends an Ethernet PAUSE message to the connected peer (interface Node B) to tell the peer to stop sending frames. The Node B buffers store frames until the time period specified in the Ethernet PAUSE frame elapses; then Node B resumes sending frames to Node A.
- When interface Node A receives an Ethernet PAUSE message from interface Node B, interface Node A stops transmitting frames until the time period specified in the Ethernet PAUSE frame elapses; then Node A resumes transmission. (The Node A transmit buffers store frames until Node A resumes sending frames to Node B.)

In this scenario, if Node B sends an Ethernet PAUSE frame with a time value of 0 to Node A, the 0 time value indicates to Node A that it can resume transmission. This happens when the Node B buffer empties to below a certain threshold and the buffer can once again accept traffic.

Symmetric flow control means an interface has the same Ethernet PAUSE configuration in both directions. The Ethernet PAUSE generation and Ethernet PAUSE response functions are both configured as enabled, or they are both disabled. You configure symmetric flow control by including the **flow-control** statement at the **[edit interfaces interface-name ether-options]** hierarchy level.

Asymmetric flow control allows you to configure the Ethernet PAUSE functionality in each direction independently on an interface. The configuration for generating Ethernet PAUSE messages and for responding to Ethernet PAUSE messages does not have to be the same. It can be enabled in both directions, disabled in both directions, or enabled in one direction and disabled in the other direction. You configure asymmetric flow control by including the **configured-flow-control** statement at the **[edit interfaces interface-name ether-options]** hierarchy level.

On any particular interface, symmetric and asymmetric flow control are mutually exclusive. Asymmetric flow control overrides and disables symmetric flow control. (If PFC is configured on an interface, you cannot commit an Ethernet PAUSE configuration on the interface. Attempting to commit an Ethernet PAUSE configuration on an interface with PFC enabled on one or more queues results in a commit error. To commit the PAUSE

configuration, you must first delete the PFC configuration.) Both symmetric and asymmetric flow control are supported.

- [Symmetric Flow Control on page 330](#)
- [Asymmetric Flow Control on page 330](#)

Symmetric Flow Control

Symmetric flow control configures both the receive and transmit buffers in the same state. The interface can both send Ethernet PAUSE messages and respond to them (flow control is enabled), or the interface cannot send Ethernet PAUSE messages or respond to them (flow control is disabled).

When you enable symmetric flow control on an interface, the Ethernet PAUSE behavior depends on the configuration of the connected peer. With symmetric flow control enabled, the interface can perform any Ethernet PAUSE functions that the connected peer can perform. (When symmetric flow control is disabled, the interface does not send or respond to Ethernet PAUSE messages.)

Asymmetric Flow Control

Asymmetric flow control enables you to specify independently whether or not the interface receive buffer generates and sends Ethernet PAUSE messages to stop the connected peer from transmitting traffic, and whether or not the interface transmit buffer responds to Ethernet PAUSE messages it receives from the connected peer and stops transmitting traffic. The receive buffer configuration determines if the interface transmits Ethernet PAUSE messages, and the transmit buffer configuration determines if the interface receives and responds to Ethernet PAUSE messages:

- Receive buffers on—Enable Ethernet PAUSE transmission (generate and send Ethernet PAUSE frames)
- Transmit buffers on—Enable Ethernet PAUSE reception (respond to received Ethernet PAUSE frames)

You must explicitly set the flow control for both the receive buffer and the transmit buffer (**on** or **off**) to configure asymmetric Ethernet PAUSE. [Table 21 on page 330](#) describes the configured flow control state when you set the receive (Rx) and transmit (Tx) buffers on an interface:

Table 21: Asymmetric Ethernet PAUSE Flow Control Configuration

Receive (Rx) Buffer	Transmit (Tx) Buffer	Configured Flow Control State
On	Off	Interface generates and sends Ethernet PAUSE messages. Interface does not respond to Ethernet PAUSE messages (interface continues to transmit even if peer requests that the interface stop sending traffic).
Off	On	Interface responds to Ethernet PAUSE messages received from the connected peer, but does not generate or send Ethernet PAUSE messages. (The interface does not request that the connected peer stop sending traffic.)

Table 21: Asymmetric Ethernet PAUSE Flow Control Configuration (continued)

Receive (Rx) Buffer	Transmit (Tx) Buffer	Configured Flow Control State
On	On	Same functionality as symmetric Ethernet PAUSE. Interface generates and sends Ethernet PAUSE messages and responds to received Ethernet PAUSE messages.
Off	Off	Ethernet PAUSE flow control is disabled.

The configured flow control is the Ethernet PAUSE state configured on the interface.

On 1-Gigabit Ethernet interfaces, autonegotiation of Ethernet PAUSE with the connected peer is supported. (Autonegotiation on 10-Gigabit Ethernet interfaces is not supported.) Autonegotiation enables the interface to exchange state advertisements with the connected peer so that the two devices can agree on the Ethernet PAUSE configuration. Each interface advertises its flow control state to the connected peer using a combination of the Ethernet PAUSE and ASM_DIR bits, as described in [Table 22 on page 331](#):

Table 22: Flow Control State Advertised to the Connected Peer (Autonegotiation)

Rx Buffer State	Tx Buffer State	PAUSE Bit	ASM_DIR Bit	Description
Off	Off	0	0	The interface advertises no Ethernet PAUSE capability. This is equivalent to disabling flow control on an interface.
On	On	1	0	The interface advertises symmetric flow control (both the transmission of Ethernet PAUSE messages and the ability to receive and respond to Ethernet PAUSE messages).
On	Off	0	1	The interface advertises asymmetric flow control (the transmission of Ethernet PAUSE messages, but not the ability to receive and respond to Ethernet PAUSE messages).

Table 22: Flow Control State Advertised to the Connected Peer (Autonegotiation) (continued)

Rx Buffer State	Tx Buffer State	PAUSE Bit	ASM_DIR Bit	Description
Off	On	1	1	The interface advertises both symmetric and asymmetric flow control. Although the interface does not generate and send Ethernet PAUSE requests to the peer, the interface supports both symmetric and asymmetric Ethernet PAUSE configuration on the peer because the peer is not affected if the peer does not receive Ethernet PAUSE requests. (If the interface responds to the peer's Ethernet PAUSE requests, that is sufficient to support either symmetric or asymmetric flow control on the peer.)

The flow control configuration on each switch interface interacts with the flow control configuration of the connected peer. Each peer advertises its state to the other peer. The interaction of the flow control configuration of the peers determines the flow control behavior (resolution) between them, as shown in [Table 23 on page 333](#). The first four columns show the Ethernet PAUSE configuration on the local QFX Series or EX4600 switch and on the connected peer (also known as the *link partner*). The last two columns show the Ethernet PAUSE resolution that results from the local and peer configurations on each interface. This illustrates how the Ethernet PAUSE configuration of each interface affects the Ethernet PAUSE behavior on the other interface.



NOTE: In the Resolution columns of the table, disabling Ethernet PAUSE transmit means that the interface receive buffers do not generate and send Ethernet PAUSE messages to the peer. Disabling Ethernet PAUSE receive means that the interface transmit buffers do not respond to Ethernet PAUSE messages received from the peer.

Table 23: Asymmetric Ethernet PAUSE Behavior on Local and Peer Interfaces

Local Interface (QFX Series or EX4600 Switch)		Peer Interface		Local Resolution	Peer Resolution
PAUSE Bit	ASM_DIR Bit	PAUSE Bit	ASM_DIR Bit		
0	0	Don't care	Don't care	Disable Ethernet PAUSE transmit and receive	Disable Ethernet PAUSE transmit and receive
0	1	0	Don't care	Disable Ethernet PAUSE transmit and receive	Disable Ethernet PAUSE transmit and receive
0	1	1	0	Disable Ethernet PAUSE transmit and receive	Disable Ethernet PAUSE transmit and receive
0	1	1	1	Enable Ethernet PAUSE transmit and disable Ethernet PAUSE receive	Disable Ethernet PAUSE transmit and enable Ethernet PAUSE receive
1	0	0	Don't care	Disable Ethernet PAUSE transmit and receive	Disable Ethernet PAUSE transmit and receive
1	0	1	Don't care	Enable Ethernet PAUSE transmit and receive	Enable Ethernet PAUSE transmit and receive
1	1	0	0	Disable Ethernet PAUSE transmit and receive	Disable Ethernet PAUSE transmit and receive
1	1	0	1	Enable Ethernet PAUSE receive and disable Ethernet PAUSE transmit	Enable Ethernet PAUSE transmit and disable Ethernet PAUSE receive
1	1	Don't care	Don't care	Enable Ethernet PAUSE transmit and receive	Enable Ethernet PAUSE transmit and receive



NOTE: For your convenience, [Table 23 on page 333](#) replicates Table 28B-3 of Section 2 of the IEEE 802.X specification.

PFC

PFC is a lossless transport and congestion relief feature that works by providing granular link-level flow control for each IEEE 802.1p code point (priority) on a full-duplex Ethernet link. When the receive buffer on a switch interface fills to a threshold, the switch transmits a pause frame to the sender (the connected peer) to temporarily stop the sender from transmitting more frames. The buffer threshold must be low enough so that the sender has time to stop transmitting frames and the receiver can accept the frames already on the wire before the buffer overflows. The switch automatically sets queue buffer thresholds to prevent frame loss.

When congestion forces one priority on a link to pause, all of the other priorities on the link continue to send frames. Only frames of the paused priority are not transmitted. When the receive buffer empties below another threshold, the switch sends a message that starts the flow again.

You configure PFC using a congestion notification profile (CNP). A CNP has two parts:

- **Input**—Specify the code point (or code points) on which to enable PFC, and optionally specify the maximum receive unit (MRU) and the cable length between the interface and the connected peer interface.
- **Output**—Specify the output queue or output queues that respond to pause messages from the connected peer.

You apply a PFC configuration by configuring a CNP on one or more interfaces. Each interface that uses a particular CNP is enabled to pause traffic identified by the priorities (code points) specified in that CNP. You can configure one CNP on an interface, and you can configure different CNPs on different interfaces. When you configure a CNP on an interface, ingress traffic that is mapped to a priority that the CNP enables for PFC is paused whenever the queue buffer fills to the pause threshold. (The pause threshold is not user-configurable.)

Configure PFC for a priority end to end along the entire data path to create a lossless lane of traffic on the network. You can selectively pause the traffic in any queue without pausing the traffic for other queues on the same link. You can create lossless lanes for traffic such as FCoE, LAN backup, or management, while using standard frame-drop congestion management for IP traffic on the same link.

Potential consequences of flow control are:

- Ingress port congestion (configuring too many lossless flows can cause ingress port congestion)
- A paused priority that causes upstream devices to pause the same priority, thus spreading congestion back through the network

By definition, PFC supports symmetric pause only (as opposed to Ethernet PAUSE, which supports symmetric and asymmetric pause). With symmetric pause, a device can:

- Transmit pause frames to pause incoming traffic. (You configure this using the input stanza of a congestion notification profile.)
- Receive pause frames and stop sending traffic to a device whose buffer is too full to accept more frames. (You configure this using the output stanza of a congestion notification profile.)

Receiving a PFC frame from a connected peer pauses traffic on egress queues based on the IEEE 802.1p priorities that the PFC pause frame identifies. The priorities are 0 through 7. By default, the priorities map to queue numbers 0 through 7, respectively, and to specific forwarding classes, as shown in [Table 24 on page 335](#):

Table 24: Default PFC Priority to Queue and Forwarding Class Mapping

IEEE 802.1p Priority (Code Point)	Queue	Forwarding Class
0 (000)	0	best-effort
1 (001)	1	best-effort
2 (010)	2	best-effort
3 (011)	3	fcoe
4 (100)	4	no-loss
5 (101)	5	best-effort
6 (110)	6	network-control
7 (111)	7	network-control

For example, a received PFC pause frame that pauses priority 3 pauses output queue 3. If you do not want to use the default configuration, you can configure customized mapping of priorities to queues and forwarding classes.



NOTE: By convention, deployments with converged server access typically use IEEE 802.1p priority 3 for FCoE traffic. The default configuration sets the fcoe forwarding class as a lossless forwarding class that is mapped to queue 3. The default classifier maps incoming priority 3 traffic to the fcoe forwarding class. *However, you must apply PFC to the entire FCoE data path to configure the end-to-end lossless behavior that FCoE traffic requires.*

If your network uses priority 3 for FCoE traffic, we recommend that you use the default configuration. If your network uses a priority other than 3 for FCoE traffic, you can configure lossless FCoE transport on any IEEE 802.1p priority as described in *Understanding CoS IEEE 802.1p Priorities for Lossless Traffic Flows* and *Understanding CoS IEEE 802.1p Priority Remapping on an FCoE-FC Gateway*.

To enable PFC on a priority:

1. Specify the IEEE 802.1p code point to pause in the input stanza of a CNP.
2. If you are not using the default lossless forwarding classes, specify the IEEE 802.1p code point to pause and the corresponding output queue in the output stanza of the CNP.
3. Apply the CNP to the ingress interfaces on which you want to pause the traffic.
4. If you are not using the default lossless forwarding classes, apply the CNP to the ingress interfaces on which you want to pause the traffic.



CAUTION: Any change to the PFC configuration on a port temporarily blocks the entire port (not just the priorities affected by the PFC change) so that the port can implement the change, then unblocks the port. Blocking the port stops ingress and egress traffic, and causes packet loss on all queues on the port until the port is unblocked.

A change to the PFC configuration means any change to a CNP, including changing the input portion of the CNP (enabling or disabling PFC on a priority, or changing the MRU or cable-length values) or changing the output portion of the CNP that enables or disables output flow control on a queue. A PFC configuration change only affects ports that use the changed CNP.

The following actions change the PFC configuration:

- Deleting or disabling a PFC configuration (input or output) in a CNP that is in use on one or more interfaces. For example:
 1. An existing CNP with an input stanza that enables PFC on priorities 3, 5, and 6 is configured on interfaces xe-0/0/20 and xe-0/0/21.
 2. We disable the PFC configuration for priority 6 in the input CNP, and then commit the configuration.
 3. The PFC configuration change causes all traffic on interfaces xe-0/0/20 and xe-0/0/21 to stop until the PFC change has been implemented. When the PFC change has been implemented, traffic resumes.
- Configuring a CNP on an interface. (This changes the PFC state by enabling PFC on one or more priorities.)
- Deleting a CNP from an interface. (This changes the PFC state by disabling PFC on one or more priorities.)

When you associate the CNP with an interface, the interface uses PFC to send pause requests when the output queue buffer for the lossless traffic fills to the pause threshold.

On switches that use different classifiers for unicast and multidestination traffic, you can map a unicast queue (queue 0 through 7) and a multidestination queue (queue 8, 9, 10, or 11) to the same IEEE 802.1p code point (priority) so that both unicast and multicast traffic use that priority. However, do not map multidestination traffic to lossless output queues. Starting with Junos OS Release 12.3, you can map one priority to multiple output queues.



NOTE: You can attach a maximum of one CNP to an interface, but you can create an unlimited number of CNPs that explicitly configure only the input stanza and use the default output stanza.

The output stanza of the CNP maps to a profile that interfaces use to respond to pause messages received from the connected peer. On standalone switches, you can create two CNPs with an explicitly configured output stanza.

When a switch is a Node device in a QFabric system, you can create one CNP with an explicitly configured output stanza. (One fewer profile is available on QFabric systems because the system needs a default profile for fabric interfaces, which are not used as fabric interfaces when the switches are not part of a QFabric system. *Understanding CoS IEEE 802.1p Priorities for Lossless Traffic Flows* describes configuring output flow control.

Lossless Transport Support Summary

The switch supports up to six lossless forwarding classes. For lossless transport, you must enable PFC on the IEEE 802.1p priorities (code points) mapped to lossless forwarding classes.



CAUTION: Any change to the PFC configuration on a port temporarily blocks the entire port (not just the priorities affected by the PFC change) so that the port can implement the change, then unblocks the port. Blocking the port stops ingress and egress traffic, and causes packet loss on all queues on the port until the port is unblocked.

The following limitation applies to support lossless transport on QFabric systems only:

- The internal fiber cable length from the QFabric system Node device to the QFabric system Interconnect device cannot exceed 150 meters.

The default CoS configuration provides two lossless forwarding classes, *fcoe* and *no-loss*. If you explicitly configure lossless forwarding classes, you must include the **no-loss** packet drop attribute to enable lossless behavior, or the traffic is not lossless. For both default and explicit lossless forwarding class configuration, you must configure CNP input stanzas to enable PFC on the priority of the lossless traffic and apply the CNPs to ingress interfaces.



NOTE: The information in this note applies only to systems that do not run the ELS CLI.

Junos OS Release 12.2 introduced changes to the way the switch handles lossless forwarding classes (including the default fcoe and no-loss forwarding classes).

In Junos OS Release 12.1, either explicitly configuring the fcoe and no-loss forwarding classes or using the default configuration for these forwarding classes resulted in the same lossless behavior for traffic mapped to those forwarding classes.

However, in Junos OS Release 12.2, if you explicitly configure the fcoe or the no-loss forwarding class, that forwarding class is no longer treated as a lossless forwarding class. Traffic mapped to these forwarding classes is treated as lossy (best-effort) traffic. This is true even if the explicit configuration is exactly the same as the default configuration.

If your CoS configuration from Junos OS Release 12.1 or earlier includes the explicit configuration of the fcoe or the no-loss forwarding class, then when you upgrade to Junos OS Release 12.2, those forwarding classes are not lossless. To preserve the lossless treatment of these forwarding classes, delete the the explicit fcoe and no-loss forwarding class configuration before you upgrade to Junos OS Release 12.2.

See *Overview of CoS Changes Introduced in Junos OS Release 12.2* for detailed information about this change and how to delete an existing lossless configuration.

In Junos OS Release 12.3, the default behavior of the fcoe and no-loss forwarding classes is the same as in Junos OS Release 12.2. However, in Junos OS Release 12.3, you can configure up to six lossless forwarding classes. All explicitly configured lossless forwarding classes must include the new no-loss packet drop attribute or the forwarding class is lossy.

Understanding CoS IEEE 802.1p Priorities for Lossless Traffic Flows provides detailed information about the explicit configuration of lossless priorities and about the default configuration of lossless priorities, including the input and output stanzas of the CNP.



NOTE: PFC and Ethernet PAUSE are used only on Ethernet interfaces. Fabric (fte) ports on QFabric systems (Node device fabric ports and Interconnect device fabric ports) use link-layer flow control (LLFC) to ensure the appropriate treatment of lossless traffic.

Release History Table

Release	Description
12.3	Starting with Junos OS Release 12.3, you can map one priority to multiple output queues.

Related Documentation

- [Understanding DCB Features and Requirements on page 292](#)
- [Understanding CoS Explicit Congestion Notification](#)
- [Configuring CoS PFC \(Congestion Notification Profiles\)](#)
- [Example: Configuring CoS PFC for FCoE Traffic on page 339](#)

Example: Configuring CoS PFC for FCoE Traffic

Priority-based flow control (PFC, described in IEEE 802.1Qbb) is a link-level flow control mechanism that you apply at ingress interfaces. PFC enables you to divide traffic on one physical link into eight priorities. You can think of the eight priorities as eight “lanes” of traffic that correspond to queues (forwarding classes). Each priority is mapped to a 3-bit IEEE 802.1p CoS value in the VLAN header.

You can selectively apply PFC to the traffic in any queue without pausing the traffic in other queues on the same link. You must apply PFC to FCoE traffic to ensure lossless transport.

This example describes how to configure PFC for FCoE traffic:

- [Requirements on page 339](#)
- [Overview on page 339](#)
- [Configuration on page 342](#)
- [Verification on page 347](#)

Requirements

This example uses the following hardware and software components:

- One switch
- Junos OS Release 11.1 or later for the QFX Series

Overview

FCoE traffic requires PFC to ensure lossless packet transport. This example shows you how to configure PFC on FCoE traffic, use the default FCoE forwarding-class-to-queue mapping and:

- Configure a classifier that associates the FCoE forwarding class with FCoE traffic, which is identified by IEEE 802.1p code point 011 (priority 3).
- Configure a congestion notification profile to apply PFC to the FCoE traffic.

- Apply the classifier and the PFC configuration to ingress interfaces.



NOTE: Configuring or changing PFC on an interface blocks the entire port until the PFC change is completed. After a PFC change is completed, the port is unblocked and traffic resumes. Blocking the port stops ingress and egress traffic, and causes packet loss on all queues on the port until the port is unblocked.

- Configure the CoS bandwidth scheduling for the FCoE forwarding class output queue.
- On switches that support enhanced transmission selection (ETS) hierarchical port scheduling, create a forwarding class set (priority group) that includes the FCoE forwarding class; this is required to configure enhanced transmission selection (ETS) and support data center bridging (DCB).
- For ETS, configure the bandwidth scheduling for the FCoE priority group.
- Apply the configuration to ingress and egress interfaces. How this is done differs depending on whether you use ETS or direct port scheduling for the CoS configuration.

For direct port scheduling, you apply a scheduler map directly to the interface. A scheduler map maps schedulers to forwarding classes, and applies the CoS properties of the scheduler to the output queue mapped to the forwarding class.

For ETS hierarchical port scheduling, you apply the scheduler map to a traffic control profile, and then apply the traffic control profile to the interface. The scheduler map maps CoS properties to forwarding classes (and their associated output queues) just as it does for direct port scheduling. The traffic control profile maps CoS properties to the priority group (a group of forwarding classes defined in a forwarding class set) that contains the forwarding class, creating a CoS hierarchy that allocates port bandwidth to a group of forwarding classes (priority group), and then allocates the priority group bandwidth to the individual forwarding classes.

Each interface in this example acts as both an ingress interface and an egress interface, so the classifier, congestion notification profile, and scheduling are applied to all of the interfaces.

Topology

Table 25 on page 340 shows the configuration components for this example.

Table 25: Components of the PFC for FCoE Traffic Configuration Topology

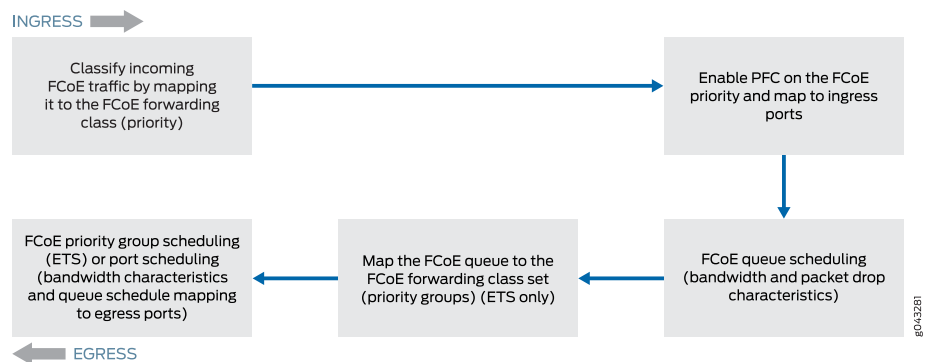
Component	Settings
Hardware	One switch
Behavior aggregate classifier (maps the FCoE forwarding class to incoming packets by IEEE 802.1 code point)	Code point 011 to forwarding class fcoe and loss priority low Ingress interfaces: xe-0/0/31, xe-0/0/32, xe-0/0/33, xe-0/0/34

Table 25: Components of the PFC for FCoE Traffic Configuration Topology (continued)

Component	Settings
PFC congestion notification profile	fcoe-cnp: Code point 011 Ingress interfaces: xe-0/0/31, xe-0/0/32, xe-0/0/33, xe-0/0/34
FCoE queue scheduler	fcoe-sched: Minimum bandwidth 3g Maximum bandwidth 100% Priority low
Forwarding class-to-scheduler mapping	Scheduler map fcoe-map: Forwarding class fcoe Scheduler fcoe-sched On switches that support direct port scheduling, if you use port scheduling, attach the scheduler map directly to interfaces xe-0/0/31, xe-0/0/32, xe-0/0/33, and xe-0/0/34 .
ETS only: Forwarding class set (FCoE priority group)	fcoe-pg: Forwarding class fcoe Egress interfaces: xe-0/0/31, xe-0/0/32, xe-0/0/33, xe-0/0/34
ETS only: Traffic control profile	fcoe-tcp: Scheduler map fcoe-map Minimum bandwidth 3g Maximum bandwidth 100% For ETS hierarchical scheduling, attach the traffic control profile (using the output-traffic-control-profile keyword) to interfaces xe-0/0/31, xe-0/0/32, xe-0/0/33, and xe-0/0/34 .

Figure 16 on page 341 shows a block diagram of the configuration components and the configuration flow of the CLI statements used in the example.

Figure 16: PFC for FCoE Traffic Configuration Components Block Diagram



Configuration

CLI Quick Configuration

To quickly configure PFC for FCoE traffic, copy the following commands, paste them in a text file, remove line breaks, change variables and details to match your network configuration, and then copy and paste the commands into the CLI at the [edit] hierarchy level. The configuration is separated into the configuration common to ETS and direct port scheduling, and the portions of the configuration that apply only to ETS and only to port scheduling.

Common Configuration (Applies to ETS Hierarchical Scheduling and to Port Scheduling)

```
[edit class-of-service]
set classifiers ieee-802.1 fcoe-classifier forwarding-class fcoe loss-priority low code-points 011
set congestion-notification-profile fcoe-cnp input ieee-802.1 code-point 011 pfc
set interfaces xe-0/0/31 unit 0 classifiers ieee-802.1 fcoe-classifier
set interfaces xe-0/0/32 unit 0 classifiers ieee-802.1 fcoe-classifier
set interfaces xe-0/0/33 unit 0 classifiers ieee-802.1 fcoe-classifier
set interfaces xe-0/0/34 unit 0 classifiers ieee-802.1 fcoe-classifier
set interfaces xe-0/0/31 congestion-notification-profile fcoe-cnp
set interfaces xe-0/0/32 congestion-notification-profile fcoe-cnp
set interfaces xe-0/0/33 congestion-notification-profile fcoe-cnp
set interfaces xe-0/0/34 congestion-notification-profile fcoe-cnp
set schedulers fcoe-sched priority low transmit-rate 3g
set schedulers fcoe-sched shaping-rate percent 100
set scheduler-maps fcoe-map forwarding-class fcoe scheduler fcoe-sched
```

Configuration for ETS Hierarchical Scheduling

The ETS-specific portion of this example configures forwarding class set (priority group) membership, priority group CoS settings (traffic control profile), and assigns the priority group and its CoS configuration to the interfaces.

```
[edit class-of-service]
set forwarding-class-sets fcoe-pg class fcoe
set traffic-control-profiles fcoe-tcp scheduler-map fcoe-map guaranteed-rate 3g
set traffic-control-profiles fcoe-tcp shaping-rate percent 100
set interfaces xe-0/0/31 forwarding-class-set fcoe-pg output-traffic-control-profile fcoe-tcp
set interfaces xe-0/0/32 forwarding-class-set fcoe-pg output-traffic-control-profile fcoe-tcp
set interfaces xe-0/0/33 forwarding-class-set fcoe-pg output-traffic-control-profile fcoe-tcp
set interfaces xe-0/0/34 forwarding-class-set fcoe-pg output-traffic-control-profile fcoe-tcp
```

Configuration for Port Scheduling

The port-scheduling-specific portion of this example assigns the scheduler map (which sets the CoS treatment of the forwarding classes in the scheduler map) to the interfaces.

```
[edit class-of-service]
set interfaces xe-0/0/31 scheduler-map fcoe-map
```

```
set interfaces xe-0/0/32 scheduler-map fcoe-map
set interfaces xe-0/0/33 scheduler-map fcoe-map
set interfaces xe-0/0/34 scheduler-map fcoe-map
```

Common Configuration (Applies to ETS Hierarchical Scheduling and to Port Scheduling)

Step-by-Step Procedure

To configure the ingress classifier for FCoE traffic, PFC on the FCoE traffic, apply the PFC and classifier configurations to interfaces, and configure queue scheduling, for both ETS hierarchical scheduling and port scheduling (common configuration):

1. Configure a classifier to set the loss priority and IEEE 802.1 code point assigned to the FCoE forwarding class at the ingress:

```
[edit class-of-service]
user@switch# set classifiers ieee-802.1 fcoe-classifier forwarding-class fcoe loss-priority
low code-points 011
```

2. Configure PFC on the FCoE queue by applying FCoE to the IEEE 802.1 code point 011:

```
[edit class-of-service]
user@switch# set congestion-notification-profile fcoe-cnp input ieee-802.1 code-point
011 pfc
```

3. Apply the PFC configuration to the ingress interfaces:

```
[edit class-of-service]
user@switch# set interfaces xe-0/0/31 congestion-notification-profile fcoe-cnp
user@switch# set interfaces xe-0/0/32 congestion-notification-profile fcoe-cnp
user@switch# set interfaces xe-0/0/33 congestion-notification-profile fcoe-cnp
user@switch# set interfaces xe-0/0/34 congestion-notification-profile fcoe-cnp
```

4. Assign the classifier to the ingress interfaces:

```
[edit class-of-service]
user@switch# set interfaces xe-0/0/31 unit 0 classifiers ieee-802.1 fcoe-classifier
user@switch# set interfaces xe-0/0/32 unit 0 classifiers ieee-802.1 fcoe-classifier
user@switch# set interfaces xe-0/0/33 unit 0 classifiers ieee-802.1 fcoe-classifier
user@switch# set interfaces xe-0/0/34 unit 0 classifiers ieee-802.1 fcoe-classifier
```

5. Configure output scheduling for the FCoE queue:

```
[edit class-of-service]
user@switch# set schedulers fcoe-sched priority low transmit-rate 3g
user@switch# set schedulers fcoe-sched shaping-rate percent 100
```

6. Map the FCoE forwarding class to the FCoE scheduler:

```
[edit class-of-service]
user@switch# set scheduler-maps fcoe-map forwarding-class fcoe scheduler fcoe-sched
```

ETS Hierarchical Scheduling Configuration

Step-by-Step Procedure To configure the forwarding class set (priority group) and priority group scheduling (in a traffic control profile), and apply the ETS hierarchical scheduling for FCoE traffic to interfaces:

1. Configure the forwarding class set for the FCoE traffic:

```
[edit class-of-service]
user@switch# set forwarding-class-sets fcoe-pg class fcoe
```

2. Define the traffic control profile for the FCoE forwarding class set:

```
[edit class-of-service]
user@switch# set traffic-control-profiles fcoe-tcp scheduler-map fcoe-map
guaranteed-rate 3g
user@switch# set traffic-control-profiles fcoe-tcp shaping-rate percent 100
```

3. Apply the FCoE forwarding class set and traffic control profile to the egress ports:

```
[edit class-of-service]
user@switch# set interfaces xe-0/0/31 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
user@switch# set interfaces xe-0/0/32 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
user@switch# set interfaces xe-0/0/33 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
user@switch# set interfaces xe-0/0/34 forwarding-class-set fcoe-pg
output-traffic-control-profile fcoe-tcp
```

Port Scheduling Configuration

Step-by-Step Procedure To apply port scheduling for FCoE traffic to interfaces:

1. Apply the scheduler map to the egress ports:

```
[edit class-of-service]
user@switch# set interfaces xe-0/0/31 scheduler-map fcoe-map
user@switch# set interfaces xe-0/0/32 scheduler-map fcoe-map
user@switch# set interfaces xe-0/0/33 scheduler-map fcoe-map
user@switch# set interfaces xe-0/0/34 scheduler-map fcoe-map
```

Results

Display the results of the configuration (the system shows only the explicitly configured parameters; it does not show default parameters such as the **fcoe** lossless forwarding class). The results are from the ETS hierarchical scheduling configuration to show the more complex configuration. Direct port scheduling results would not show the traffic control profile or forwarding class set portions of the configuration, and would display

the name of the scheduler map under each interface (instead of the names of the forwarding class set and output traffic control profile), but is otherwise the same.

```

user@switch> show configuration class-of-service
classifiers {
  ieee-802.1 fcoe-classifier {
    forwarding-class fcoe {
      loss-priority low code-points 011;
    }
  }
}
traffic-control-profiles {
  fcoe-tcp {
    scheduler-map fcoe-map;
    shaping-rate percent 100;
    guaranteed-rate 3000000000;
  }
}
forwarding-class-sets {
  fcoe-pg {
    class fcoe;
  }
}
congestion-notification-profile {
  fcoe-cnp {
    input {
      ieee-802.1 {
        code-point 011 {
          pfc;
        }
      }
    }
  }
}
}
interfaces {
  xe-0/0/31 {
    congestion-notification-profile fcoe-cnp;
    forwarding-class-set {
      fcoe-pg {
        output-traffic-control-profile fcoe-tcp;
      }
    }
    unit 0 {
      classifiers {
        ieee-802.1 fcoe-classifier;
      }
    }
  }
  xe-0/0/32 {
    congestion-notification-profile fcoe-cnp;
    forwarding-class-set {
      fcoe-pg {
        output-traffic-control-profile fcoe-tcp;
      }
    }
    unit 0 {

```

```

        classifiers {
            ieee-802.1 fcoe-classifier;
        }
    }
}
xe-0/0/33 {
    congestion-notification-profile fcoe-cnp;
    forwarding-class-set {
        fcoe-pg {
            output-traffic-control-profile fcoe-tcp;
        }
    }
    unit 0 {
        classifiers {
            ieee-802.1 fcoe-classifier;
        }
    }
}
xe-0/0/34 {
    congestion-notification-profile fcoe-cnp;
    forwarding-class-set {
        fcoe-pg {
            output-traffic-control-profile fcoe-tcp;
        }
    }
    unit 0 {
        classifiers {
            ieee-802.1 fcoe-classifier;
        }
    }
}
}
scheduler-maps {
    fcoe-map {
        forwarding-class fcoe scheduler fcoe-sched;
    }
}
schedulers {
    fcoe-sched {
        transmit-rate 3000000000;
        shaping-rate percent 100;
        priority low;
    }
}
}

```



TIP: To quickly configure the interfaces, issue the **load merge terminal** command and then copy the hierarchy and paste it into the switch terminal window.

Verification

To verify that the PFC configuration for FCoE traffic components has been created and is operating properly, perform these tasks:

- [Verifying That Priority-Based Flow Control Has Been Enabled on page 347](#)
- [Verifying the Ingress Interface PFC Configuration on page 348](#)

Verifying That Priority-Based Flow Control Has Been Enabled

Purpose Verify that PFC is enabled on the FCoE queue to enable lossless transport.

Action List the congestion notification profiles using the operational mode command **show class-of-service congestion-notification**:

```
user@switch> show class-of-service congestion-notification
```

```
Type: Input, Name: fcoe-cnp, Index: 51697
```

```
Cable Length: 100 m
```

Priority	PFC	MRU
000	Disabled	
001	Disabled	
010	Disabled	
011	Enabled	2500
100	Disabled	
101	Disabled	
110	Disabled	
111	Disabled	

```
Type: Output
```

Priority	Flow-Control-Queues
000	
	0
001	
	1
010	
	2
011	
	3
100	
	4
101	
	5
110	
	6
111	
	7

Meaning The **show class-of-service congestion-notification** operational command lists all of the congestion notification profiles and which IEEE 802.1p code points have PFC enabled. The command output shows that PFC is enabled on code point **011** for the **fcoe-cnp** congestion notification profile.

The command also shows the default cable length (100 meters), the default maximum receive unit (2500 bytes), and the default mapping of priorities to output queues because this example does not include configuring these options.

Verifying the Ingress Interface PFC Configuration

Purpose Verify that the classifier **fcoe-classifier** and the congestion notification profile **fcoe-cnp** are configured on ingress interfaces **xe-0/0/31**, **xe-0/0/32**, **xe-0/0/33**, and **xe-0/0/34**.

Action List the ingress interfaces using the operational mode command **show configuration class-of-service interfaces**:

```
user@switch> show configuration class-of-service interfaces xe-0/0/31
```

```
congestion-notification-profile fcoe-cnp;
unit 0 {
  classifiers {
    ieee-802.1 fcoe-classifier;
  }
}
```

```
user@switch> show configuration class-of-service interfaces xe-0/0/32
```

```
congestion-notification-profile fcoe-cnp;
unit 0 {
  classifiers {
    ieee-802.1 fcoe-classifier;
  }
}
```

```
user@switch> show configuration class-of-service interfaces xe-0/0/33
```

```
congestion-notification-profile fcoe-cnp;
unit 0 {
  classifiers {
    ieee-802.1 fcoe-classifier;
  }
}
```

```
user@switch> show configuration class-of-service interfaces xe-0/0/34
```

```
congestion-notification-profile fcoe-cnp;
unit 0 {
  classifiers {
    ieee-802.1 fcoe-classifier;
  }
}
```

Meaning The **show configuration class-of-service interfaces** commands list the congestion notification profile that is mapped to the interface (**fcoe-cnp**) and the IEEE 802.1p classifier associated with the interface (**fcoe-classifier**).

- Related Documentation**
- [Understanding CoS Flow Control \(Ethernet PAUSE and PFC\) on page 327](#)

CHAPTER 5

Learn About Technology

- [Data Center Technology Overview Videos on page 351](#)

Data Center Technology Overview Videos

Juniper Information Experience (IX) videos provide brief, high-level overviews of data center technologies and concepts. Each video runs approximately one-and-a-half to two minutes in length. This document contains SDN-related videos and links to conceptual documents that contain other data center technology videos:

- [Learn About Video: Why Do We Need an IP Fabric? on page 351](#)
- [Learn About Video: What is the Best Control Plane Protocol to Use in a Data Center IP Fabric? on page 351](#)
- [Learn About Video: Why Use an Overlay Network in a Data Center? on page 351](#)
- [Conceptual Documents That Contain Technology Overview Videos on page 352](#)

Learn About Video: Why Do We Need an IP Fabric?

The video *Why Do We Need an IP Fabric?* presents a brief overview of IP Fabric use cases.



Video: [Why Do We Need an IP Fabric?](#)

Learn About Video: What is the Best Control Plane Protocol to Use in a Data Center IP Fabric?

The video *What is the Best Control Plane Protocol to Use in a Data Center IP Fabric?* presents a brief overview of the arguments for using Border Gateway Protocol (BGP) as the data center IP fabric control plane protocol.



Video: [What is the Best Control Plane Protocol to Use in a Data Center IP Fabric?](#)

Learn About Video: Why Use an Overlay Network in a Data Center?

The video *Why Use an Overlay Network in a Data Center?* presents a brief overview of the advantages of data center overlay networks.



Video: [Why Use an Overlay Network in a Data Center?](#)

Conceptual Documents That Contain Technology Overview Videos

The following conceptual documents include brief video overviews of the technology:

- [Understanding DCB Features and Requirements on page 292](#)
- *Understanding CoS Hierarchical Port Scheduling (ETS)*
- [Understanding CoS Flow Control \(Ethernet PAUSE and PFC\) on page 327](#)
- [Understanding DCBX on page 295](#)
- *Understanding PFC Functionality Across Layer 3 Interfaces*
- *Virtual Chassis Fabric Overview*
- *Understanding In-Service Software Upgrade (ISSU) and In-Service Software Upgrade (ISSU) System Requirements (same video)*

PART 4

Configuration Statements and Operational Commands


- [Configuration Statements for Transit Switches, FCoE, and FIP Snooping on page 355](#)
- [Operational Commands for Transit Switches, FCoE, and FIP Snooping on page 371](#)
- [Configuration Statements for Fibre Channel and FCoE-FC Gateways on page 433](#)
- [Operational Commands for Fibre Channel and FCoE-FC Gateways on page 473](#)
- [Configuration Statements for Data Center Bridging and PFC on page 563](#)
- [Operational Commands for Data Center Bridging on page 583](#)

CHAPTER 6


Configuration Statements for Transit Switches, FCoE, and FIP Snooping

- [beacon-period on page 356](#)
- [examine-vn2vf on page 357](#)
- [examine-vn2vn on page 358](#)
- [family fcoe on page 359](#)
- [fc-map on page 360](#)
- [fcoe-lag on page 362](#)
- [fip-security on page 363](#)
- [fcoe-trusted on page 364](#)
- [interface \(FIP Snooping\) on page 365](#)
- [no-fcoe-lag on page 366](#)
- [no-fip-snooping-scaling on page 367](#)
- [node-group \(OxID Hash Control\) on page 368](#)
- [oxid on page 369](#)

beacon-period

Syntax	<code>beacon-period <i>milliseconds</i>;</code>
Hierarchy Level	Original CLI [edit ethernet-switching options secure-access-port vlan (all <i>vlan-name</i>) examine-fip examine-vn2vn] ELS CLI for Platforms that Support FCoE [edit vlans <i>vlan-name</i> forwarding-options fip-security]
	<div>  <p>NOTE: The <code>beacon-period</code> configuration statement is in a different hierarchy on the original CLI than on the Enhanced Layer 2 Software (ELS) CLI.</p> </div>
Release Information	Statement introduced in Junos OS Release 12.2 for the QFX Series. Statement introduced for the ELS CLI in Junos OS Release 13.2 for the QFX Series.
Description	<p>Set the interval between periodic beacons. Beacons perform virtual link maintenance for VN_Ports in a way that is similar to FIP keepalive advertisements.</p> <p>The ENode sends periodic beacons every 90 seconds on behalf of the VN_Port. Each received beacon resets the session timer for the virtual link connection to the other VN_Port. If the FCF does not receive a beacon before the beacon timer expires, the VN_Port is considered as “down” and the virtual link is terminated. The beacon timer expires in 2.5 times the configured beacon timer value.</p>
Options	<p><i>milliseconds</i>—Time in milliseconds between beacons.</p> <p>Range: 250 through 90000 milliseconds</p> <p>Default: 8000 milliseconds</p>
Required Privilege Level	<p>storage—To view this statement in the configuration.</p> <p>storage-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring VN2VN_Port FIP Snooping (FCoE Hosts Directly Connected to the Same FCoE Transit Switch) on page 120 • Example: Configuring VN2VN_Port FIP Snooping (FCoE Hosts Directly Connected to Different FCoE Transit Switches) on page 125 • Example: Configuring VN2VN_Port FIP Snooping (FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch) on page 132

examine-vn2vf

Syntax	<pre>examine-vn2vf { }</pre>
Hierarchy Level	[edit vlans <i>vlan-name</i> forwarding-options fip-security]
Release Information	Statement introduced for the ELS CLI in Junos OS Release 13.2 for the QFX Series.
Description	<p> NOTE: This statement supports the Enhanced Layer 2 Software (ELS) CLI. If your switch runs the original (non-ELS) software, see <i>examine-fip</i>. For ELS details, see <i>Using the Enhanced Layer 2 Software CLI</i>.</p> <p>Enable VN_Port to VF_Port (VN2VF_Port) FIP snooping on the specified VLAN. Ensure that the VLAN is a dedicated FCoE VLAN that transports only FCoE traffic.</p> <p>If the switch also performs VN_Port to VN_Port (VN2VN_Port) FIP snooping, ensure that the VN2VN_Port traffic is on a different VLAN than the VN2VF_Port traffic. You cannot mix VN2VF_Port and VN2VN_Port traffic in the same VLAN, so you must use separate VLANs for VN2VF_Port and VN2VN_Port traffic.</p> <p>The remaining statement is explained separately. Also, see CLI Explorer.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • examine-vn2vn on page 358 • Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch on page 101 • Understanding FCoE Transit Switch Functionality on page 46 • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108

examine-vn2vn

Syntax `examine-vn2vn {
 beacon-period milliseconds;
}`

Hierarchy Level Original CLI

`[edit ethernet-switching options secure-access-port vlan (all | vlan-name) examine-fip]`

ELS CLI for Platforms that Support FCoE

`[edit vlans vlan-name forwarding-options fip-security]`



NOTE: The `examine-vn2vn` configuration statement is in a different hierarchy on the original CLI than on the Enhanced Layer 2 Software (ELS) CLI.

Release Information Statement introduced in Junos OS Release 12.2 for the QFX Series.
Statement introduced for the ELS CLI in Junos OS Release 13.2 for the QFX Series.

Description Enable VN_Port to VN_Port (VN2VN) FIP snooping on a specified VLAN. The VLAN must be a dedicated FCoE VLAN that transports only FCoE traffic. A VLAN cannot support VN2VN FIP snooping and VN_Port to VF_Port FIP snooping (VN2VF) simultaneously. Configure separate VLANs for VN2VN FIP snooping and VN2VF FIP snooping.

When you enable VN2VN FIP snooping on a VLAN, the VN2VF session filters are removed and the all existing VN2VF sessions are terminated.

The remaining statement is explained separately. See [CLI Explorer](#).

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to the Same FCoE Transit Switch\) on page 120](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Directly Connected to Different FCoE Transit Switches\) on page 125](#)
- [Example: Configuring VN2VN_Port FIP Snooping \(FCoE Hosts Indirectly Connected Through an Aggregation Layer FCoE Transit Switch\) on page 132](#)

family fcoe

Syntax QFX Series Standalone Switches

```
family fcoe {
  oxid (enable | disable);
}
```

QFabric Systems

```
family fcoe {
  ethernet-interfaces {
    node-group (node-group-name | all) {
      oxid (enable | disable);
    }
  }
  fabric-interfaces {
    node-group (node-group-name | all) {
      oxid (enable | disable);
    }
  }
}
```

Hierarchy Level [edit forwarding-options hash-key]

Release Information Statement introduced in Junos OS Release 12.3 for the QFX Series. Ethernet-interfaces and fabric-interfaces statements introduced in Junos OS Release 13.2X52-D10 for the QFX Series.

Description Configure whether or not to use the originator exchange identifier (OxID) field for hash control for FCoE traffic load balancing.

Options The remaining statement is explained separately. See [CLI Explorer](#).

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- [Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on Standalone Switches on page 82](#)
- [Understanding OxID Hash Control for FCoE Traffic Load Balancing on Standalone Switches on page 81](#)

fc-map

Syntax `fc-map fc-map-value;`

Hierarchy Level Original CLI

[edit ethernet-switching options secure-access-port vlan (all | *vlan-name*) examine-fip]

ELS CLI for Platforms that Support FCoE

[edit vlans *vlan-name* forwarding-options **fip-security**]



NOTE: The `fc-map` configuration statement is in a different hierarchy on the original CLI than on the Enhanced Layer 2 Software (ELS) CLI.

QFX Series that Support FCoE-FC Gateway Configuration

[edit **fc-fabrics** *fc-fabric-name* **protocols fip**]

Release Information Statement introduced in Junos OS Release 10.4 for EX Series switches.
Statement introduced in Junos OS Release 11.1 for the QFX Series.
Statement introduced for the ELS CLI in Junos OS Release 13.2 for the QFX Series.

Description Set the FCoE mapped address prefix (FC-MAP) value for the FCoE VLAN to match the FC switch (or FCoE forwarder) FC-MAP value for the FC fabric. The FC-MAP value is a unique MAC address prefix an FC switch uses to identify FCoE traffic for a given FC fabric (traffic on a particular FCoE VLAN).

You can configure the FC-MAP value or use the default value. The default FC-MAP value is different for VN_Port to VF_Port (VN2VF_Port) FIP snooping (0x0EFC00) than for VN_Port to VN_Port (VN2VN_Port) FIP snooping.

The FC switch provides the FC-MAP value to FCoE nodes (ENodes) in the FIP discovery advertisement message. If the EX Series switch or the QFX Series FCoE VLAN FC-MAP value does not match the FC switch FC-MAP value, neither device discovers the FC switch on that VLAN, and the ENodes on that VLAN cannot access the FC switch. The FC switch accepts only FCoE traffic that uses the correct FC-MAP value as part of the VN_Port MAC address.

When the QFX Series acts as an FCoE-FC gateway, the FC-MAP value for the gateway and the FCoE devices must match the FC switch FC-MAP value in order to communicate with the FC switch.



NOTE: Changing the FC-MAP value causes all logins to drop and forces the ENodes to log in again.

Options	<p><i>fc-map-value</i>—FC-MAP value, hexadecimal value preceded by “0x”.</p> <p>Range: 0x0EFC00 through 0x0EFCFF</p> <p>Default: 0x0EFC00 for VN2VF_Port FIP snooping 0x0EFD00 for VN2VN_Port FIP snooping</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>examine-fip</i> • show fip snooping on page 377 • <i>Example: Configuring an FCoE Transit Switch</i> • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108

fcoe-lag

Syntax	fcoe-lag;
Hierarchy Level	[edit interfaces <i>lag-interface-name</i> aggregated-ether-options]
Release Information	Statement introduced in Junos OS Release 13.2X52-D10 for the QFX Series.
Description	<p>Configure a special link aggregation group (LAG) to transport Fibre Channel over Ethernet (FCoE) traffic and regular Ethernet traffic across the same link aggregation bundle.</p> <p>An FCoE LAG ensures that FCoE traffic uses the same link within a LAG to transmit and receive information between an FCoE device and a Fibre Channel (FC) SAN switch across a QFabric system Node device. This preserves the point-to-point link emulation that FC requires. A standard LAG uses a hashing algorithm to determine the LAG link used for each communication, so with a standard LAG, you cannot guarantee that communication between an FCoE device and the QFabric system Node device always uses the same link. If communication between the FCoE device and the QFabric system Node device uses different physical links, the SAN terminates the link.</p> <p>An FCoE LAG treats regular Ethernet traffic (traffic that is not FCoE traffic) in the same way as on a standard LAG, providing link redundancy and load-balancing for the regular Ethernet traffic. An FCoE LAG does not provide link redundancy or load balancing for FCoE traffic.</p> <p>On FCoE-FC gateways, if the gateway has one or more untrusted FC fabrics, you must also disable FIP snooping scaling on the gateway by including the no-fip-snooping-scaling option in the [edit fc-options] hierarchy.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • no-fcoe-lag on page 366 • no-fip-snooping-scaling on page 367 • Configuring an FCoE LAG on page 63 • Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85 • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • Understanding FCoE LAGs on page 57

fip-security

Syntax (EX4600
Switches and QFX
Series Switches)

```
fip-security {
  examine-vn2vf;
  examine-vn2vn {
    beacon-period milliseconds;
  }
  fc-map fc-map-value;
  interface interface-name {
    (fcoe-trusted | no-fcoe-trusted;)
  }
}
```

Hierarchy Level

[edit vlans *vlan-name* forwarding-options]

Release Information

Statement introduced for the ELS CLI in Junos OS Release 13.2 for the QFX Series.

Description



NOTE: This statement supports the Enhanced Layer 2 Software (ELS) CLI. If your switch runs the original (non-ELS) software, see *examine-fip*. For ELS details, see *Using the Enhanced Layer 2 Software CLI*.

Configure FIP snooping and FCoE interface properties.

The remaining statements are explained separately. Also, see [CLI Explorer](#).


Required Privilege
Level

routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related
Documentation


- [Understanding VN_Port to VF_Port FIP Snooping on an FCoE Transit Switch on page 101](#)
- [Understanding VN_Port to VN_Port FIP Snooping on an FCoE Transit Switch on page 111](#)
- [Understanding FCoE Transit Switch Functionality on page 46](#)
- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Enabling VN2VN_Port FIP Snooping and Configuring the Beacon Period on an FCoE Transit Switch on page 118](#)

fcoe-trusted

Syntax	fcoe-trusted;
Hierarchy Level	Original CLI [edit ethernet-switching-options secure-access-port interface <i>interface-name</i>] ELS CLI for Platforms that Support FCoE [edit vlans <i>vlan-name</i> forwarding-options fip-security interface <i>interface-name</i>]
	<p> NOTE: The fcoe-trusted configuration statement is in a different hierarchy on the original CLI than on the Enhanced Layer 2 Software (ELS) CLI.</p> <p>QFX Series that Support FCoE-FC Gateway Configuration</p> <p>[edit fc-fabrics <i>fc-fabric-name</i> protocols fip]</p>
Release Information	Statement introduced in Junos OS Release 10.4 for EX Series switches. Statement introduced in Junos OS Release 11.1 for the QFX Series. Statement introduced for the FC fabric in Junos OS Release 11.3 for the QFX Series. Statement introduced for the ELS CLI in Junos OS Release 13.2 for the QFX Series.
Description	<p>Configure the specified 10-Gigabit Ethernet interface to trust Fibre Channel over Ethernet (FCoE) traffic. If an interface is connected to another switch such as an FCoE forwarder (FCF) or a transit switch, you can configure the interface as trusted so that the interface forwards FCoE traffic from the switch to the FCoE devices without installing FIP snooping filters.</p> <p>(QFX Series FCoE-FC gateway) Configure the specified local Fibre Channel fabric to trust FCoE traffic on all ports in the fabric. Changing the fabric ports from untrusted to trusted removes any existing FIP snooping filters from the ports. Changing the fabric ports from trusted to untrusted by removing the fcoe-trusted configuration from the fabric forces all of the FCoE sessions on those ports to log out so that when the ENodes and VN_Ports log in again, the switch can build the appropriate FIP snooping filters.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • show fip snooping on page 377 • <i>Example: Configuring an FCoE Transit Switch</i>

- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)

interface (FIP Snooping)

Syntax	<pre>interface <i>interface-name</i> { (<i>fcoe-trusted</i> no-fcoe-trusted); }</pre>
Hierarchy Level	[edit vlans <i>vlan-name</i> forwarding-options <i>fip-security</i>]
Release Information	Statement introduced for the ELS CLI in Junos OS Release 13.2 for the QFX Series.
Description	<p> NOTE: This statement supports the Enhanced Layer 2 Software (ELS) CLI. If your switch runs the original (non-ELS) software, see <i>interface (Secure Access Port)</i> for how to specify an interface to configure as FCoE trusted or FCoE untrusted. For ELS details, see <i>Using the Enhanced Layer 2 Software CLI</i>.</p> <p>Specify an interface to set as FCoE trusted or as FCoE untrusted. Configure interfaces that connect to other switches as trusted interfaces. Configure interfaces that connect directly to FCoE devices as untrusted interfaces and enabled FIP snooping on the untrusted interfaces to prevent unauthorized access to the storage network.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • Understanding FCoE Transit Switch Functionality on page 46

no-fcoe-lag

Syntax	no-fcoe-lag;
Hierarchy Level	[edit interfaces <i>lag-interface-name</i> aggregated-ether-options]
Release Information	Statement introduced in Junos OS Release 13.2X52-D10 for the QFX Series.
Description	<p>Convert an FCoE LAG into a standard LAG. When you convert an FCoE LAG into a standard LAG, the standard LAG no longer works reliably for FCoE traffic. This is because FCoE traffic must use the same physical link within a LAG interface for communication between the FCoE device and the Fibre Channel SAN across a QFabric system Node device. A standard LAG uses a hashing algorithm to determine the link to use for each transmission, so there is no way to guarantee that a response will use the same link on which a device receives a request. An FCoE LAG guarantees that the same physical LAG link is used for communication between an FCoE device and the QFabric system Node device.</p> <p>If you convert an FCoE LAG into a standard LAG, do not use the standard LAG for FCoE traffic.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• fcoe-lag on page 362• no-fip-snooping-scaling on page 367• Configuring an FCoE LAG on page 63• Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85• Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108• Understanding FCoE LAGs on page 57

no-fip-snooping-scaling

Syntax	no-fip-snooping-scaling
Hierarchy Level (FCoE-FC gateway)	[edit fc-options]
Hierarchy Level (FCoE Transit Switch)	[edit ethernet-switching-options secure-access-port vlan (all <i>vlan-name</i>) examine-fip]
Release Information	Statement introduced in Junos OS Release 13.2X52-D10 for the QFX Series.
Description	<p>Disable FIP snooping scaling on all FCoE VLANs on an FCoE-FC gateway, or disable FIP snooping scaling on the specified FCoE VLAN on an FCoE transit switch.</p> <p>Disabling FIP snooping scaling reduces the maximum number of FIP snooping sessions from 2,500 sessions (the maximum with FIP snooping scaling enabled) to 376 sessions. FIP snooping scaling is enabled by default.</p> <p>Use this statement to disable FIP snooping scaling if you want to configure an FCoE LAG on an FCoE-FC gateway that contains one or more untrusted FC fabrics. Untrusted FC fabrics do not support FIP snooping scaling.</p> <p>On an FCoE transit switch, you can use this statement to disable FIP snooping scaling on a specified FCoE VLAN.</p>
Default	FIP snooping scaling is enabled by default.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • fcoe-lag on page 362 • Configuring an FCoE LAG on page 63 • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85 • Understanding FCoE LAGs on page 57

node-group (OxID Hash Control)

Syntax	<pre>node-group (<i>node-group-name</i> all) { oxid (enable disable); }</pre>
Hierarchy Level	<pre>[edit forwarding-options hash-key <i>family fcoe</i> ethernet-interfaces] [edit forwarding-options hash-key <i>family fcoe fabric-interfaces]</i></pre>
Release Information	Statement introduced in Junos OS Release 13.2X52-D10 for the QFX Series.
Description	Specify a QFabric system Node group on which to enable or disable OxID hash control. OxID hash control is enabled or disabled on the fabric ports or on the Ethernet (FCoE) LAG ports that face an FCoE forwarder (FCF).
Options	<p><i>node-group</i>—Name of the Node group on which you want to enable OxID hash control.</p> <p><i>all</i>—All Node groups on the QFabric system (OxID hash control will be enabled or disabled on all Node groups).</p> <p>The remaining statement is explained separately. See CLI Explorer.</p>
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on QFabric Systems on page 83 • Understanding OxID Hash Control for FCoE Traffic Load Balancing on QFabric Systems on page 79

oxid

Syntax	<code>oxid (enable disable)</code>
Hierarchy Level	<p>QFX Series Standalone Switches</p> <pre>[edit forwarding-options hash-key family fcoe]</pre> <p>QFabric Systems</p> <pre>[edit forwarding-options hash-key family fcoe ethernet-interfaces node-group (node-group-name all) {}] [edit forwarding-options hash-key family fcoe fabric-interfaces node-group (node-group-name all) {}]</pre>
Release Information	<p>Statement introduced in Junos OS Release 12.3 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 13.2X52-D10 for the QFabric System.</p>
Description	Enable or disable whether the switch uses the originator exchange identifier (OxID) field for hash control for FCoE traffic load balancing.
Default	OxID hash control is enabled by default.
Options	oxid (enable disable) —Enable or disable whether the switch uses the OxID hash control field for FCoE traffic load balancing.
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on Standalone Switches on page 82 • Understanding OxID Hash Control for FCoE Traffic Load Balancing on Standalone Switches on page 81

CHAPTER 7

Operational Commands for Transit Switches, FCoE, and FIP Snooping

- `clear fip snooping enode`
- `clear fip snooping statistics`
- `clear fip snooping vlan`
- `clear fip vlan-discovery statistics`
- `show dcbx`
- `show fip snooping`
- `show fip snooping enode`
- `show fip snooping fcf`
- `show fip snooping interface`
- `show fip snooping statistics`
- `show fip snooping vlan`
- `show fip vlan-discovery`
- `show dcbx neighbors`

clear fip snooping enode

Syntax	<code>clear fip snooping enode <i>enode-mac</i> <vlan <i>vlan-name</i>></code>
Syntax (Junos Fusion)	<code>clear fip snooping satellite enode <i>enode-mac</i> <vlan <i>vlan-name</i>></code>
Release Information	<p>Command introduced in Junos OS Release 10.4 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Command introduced with satellite keyword in Junos OS Release 17.4R1 for Junos Fusion Data Center.</p>
Description	<p>Clear FIP snooping information for the specified FCoE Node (ENode) or (optionally) only on a specified FCoE VLAN.</p> <p>This operation deletes the ENode state from the switch database and from the FIP snooping firewall filters, which causes the ENode to lose its connection to the FCoE forwarder (FCF) and to log in to the FCF again.</p> <p>The command syntax in a Junos Fusion environment includes the satellite keyword and clears FIP snooping Enode information on satellite device FCoE VLANs, which have FCoE and FIP functions and status information distributed between the aggregation devices and satellite devices. The command validates that a specified VLAN is a satellite FCoE VLAN, and displays an error message if the satellite syntax is not used for a satellite FCoE VLAN, or if the satellite syntax is used with a VLAN that is not a satellite FCoE VLAN.</p>
Options	<p><i>enode-mac</i>—MAC address of the ENode.</p> <p><i>vlan vlan-name</i>—(Optional) Name of the VLAN.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fip snooping enode (or show fip snooping satellite enode) on page 383
List of Sample Output	clear fip snooping enode enode-mac on page 372

Sample Output

clear fip snooping enode enode-mac

```
user@switch> clear fip snooping enode 00:10:94:00:00:02
```

clear fip snooping statistics

Syntax	<code>clear fip snooping statistics</code> <code><vlan vlan-name></code>
Syntax (Junos Fusion)	<code>clear fip snooping satellite statistics</code> <code><vlan vlan-name></code>
Release Information	<p>Command introduced in Junos OS Release 10.4 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Command introduced with satellite keyword in Junos OS Release 17.4R1 for Junos Fusion Data Center.</p>
Description	<p>Clear FIP snooping statistics globally or on a specified VLAN.</p> <p>The command syntax in a Junos Fusion environment includes the satellite keyword and clears FIP snooping information for satellite device FCoE VLANs, which have FCoE and FIP functions and status information distributed between the aggregation devices and satellite devices. The command validates that a specified VLAN is a satellite FCoE VLAN, and displays an error message if the satellite syntax is not used for a satellite FCoE VLAN, or if the satellite syntax is used with a VLAN that is not a satellite FCoE VLAN.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fip snooping statistics (or show fip snooping satellite statistics) on page 394
List of Sample Output	clear fip snooping statistics on page 373

Sample Output

clear fip snooping statistics

```
user@switch> clear fip snooping statistics
```

clear fip snooping vlan

Syntax	<code>clear fip snooping vlan <i>vlan-name</i></code>
Syntax (Junos Fusion)	<code>clear fip snooping satellite vlan <i>vlan-name</i></code>
Release Information	<p>Command introduced in Junos OS Release 10.4 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Command introduced with satellite keyword in Junos OS Release 17.4R1 for Junos Fusion Data Center.</p>
Description	<p>Clear FIP snooping information for the specified FCoE VLAN.</p> <p>This operation deletes all ENode and FCF information for the specified VLAN from the switch database and causes the ENodes to lose their connections to the FCFs. After clearing a VLAN, the switch relearns all of the FCFs and ENodes on the VLAN, and the ENodes must log in to the FCF again.</p> <p>The command syntax in a Junos Fusion environment includes the satellite keyword to clear FIP snooping information for satellite device FCoE VLANs, which have FCoE and FIP functions distributed between the aggregation devices and satellite devices. The command validates that a specified VLAN is a satellite FCoE VLAN, and displays an error message if the satellite syntax is not used for a satellite FCoE VLAN, or if the satellite syntax is used with a VLAN that is not a satellite FCoE VLAN.</p>
Options	<i>vlan-name</i> —Name of the VLAN.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> show fip snooping vlan (or show fip snooping satellite vlan) on page 398
List of Sample Output	clear fip snooping vlan vlan-name on page 374

Sample Output

clear fip snooping vlan *vlan-name*

```
user@switch> clear fip snooping vlan fcoevlan1
```

clear fip vlan-discovery statistics

Syntax `clear fip vlan-discovery statistics`

Release Information Command introduced in Junos OS Release 12.1 for the QFX Series.

Description Clear FIP VLAN discovery statistics.

Required Privilege Level view

Related Documentation

- [show fip vlan-discovery on page 402](#)

List of Sample Output [clear fip vlan-discovery statistics on page 375](#)

Sample Output

`clear fip vlan-discovery statistics`

```
user@switch> clear fip vlan-discovery statistics
```

show dcbx

Syntax	show dcbx
Release Information	Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	List DCBX status (enabled or disabled) and the interfaces on which DCBX is enabled.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show dcbx neighbors on page 404 • Configuring DCBX Autonegotiation on page 305
Output Fields	Table 26 on page 376 lists the output fields for the show dcbx command. Output fields are listed in the approximate order in which they appear.

Table 26: show dcbx output fields

Field Name	Field Description
DCBX	Status of DCBX on the switch or for the specified interface: <ul style="list-style-type: none"> • Enabled—DCBX is enabled on the switch or on the specified interface • Disabled—DCBX is disabled on the switch or on the specified interface
Interface	Name of the interface

Sample Output

show dcbx

```

user@switch> show dcbx
DCBX                               : Enabled
Interface      DCBX
xe-0/0/9.0     enabled
xe-0/0/32.0    enabled
xe-0/0/36.0    enabled

```


show fip snooping

Syntax	show fip snooping <brief detail>
Syntax (Junos Fusion)	show fip snooping satellite <brief detail>
Release Information	Command introduced in Junos OS Release 10.4 for EX Series switches. Command introduced in Junos OS Release 11.1 for the QFX Series. Command introduced with satellite keyword in Junos OS Release 17.4R1 for Junos Fusion Data Center.
Description	Display FIP snooping information. The command syntax in a Junos Fusion environment includes the satellite keyword and displays FIP snooping information for satellite device FCoE VLANs, which have FCoE and FIP functions and status information distributed between the aggregation devices and satellite devices. The command validates that a specified VLAN is a satellite FCoE VLAN, and displays an error message if the satellite syntax is not used for a satellite FCoE VLAN, or if the satellite syntax is used with a VLAN that is not a satellite FCoE VLAN.
Options	none —Display FIP snooping information. brief detail —(Optional) Display the specified level of output.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • Configuring an FCoE LAG on page 63 • Example: Configuring an FCoE LAG on a Redundant Server Node Group on page 66 • show fip snooping enode on page 383 • show fip snooping fcf on page 387 • show fip snooping statistics on page 394 • show fip snooping vlan on page 398 • show fip snooping interface on page 391
List of Sample Output	show fip snooping on page 380 show fip snooping brief (QFX Series) on page 380

[show fip snooping detail \(QFX Series Switches\) on page 380](#)
[show fip snooping detail \(QFabric System FCoE with LAG Configured\) on page 381](#)
[show fip snooping detail \(EX Series Switches\) on page 381](#)
[show fip snooping satellite detail \(Junos Fusion Data Center\) on page 382](#)
[show fip snooping satellite detail \(Junos Fusion Data Center with FCoE LAG Configured\) on page 382](#)

Output Fields Table 27 on page 378 lists the output fields for the **show fip snooping** command. Output fields are listed in the approximate order in which they appear.

Table 27: show fip snooping Output Fields

Field Name	Field Description	Level of Output
VLAN	Name of the VLAN.	All
Mode	(QFX Series only) Snooping mode enabled on the FCoE VLAN: <ul style="list-style-type: none"> • VN2VF Snooping—The FCoE VLAN is configured for FIP snooping between an ENode VN_Port and a switch VF_Port. • VN2VN Snooping—The FCoE VLAN is configured for VN_Port to VN_Port FIP snooping between ENode VN_Ports. 	All
FC-MAP	FCoE mapped address prefix of the FCoE forwarder for the VLAN.	All
FCF or FCF-MAC	MAC address of the FCF.	All
Session Count or Active Sessions	Current number of virtual link sessions with VN_Ports.	All
VN_Port Count	(QFX Series only) Number of VN_Ports active on an ENode.	brief
Configured FKA-ADV	FIP keepalive interval in seconds configured on the FCF multiplied by three. For example, if the FKA_ADV period configured on the FCF is 86 seconds, the value of this field is 258. For the QFX Series only, the output of this field is always 0 (zero) if the VLAN is an FCoE-FC gateway VLAN. If the VLAN is a FIP snooping VLAN (a transit switch VLAN), then the output is accurate. This is because for an FCoE-FC gateway VLAN, FIP snooping is performed internally and the keepalive advertisements are not tracked by the switch's Ethernet module.	detail

Table 27: show fip snooping Output Fields (continued)

Field Name	Field Description	Level of Output
Running FKA-ADV	<p>Runtime interval in seconds of the last FIP keepalive advertisement the FCF received. This value changes every time the FCF receives an FKA_ADV.</p> <p>For the QFX Series only, the output of this field is always 0 (zero) if the VLAN is an FCoE-FC gateway VLAN. If the VLAN is a FIP snooping VLAN (a transit switch VLAN), then the output is accurate. This is because for an FCoE-FC gateway VLAN, FIP snooping is performed internally and the keepalive advertisements are not tracked by the switch's Ethernet module.</p> <p>In a Junos Fusion environment when using the satellite syntax of this command, this field is not included in the output.</p>	detail
Beacon Period	<p>(QFX Series only)</p> <p>Beacon period interval in milliseconds.</p>	detail
VN2VN Mode	<p>(QFX Series only)</p> <p>Mode of VN2VN_Port snooping:</p> <ul style="list-style-type: none"> Multi-Point—Multiple ENodes are connected to the network and form multiple virtual links. Each virtual link is created between one pair of VN_Ports. This is analogous to the loop mode in traditional FC networks. Point-to-Point—Two ENodes are connected to the network and form a single VN_Port to VN_Port virtual link. This is analogous to the point-to-point FC link between an FC initiator and an FC target. 	detail
ENode-MAC	MAC address of the connected FCoE node (ENode).	All
Interface	<p>Interface connected to the ENode.</p> <p>When using the Junos Fusion satellite keyword for this command, the ENode is always connected to a satellite device port, so the interface name corresponds to a satellite device FPC ID. (See <i>Understanding Junos Fusion Data Center Components</i> for details.)</p> <p>(QFabric System or Junos Fusion satellite command output only)</p> <p>When an FCoE LAG has been configured, this field displays both the LAG interface and the LAG member interface connected to the ENode.</p>	detail
VN-Port MAC	MAC address of a VN_Port on the ENode.	All
FKA-ADV	<p>Runtime interval in seconds of the last FIP keepalive advertisement the ENode sent to the FCF on behalf of the VN_Port (VN_Port FKA_ADV). This value changes every time the ENode sends a VN_Port FKA_ADV to the FCF.</p> <p>In a Junos Fusion environment when using the satellite syntax of this command, this field is not included in the output.</p>	detail

Table 27: show fip snooping Output Fields (continued)

Field Name	Field Description	Level of Output
Active VN_Ports	(QFX Series only) Number of VN_Ports active on an ENode.	detail
Vlink far-end VN-Port-MAC	(QFX Series only) Media access control (MAC) address of the VN_Port at the other end of the virtual link.	detail

Sample Output

show fip snooping

```

user@switch> show fip snooping

VLAN : fcoevlan1      FC-MAP : 0e:fc:00
FCF : 00:10:94:00:00:01  Session Count : 2
  Enode-MAC : 00:10:94:00:00:02
    VN-Port-MAC : 0E:FC:00:01:00:05
    VN-Port-MAC : 0E:FC:00:01:00:01

```

show fip snooping brief (QFX Series)

```

user@switch> show fip snooping brief

VLAN: vlan100,      Mode: VN2VF Snooping
FC-MAP: 0e:fc:00
FCF: 30:10:94:01:00:00  Session Count: 2
  Enode-MAC: 10:10:94:01:00:01
    VN-Port-MAC: 0e:fc:00:01:0d:01
    VN-Port-MAC: 0e:fc:00:01:0e:01
VLAN: vlan101,      Mode: VN2VN Snooping
FC-MAP: 0e:fc:00
  Enode-MAC: 10:10:94:01:00:02 VN_Port count: 1
    VN-Port-MAC: 0e:fc:00:01:0a:01  Session Count: 2
  Enode-MAC: 10:10:94:01:00:03 VN_Port count: 0

```

show fip snooping detail (QFX Series Switches)

```

user@switch> show fip snooping detail

root@sw-pa02v> show fip snooping detail
VLAN: vlan100,      Mode: VN2VF Snooping
FC-MAP: 0e:fc:00
FCF Information
FCF-MAC           : 30:10:94:01:00:00
Active Sessions   : 2
Configured FKA-ADV : 258
Running FKA-ADV    : 188
  Enode Information
    Enode-MAC: 10:10:94:01:00:01,      Interface: xe-0/0/10
    Configured FKA-ADV : 258
    Running FKA-ADV    : 230
    Session Information
      VN-Port MAC: 0e:fc:00:01:0d:01,    FKA-ADV : 230

```

```

VN-Port MAC: 0e:fc:00:01:0e:01,   FKA-ADV : 245
VLAN: vlan101, Mode: VN2VN Snooping
FC-MAP: 0e:fd:00
Beacon_Period: 90000
VN2VN Mode: Multi-Point
  Enode Information
    Enode-MAC: 10:10:94:01:00:02,   Interface: xe-0/0/10
    Active VN_Ports : 1
    VN_Port Information
      VN-Port MAC: 0e:fd:00:01:0a:01
      Active Sessions : 2
      Session Information
        Vlink far-end VN-Port-MAC: 0e:fd:00:01:0b:01
        Vlink far-end VN-Port-MAC: 0e:fd:00:01:0c:01
      Enode-MAC: 10:10:94:01:00:02,   Interface: xe-0/0/11
      Active VN_Ports : 0

```

show fip snooping detail (QFabric System FCoE with LAG Configured)

```

admin@qfabric> show fip snooping detail
VLAN: vlan_100, Mode: VN2VF Snooping
FC-MAP: 0e:fc:00
FCF Information
FCF-MAC : 84:18:88:d1:f5:cc
Active Sessions : 2
Configured FKA-ADV : 8000
Running FKA-ADV : 23962
  Enode Information
    Enode-MAC: 00:c0:dd:14:ae:6d,   Interface: P4546-C:ae0 P4546-C:xe-0/0/39

    Configured FKA-ADV : 8000
    Running FKA-ADV : 16622
    Session Information
      VN-Port MAC: 0e:fc:00:6c:06:a5,   FKA-ADV : 246303
    Enode Information
      Enode-MAC: 00:c0:dd:14:ae:6f,   Interface: P4546-C:ae0 P4546-C:xe-0/0/38

    Configured FKA-ADV : 8000
    Running FKA-ADV : 16512
    Session Information
      VN-Port MAC: 0e:fc:00:6c:06:a4,   FKA-ADV : 238150

```

show fip snooping detail (EX Series Switches)

```

user@switch> show fip snooping detail
VLAN : fcoevlan1   FC-MAP : 0e:fc:00
FCF Information
FCF-MAC : 00:10:94:00:00:01
Active Sessions : 2
Configured FKA-ADV : 258
Running FKA-ADV : 244
  Enode Information
    Enode-MAC : 00:10:94:00:00:02   Interface : xe-0/0/1
    Configured FKA-ADV : 258
    Running FKA-ADV : 248
    Session Information

```

```
VN-Port MAC : 0E:FC:00:01:00:05    FKA-ADV : 264
VN-Port MAC : 0E:FC:00:01:00:01    FKA-ADV : 260
```

show fip snooping satellite detail (Junos Fusion Data Center)

```
user@switch> show fip snooping satellite detail
VLAN: v200, Mode: VN2VF Snooping
FC-MAP: 0e:fc:00
FCF Information
FCF-MAC : 30:10:94:01:00:00
Active Sessions : 1
Configured FKA-ADV : 80000
  Enode Information
    Enode-MAC: 10:10:94:01:00:01,      Interface: xe-102/0/1.0
    Session Information
      VN-Port MAC: 0e:fc:00:01:0a:01,
```

show fip snooping satellite detail (Junos Fusion Data Center with FCoE LAG Configured)

```
user@switch> show fip snooping satellite detail
VLAN: vlan_100, Mode: VN2VF Snooping
FC-MAP: 0e:fc:00
FCF Information
FCF-MAC : 30:10:94:01:00:00
Active Sessions : 2
Configured FKA-ADV : 90000
  Enode Information
    Enode-MAC: 10:10:94:01:00:01,      Interface: ae0 et-101/0/2
    Session Information
      VN-Port MAC: 0e:fc:00:01:0a:01,
      VN-Port MAC: 0e:fc:00:01:0b:01,
```

show fip snooping enode

Syntax	<code>show fip snooping enode <i>enode-mac</i></code> <code><brief detail></code> <code><vlan <i>vlan-name</i>></code>
Syntax (Junos Fusion)	<code>show fip snooping satellite enode <i>enode-mac</i></code> <code><brief detail></code> <code><vlan <i>vlan-name</i>></code>
Release Information	Command introduced in Junos OS Release 10.4 for EX Series switches. Command introduced in Junos OS Release 11.1 for the QFX Series. Command introduced with satellite keyword in Junos OS Release 17.4R1 for Junos Fusion Data Center.
Description	Display FIP snooping FCoE node (ENode) information. The command syntax in a Junos Fusion environment includes the satellite keyword and displays FIP snooping information for ENodes on satellite device FCoE VLANs, which have FCoE and FIP functions and status information distributed between the aggregation devices and satellite devices. The command validates that a specified VLAN is a satellite FCoE VLAN, and displays an error message if the satellite syntax is not used for a satellite FCoE VLAN, or if the satellite syntax is used with a VLAN that is not a satellite FCoE VLAN.
Options	brief detail —(Optional) Display the specified level of output. <i>enode-mac</i> —Display information for the ENode specified by the MAC address. vlan <i>vlan-name</i> —(Optional) Display FIP snooping information for the ENode on only the specified VLAN.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • Example: Configuring an FCoE Transit Switch • show fip snooping on page 377 • show fip snooping fcf on page 387 • show fip snooping statistics on page 394 • show fip snooping vlan on page 398 • show fip snooping interface on page 391

List of Sample Output [show fip snooping enode on page 385](#)
[show fip snooping enode brief \(QFX Series\) on page 386](#)
[show fip snooping enode detail \(QFX Series\) on page 386](#)
[show fip snooping enode detail on page 386](#)
[show fip snooping satellite enode detail \(Junos Fusion Data Center\) on page 386](#)

Output Fields Table 28 on page 384 lists the output fields for the **show fip snooping enode** command. Output fields are listed in the approximate order in which they appear.

Table 28: show fip snooping enode Output Fields

Field Name	Field Description	Level of Output
ENode and ENode MAC	MAC address of the ENode.	All
VLAN	Name of the VLAN.	All
Interface	Interface connected to the ENode. When using the Junos Fusion satellite keyword for this command, the Enode is always connected to a satellite device extended port, so the interface name corresponds to a satellite device FPC ID. (See <i>Understanding Junos Fusion Data Center Components</i> for details.)	All
Mode	(QFX Series only) Snooping mode enabled on the FCoE VLAN: <ul style="list-style-type: none"> • VN2VF Snooping—The FCoE VLAN is configured for FIP snooping between an ENode VN_Port and a switch VF_Port. • VN2VN Snooping—The FCoE VLAN is configured for VN_Port to VN_Port FIP snooping between ENode VN_Ports. 	All
VN_Port Count	(QFX Series only) Number of VN_Ports active on an ENode.	brief
Session Count	Current number of virtual link sessions with VN_Ports.	All
Configured FKA-ADV	FIP keepalive interval in seconds configured on the FCoE forwarder (FCF) multiplied by three. For example, if the FKA_ADV period configured on the FCF is 86 seconds, the value of this field is 258. This value remains constant. For the QFX Series only, the output of this field is always 0 (zero) if the VLAN is an FCoE-FC gateway VLAN. If the VLAN is a FIP snooping VLAN (a transit switch VLAN), then the output is accurate. This is because for an FCoE-FC gateway VLAN, FIP snooping is performed internally and the keepalive advertisements are not tracked by the switch's Ethernet module.	detail

Table 28: show fip snooping enode Output Fields (continued)

Field Name	Field Description	Level of Output
Running FKA-ADV	<p>Runtime interval in seconds of the last FIP keepalive advertisement the ENode sent to the FCF. This value changes every time the ENode sends an FKA_ADV to the FCF.</p> <p>For the QFX Series only, the output of this field is always 0 (zero) if the VLAN is an FCoE-FC gateway VLAN. If the VLAN is a FIP snooping VLAN (a transit switch VLAN), then the output is accurate. This is because for an FCoE-FC gateway VLAN, FIP snooping is performed internally and the keepalive advertisements are not tracked by the switch's Ethernet module.</p> <p>In a Junos Fusion environment when using the satellite syntax of this command, this field is not included in the output.</p>	detail
VN-Port or VN-Port-MAC	MAC address of a VN_Port on the ENode.	All
FKA-ADV	<p>Runtime interval in seconds of the last FIP keepalive advertisement the ENode sent to the FCF on behalf of the VN_Port (VN_Port FKA_ADV). This value changes every time the ENode sends a VN_Port FKA_ADV to the FCF.</p> <p>In a Junos Fusion environment when using the satellite syntax of this command, this field is not included in the output.</p>	detail
FCF or FCF-MAC	MAC address of the FCF to which the VN_Port is connected.	All
Beacon Period	(QFX Series only) Beacon period interval in milliseconds.	detail
VN2VN Mode	<p>(QFX Series only) Mode of VN2VN_Port snooping:</p> <ul style="list-style-type: none"> Multi-Point—Multiple ENodes are connected to the network and form multiple virtual links. Each virtual link is created between one pair of VN_Ports. This is analogous to the loop mode in traditional FC networks. Point-to-Point—Two ENodes are connected to the network and form a single VN_Port to VN_Port virtual link. This is analogous to the point-to-point FC link between an FC initiator and an FC target. 	detail
Vlink far-end VN-Port-MAC	(QFX Series only) Media access control (MAC) address of the VN_Port at the other end of the virtual link.	detail

Sample Output

show fip snooping enode

```
user@switch> show fip snooping enode 00:10:94:00:00:02
```

```
Enode : 00:10:94:00:00:02   VLAN : vlan1   Interface : xe-0/0/1
      VN-Port-MAC           FCF-MAC
      0E:FC:00:00:00:05     00:10:94:00:00:01
      0E:FC:00:00:00:01     00:10:94:00:00:01
```

show fip snooping enode brief (QFX Series)

```
user@switch> show fip snooping enode 10:10:94:01:00:02 brief
Enode: 10:10:94:01:00:02 ,   VLAN: vlan101,   Interface: xe-0/0/10
Mode: VN2VF Snooping        VN_Port Count: 1
      VN_Port Information
      VN_Port Mac: 0e:fc:00:01:0a:01   Session Count: 2
```

show fip snooping enode detail (QFX Series)

```
user@switch> show fip snooping enode 10:10:94:01:00:02 detail
Enode MAC: 10:10:94:01:00:02,   VLAN: vlan101,   Interface: xe-0/0/10
Mode: VN2VF Snooping           VN_Port Count: 1
Beacon_Period: 90000           VN2VN Mode: Multi-Point
      VN_Port Information
      VN_Port Mac: 0e:fc:00:01:0a:01   Session Count: 2
Vlink far-end VN-Port-MAC: 0e:fc:00:01:0b:01
Vlink far-end VN-Port-MAC: 0e:fc:00:01:0c:01
```

show fip snooping enode detail

```
user@switch> show fip snooping enode 00:10:94:00:00:02 detail
Enode MAC : 00:10:94:00:00:02   VLAN : vlan1   Interface : xe-0/0/1
Configured FKA-ADV : 258       Running FKA-ADV : 213
      Session Information
      VN-Port : 0E:FC:00:00:00:05   FKA-ADV : 229   FCF : 00:10:94:00:00:01
      VN-Port : 0E:FC:00:00:00:01   FKA-ADV : 225   FCF : 00:10:94:00:00:01
```

show fip snooping satellite enode detail (Junos Fusion Data Center)

```
user@switch> show fip snooping satellite enode 10:10:94:01:00:01 detail
Enode MAC: 10:10:94:01:00:01,   VLAN: 200,   Interface: xe-102/0/1.0
      Session Information
      VN-Port : 0E:FC:00:01:0A:01,   FCF : 30:10:94:01:00:00
```

show fip snooping fcf

Syntax	<code>show fip snooping fcf <i>fcf-mac</i></code> <code><brief detail></code> <code><vlan <i>vlan-name</i>></code>
Syntax (Junos Fusion)	<code>show fip snooping satellite fcf <i>fcf-mac</i></code> <code><brief detail></code> <code><vlan <i>vlan-name</i>></code>
Release Information	Command introduced in Junos OS Release 10.4 for EX Series switches. Command introduced in Junos OS Release 11.1 for the QFX Series. Command introduced with satellite keyword in Junos OS Release 17.4R1 for Junos Fusion Data Center.
Description	<p>Display FIP snooping FCoE forwarder (FCF) information.</p> <p>The command syntax in a Junos Fusion environment includes the satellite keyword and displays FIP snooping FCF information for satellite device FCoE VLANs, which have FCoE and FIP functions and status information distributed between the aggregation devices and satellite devices. The command validates that a specified VLAN is a satellite FCoE VLAN, and displays an error message if the satellite syntax is not used for a satellite FCoE VLAN, or if the satellite syntax is used with a VLAN that is not a satellite FCoE VLAN.</p>
Options	<p>brief detail—(Optional) Display the specified level of output.</p> <p><i>fcf-mac</i>—Display information for the FCF specified by the MAC address.</p> <p><i>vlan-name</i>—(Optional) Display FIP snooping information for the FCF on only the specified VLAN.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • Example: Configuring an FCoE Transit Switch • show fip snooping on page 377 • show fip snooping enode on page 383 • show fip snooping statistics on page 394 • show fip snooping vlan on page 398 • show fip snooping interface on page 391

List of Sample Output [show fip snooping fcf on page 389](#)
[show fip snooping fcf detail on page 389](#)

Output Fields [Table 29 on page 388](#) lists the output fields for the **show fip snooping fcf** command. Output fields are listed in the approximate order in which they appear.

Table 29: show fip snooping fcf Output Fields

Field Name	Field Description	Level of Output
FCF or FCF-MAC	MAC address of the FCoE forwarder.	All
VLAN	Name of the VLAN.	All
Session Count	Current number of virtual link sessions with VN_Ports.	None
Configured FKA-ADV	FIP keepalive interval in seconds configured on the FCF multiplied by three. For example, if the FKA_ADV period configured on the FCF is 86 seconds, the value of this field is 258.	detail
Running FKA-ADV	Runtime interval in seconds of the last FIP keepalive advertisement the FCF received. This value changes every time the FCF receives an FKA_ADV. In a Junos Fusion environment when using the satellite syntax of this command, this field is not included in the output.	detail

Table 29: show fip snooping fcf Output Fields (continued)

Field Name	Field Description	Level of Output
ENode-MAC	MAC address of the connected ENode.	All
<ul style="list-style-type: none"> Interface 	<p>Interface connected to the ENode.</p> <p>When using the Junos Fusion satellite keyword for this command, the ENode is always connected to a satellite device extended port, so the interface name corresponds to a satellite device FPC ID. (See <i>Understanding Junos Fusion Data Center Components</i> for details.)</p>	detail
<ul style="list-style-type: none"> Configured FKA-ADV 	FIP keepalive interval in seconds configured on the FCF multiplied by three. For example, if the FKA_ADV period configured on the FCF is 86 seconds, the value of this field is 258. This value remains constant.	detail
<ul style="list-style-type: none"> Running FKA-ADV 	<p>Runtime interval in seconds of the last FIP keepalive advertisement the ENode sent to the FCF. This value changes every time the ENode sends an FKA_ADV to the FCF.</p> <p>In a Junos Fusion environment when using the satellite syntax of this command, this field is not included in the output.</p>	detail
<ul style="list-style-type: none"> VN-Port MAC 	MAC address of a VN_Port on the ENode.	All
<ul style="list-style-type: none"> FKA-ADV 	<p>Runtime interval in seconds of the last FIP keepalive advertisement the ENode sent to the FCF on behalf of the VN_Port (VN_Port FKA_ADV). This value changes every time the ENode sends a VN_Port FKA_ADV to the FCF.</p> <p>In a Junos Fusion environment when using the satellite syntax of this command, this field is not included in the output.</p>	detail

Sample Output

show fip snooping fcf

```

user@switch> show fip snooping fcf 00:10:94:00:00:01
FCF : 00:10:94:00:00:01   VLAN : vlan1   Session Count : 2
  ENode-MAC : 00:10:94:00:00:02
    VN-Port-MAC : 0E:FC:00:00:00:05
    VN-Port-MAC : 0E:FC:00:00:00:01

```

show fip snooping fcf detail

```

user@switch> show fip snooping fcf 00:10:94:00:00:01 detail

```

```
FCF-MAC : 00:10:94:00:00:01      VLAN : v1an1
Configured FKA-ADV : 258          Running FKA-ADV : 222
  Enode Information
  Enode-MAC : 00:10:94:00:00:02 Interface: xe-0/0/1
  Configured FKA-ADV : 258
  Running FKA-ADV      : 226
    Session Information
    VN-Port MAC : 0E:FC:00:00:00:05      FKA-ADV : 242
    VN-Port MAC : 0E:FC:00:00:00:01      FKA-ADV : 238
```

show fip snooping interface

Syntax	show fip snooping interface <i>interface-name</i> <brief detail>
Release Information	Command introduced in Junos OS Release 12.1 for the QFX Series.
Description	Display FIP snooping information for the specified interface.
Options	brief detail —(Optional) Display the specified level of output. interface-name —Display information for the specified interface.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • show fip snooping on page 377 • show fip snooping enode on page 383 • show fip snooping fcf on page 387 • show fip snooping statistics on page 394 • show fip snooping vlan on page 398
List of Sample Output	show fip snooping interface on page 393 show fip snooping interface detail on page 393
Output Fields	Table 30 on page 391 lists the output fields for the show fip snooping interface interface-name command. Output fields are listed in the approximate order in which they appear.

Table 30: show fip snooping interface Output Fields

Field Name	Field Description	Level of Output
VLAN	Name of the VLAN.	All
FC-MAP	FCoE mapped address prefix of the FCoE forwarder for the VLAN.	All
FCF or FCF-MAC	MAC address of the FCF.	All
Session Count or Active Sessions	Current number of virtual link sessions with VN_Ports.	All

Table 30: show fip snooping interface Output Fields (continued)

Field Name	Field Description	Level of Output
Configured FKA-ADV	<p>FIP keepalive interval in seconds configured on the FCF multiplied by three. For example, if the FKA_ADV period configured on the FCF is 86 seconds, the value of this field is 258.</p> <p>For the QFX Series only, the output of this field is always 0 (zero) if the VLAN is an FCoE-FC gateway VLAN. If the VLAN is a FIP snooping VLAN (a transit switch VLAN), then the output is accurate. This is because for an FCoE-FC gateway VLAN, FIP snooping is performed internally and the keepalive advertisements are not tracked by the switch's Ethernet module.</p>	detail
Running FKA-ADV	<p>Runtime interval in seconds of the last FIP keepalive advertisement the FCF received. This value changes every time the FCF receives an FKA_ADV.</p> <p>For the QFX Series only, the output of this field is always 0 (zero) if the VLAN is an FCoE-FC gateway VLAN. If the VLAN is a FIP snooping VLAN (a transit switch VLAN), then the output is accurate. This is because for an FCoE-FC gateway VLAN, FIP snooping is performed internally and the keepalive advertisements are not tracked by the switch's Ethernet module.</p>	detail
ENode-MAC	MAC address of the connected FCoE node (ENode).	All
Interface	Interface connected to the ENode.	detail
Configured FKA-ADV	<p>FIP keepalive interval in seconds configured on the FCF multiplied by three. For example, if the FKA_ADV period configured on the FCF is 86 seconds, the value of this field is 258. This value remains constant.</p> <p>For the QFX Series only, the output of this field is always 0 (zero) if the VLAN is an FCoE-FC gateway VLAN. If the VLAN is a FIP snooping VLAN (a transit switch VLAN), then the output is accurate. This is because for an FCoE-FC gateway VLAN, FIP snooping is performed internally and the keepalive advertisements are not tracked by the switch's Ethernet module.</p>	detail
Running FKA-ADV	<p>Runtime interval in seconds of the last FIP keepalive advertisement the ENode sent to the FCF. This value changes every time the ENode sends an FKA_ADV to the FCF.</p> <p>For the QFX Series only, the output of this field is always 0 (zero) if the VLAN is an FCoE-FC gateway VLAN. If the VLAN is a FIP snooping VLAN (a transit switch VLAN), then the output is accurate. This is because for an FCoE-FC gateway VLAN, FIP snooping is performed internally and the keepalive advertisements are not tracked by the switch's Ethernet module.</p>	detail
VN-Port MAC	MAC address of a VN_Port on the ENode.	All

Table 30: show fip snooping interface Output Fields (continued)

Field Name	Field Description	Level of Output
FKA-ADV	Runtime interval in seconds of the last FIP keepalive advertisement the ENode sent to the FCF on behalf of the VN_Port (VN_Port FKA_ADV). This value changes every time the ENode sends a VN_Port FKA_ADV to the FCF.	detail

Sample Output

show fip snooping interface

```
user@switch> show fip snooping interface xe-0/0/9.0
VLAN: vlan_100,    FC-MAP: 0e:fc:00
FCF: 30:10:94:01:00:00    Session Count: 1
  Enode-MAC: 10:10:94:01:00:01
    VN-Port-MAC: 0e:fc:00:01:0a:01
```

show fip snooping interface detail

```
user@switch> show fip snooping interface xe-0/0/9.0 detail
VLAN: vlan_100, FC-MAP: 0e:fc:00
FCF Information
FCF-MAC      : 30:10:94:01:00:00
Active Sessions : 1
Configured FKA-ADV : 368640000
Running FKA-ADV  : 0
  Enode Information
  Enode-MAC: 10:10:94:01:00:01,      Interface: xe-0/0/9
  Configured FKA-ADV : 368640000
  Running FKA-ADV    : 0
    Session Information
    VN-Port MAC: 0e:fc:00:01:0a:01,  FKA-ADV : 0
```

show fip snooping statistics

Syntax	show fip snooping statistics <vlan vlan-name>
Syntax (Junos Fusion)	show fip snooping satellite statistics <vlan vlan-name>
Release Information	<p>Command introduced in Junos OS Release 10.4 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Command introduced with satellite keyword in Junos OS Release 17.4R1 for Junos Fusion Data Center.</p>
Description	<p>Display FIP snooping statistics.</p> <p>The command syntax in a Junos Fusion environment includes the satellite keyword and displays FIP snooping statistics for satellite device FCoE VLANs, which have FCoE and FIP functions and status information distributed between the aggregation devices and satellite devices. The command validates that a specified VLAN is a satellite FCoE VLAN, and displays an error message if the satellite syntax is not used for a satellite FCoE VLAN, or if the satellite syntax is used with a VLAN that is not a satellite FCoE VLAN.</p>
Options	vlan vlan-name —(Optional) Display FIP snooping statistics for the specified VLAN.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • <i>Example: Configuring an FCoE Transit Switch</i> • show fip snooping on page 377 • show fip snooping enode on page 383 • show fip snooping fcf on page 387 • show fip snooping vlan on page 398 • show fip snooping interface on page 391
List of Sample Output	show fip snooping statistics (FIP Snooping) on page 396 show fip snooping statistics (VN2VN_Port Snooping) on page 396
Output Fields	<p>Table 31 on page 395 lists the output fields for the show fip snooping statistics command. Output fields are listed in the approximate order in which they appear.</p>

Table 31: show fip snooping statistics Output Fields

Field Name	Field Description
VLAN	Name of the VLAN for which a set of statistics is displayed.
Mode	(QFX Series only) Snooping mode enabled on the FCoE VLAN: <ul style="list-style-type: none"> • VN2VF Snooping—The FCoE VLAN is configured for FIP snooping between an ENode VN_Port and a switch VF_Port. • VN2VN Snooping—The FCoE VLAN is configured for VN_Port to VN_Port FIP snooping between ENode VN_Ports.
Number of MDS	Number of multicast discovery solicitation messages sent on the VLAN.
Number of UDS	Number of unicast discovery solicitation messages sent on the VLAN.
Number of FLOGI	Number of fabric logins on the VLAN.
Number of FDISC	Number of fabric discovery logins on the VLAN.
Number of LOGO	Number of fabric logouts on the VLAN.
Number of ENode-keep-alive	Number of ENode keepalive messages sent on the VLAN.
Number of VNPort-keep-alive	Number of VN_Port keepalive messages sent on the VLAN.
Number of MDA	Number of multicast discovery advertisement messages sent on the VLAN.
Number of UDA	Number of unicast discovery advertisement messages sent on the VLAN.
Number of FLOGI_ACC	Number of fabric logins accepted on the VLAN.
Number of FLOGI_RJT	Number of fabric logins rejected on the VLAN.
Number of FDISC_ACC	Number of fabric discoveries accepted on the VLAN.
Number of FDISC_RJT	Number of fabric discoveries rejected on the VLAN.
Number of LOGO_ACC	Number of fabric logouts accepted on the VLAN.
Number of LOGO_RJT	Number of fabric logouts rejected on the VLAN.
Number of CVL	Number of clear virtual links (CVL) actions on the VLAN.
Number of VN_Port Probes Req	(QFX Series only) Number of multicast N_Port_ID probes sent to the ALL-VN2VN-ENode-MACs multicast address on the VLAN.

Table 31: show fip snooping statistics Output Fields (continued)

Field Name	Field Description
Number of VN_Port Claim Notif	(QFX Series only) Number of multicast N_Port_ID claim notifications sent on the VLAN.
Number of VN_Port Beacons	(QFX Series only) Number of multicast beacons sent on the VLAN.
Number of VN_Port Probes Reply	(QFX Series only) Number of replies to N_Port_ID probes sent on the VLAN. Replies are unicast to the ENode MAC address of the probe requester.
Number of VN_Port Claim Reply	(QFX Series only) Number of replies to N_Port_ID claim notifications sent on the VLAN. Replies are unicast to the ENode MAC address of the claim notifier.

Sample Output

show fip snooping statistics (FIP Snooping)

```

user@switch> show fip snooping statistics
VLAN: fcoevlan1      Mode: VN2VF Snooping

  Number of MDS:          2
  Number of UDS:          2
  Number of FLOGI:        2
  Number of FDISC:        2
  Number of LOGO:         0
  Number of Enode-keep-alive: 200
  Number of VNPort-keep-alive: 200

  Number of MDA:          25
  Number of UDA:          2
  Number of FLOGI_ACC:    2
  Number of FLOGI_RJT:    0
  Number of FDISC_ACC:    2
  Number of FDISC_RJT:    0
  Number of LOGO_ACC:     0
  Number of LOGO_RJT:     0
  Number of CVL:          0

```

show fip snooping statistics (VN2VN_Port Snooping)

```

user@switch> show fip snooping statistics
VLAN: vlan101      Mode: VN2VN Snooping

  Number of VN_Port Probes Req:    3
  Number of VN_Port Claim Notif:   3
  Number of VN_Port Beacons:       0

  Number of VN_Port Probes Reply:   3

```

Number of VN_Port Claim Reply:	3
Number of FLOGI:	0
Number of FLOGI_ACC:	0
Number of FLOGI_RJT:	0
Number of FDISC:	0
Number of FDISC_ACC:	0
Number of FDISC_RJT:	0
Number of LOGO:	0
Number of LOGO_ACC:	0
Number of LOGO_RJT:	0

show fip snooping vlan

Syntax	show fip snooping vlan <i>vlan-name</i> <brief detail>
Syntax (Junos Fusion)	show fip snooping satellite vlan <i>vlan-name</i> <brief detail>
Release Information	<p>Command introduced in Junos OS Release 10.4 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Command introduced with satellite keyword in Junos OS Release 17.4R1 for Junos Fusion Data Center.</p>
Description	<p>Display FIP snooping VLAN information.</p> <p>The command syntax in a Junos Fusion environment includes the satellite keyword and displays FIP snooping information for satellite device FCoE VLANs, which have FCoE and FIP functions and status information distributed between the aggregation devices and satellite devices. The command validates that a specified VLAN is a satellite FCoE VLAN, and displays an error message if the satellite syntax is not used for a satellite FCoE VLAN, or if the satellite syntax is used with a VLAN that is not a satellite FCoE VLAN.</p>
Options	<p>brief detail—(Optional) Display the specified level of output.</p> <p><i>vlan-name</i>—Display information for the specified VLAN.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • <i>Example: Configuring an FCoE Transit Switch</i> • show fip snooping on page 377 • show fip snooping enode on page 383 • show fip snooping fcf on page 387 • show fip snooping statistics on page 394 • show fip snooping interface on page 391
List of Sample Output	<p>show fip snooping vlan on page 400</p> <p>show fip snooping vlan (QFX Series, VN2VF_Port FIP Snooping) on page 400</p> <p>show fip snooping vlan (QFX Series, VN2VN_Port FIP Snooping) on page 401</p> <p>show fip snooping vlan detail (QFX Series, VN2VN_Port FIP Snooping) on page 401</p>

[show fip snooping vlan detail on page 401](#)

Output Fields [Table 32 on page 399](#) lists the output fields for the **show fip snooping vlan** command. Output fields are listed in the approximate order in which they appear.

Table 32: show fip snooping vlan Output Fields

Field Name	Field Description	Level of Output
VLAN	Name of the VLAN.	All
Mode	(QFX Series only) Snooping mode enabled on the FCoE VLAN: <ul style="list-style-type: none"> VN2VF Snooping—The FCoE VLAN is configured for FIP snooping between an ENode VN_Port and a switch VF_Port. VN2VN Snooping—The FCoE VLAN is configured for VN_Port to VN_Port FIP snooping between ENode VN_Ports. 	All
VN_Port count	(QFX Series only) Number of VN_Ports active on an ENode when the mode is VN2VN_Port FIP snooping.	
FC-MAP	FCoE mapped address prefix of the FCoE forwarder for the VLAN.	All
Beacon_Period	(QFX Series only) Beacon period interval in milliseconds.	detail
VN2VN Mode	(QFX Series only) Mode of VN2VN_Port snooping: <ul style="list-style-type: none"> Multi-Point—Multiple ENodes are connected to the network and form multiple virtual links. Each virtual link is created between one pair of VN_Ports. This is analogous to the loop mode in traditional FC networks. Point-to-Point—Two ENodes are connected to the network and form a single VN_Port to VN_Port virtual link. This is analogous to the point-to-point FC link between an FC initiator and an FC target. 	detail
FCF or FCF-MAC	MAC address of the FCF.	All
Session Count or Active Sessions	Current number of virtual link sessions with VN_Ports.	All
Configured FKA-ADV	FIP keepalive interval in seconds configured on the FCF multiplied by three. For example, if the FKA_ADV period configured on the FCF is 86 seconds, the value of this field is 258.	detail
Running FKA-ADV	Runtime interval in seconds of the last FIP keepalive advertisement the FCF received. This value changes every time the FCF receives an FKA_ADV.	detail

Table 32: show fip snooping vlan Output Fields (continued)

Field Name	Field Description	Level of Output
ENode-MAC	MAC address of the connected ENode.	All
<ul style="list-style-type: none"> Interface 	Interface connected to the ENode. When using the Junos Fusion satellite keyword for this command, the ENode is always connected to a satellite device extended port, so the interface name corresponds to a satellite device FPC ID. (See <i>Understanding Junos Fusion Data Center Components</i> for details.)	detail
<ul style="list-style-type: none"> Configured FKA-ADV 	FIP keepalive interval in seconds configured on the FCF multiplied by three. For example, if the FKA_ADV period configured on the FCF is 86 seconds, the value of this field is 258. This value remains constant.	detail
<ul style="list-style-type: none"> Running FKA-ADV 	Runtime interval in seconds of the last FIP keepalive advertisement the ENode sent to the FCF. This value changes every time the ENode sends an FKA_ADV to the FCF.	detail
<ul style="list-style-type: none"> VN-Port MAC 	MAC address of a VN_Port on the ENode.	All
<ul style="list-style-type: none"> FKA-ADV 	Runtime interval in seconds of the last FIP keepalive advertisement the ENode sent to the FCF on behalf of the VN_Port (VN_Port FKA_ADV). This value changes every time the ENode sends a VN_Port FKA_ADV to the FCF.	detail
<ul style="list-style-type: none"> Active VN_Ports 	(QFX Series only) Number of VN_Ports active on an ENode.	detail
<ul style="list-style-type: none"> Vlink far-end VN-Port-MAC 	(QFX Series only) Media access control (MAC) address of the VN_Port at the other end of the virtual link.	detail

Sample Output

show fip snooping vlan

```

user@switch> show fip snooping vlan fcoevlan1
VLAN : fcoevlan1      FC-MAP : 0e:fc:00
FCF : 00:10:94:00:00:01  Session Count : 2
ENode-MAC : 00:10:94:00:00:02
VN-Port-MAC : 0E:FC:00:00:00:05
VN-Port-MAC : 0E:FC:00:00:00:01

```

show fip snooping vlan (QFX Series, VN2VF_Port FIP Snooping)

```

user@switch> show fip snooping vlan fcoevlan1

```



```
VLAN : fcoevlan1      Mode: VN2VF Snooping
FC-MAP : 0e:fc:00
FCF : 00:10:94:00:00:01  Session Count : 2
Enode-MAC : 00:10:94:00:00:02
VN-Port-MAC : 0E:FC:00:00:00:05
VN-Port-MAC : 0E:FC:00:00:00:01
```

show fip snooping vlan (QFX Series, VN2VN_Port FIP Snooping)

```
user@switch> show fip snooping vlan vlan101

VLAN: vlan101,      Mode: VN2VN Snooping
FC-MAP: 0e:fd:00
Enode-MAC: 10:10:94:01:00:02 VN_Port count: 1
VN-Port-MAC: 0e:fd:00:00:0a:01 Session Count: 2
Enode-MAC: 10:10:94:01:00:03 VN_Port count: 0
```

show fip snooping vlan detail (QFX Series, VN2VN_Port FIP Snooping)

```
user@switch> show fip snooping vlan vlan101 detail

VLAN: vlan101, Mode: VN2VN Snooping
FC-MAP: 0e:fd:00
Beacon_Period: 90000
VN2VN Mode: Multi-Point
Enode Information
Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/10
Active VN_Ports : 1
VN_Port Information
VN-Port MAC: 0e:fd:00:00:0a:01
Active Sessions : 2
Session Information
Vlink far-end VN-Port-MAC: 0e:fd:00:00:0b:01
Vlink far-end VN-Port-MAC: 0e:fd:00:00:0c:01
Enode-MAC: 10:10:94:01:00:02,      Interface: xe-0/0/11
Active VN_Ports : 0
```

show fip snooping vlan detail

```
user@switch> show fip snooping vlan fcoevlan1 detail

VLAN : fcoevlan1      FC-MAP : 0e:fc:00
FCF Information
FCF-MAC : 00:10:94:00:00:01
Active Sessions : 2
Configured FKA-ADV : 258
Running FKA-ADV : 235
Enode Information
Enode-MAC : 00:10:94:00:00:02      Interface : xe-0/0/1
Configured FKA-ADV : 258
Running FKA-ADV : 239
Session Information
VN-Port MAC : 0E:FC:00:00:00:05      FKA-ADV : 255
VN-Port MAC : 0E:FC:00:00:00:01      FKA-ADV : 251
```

show fip vlan-discovery

Syntax	show fip vlan-discovery (enodes statistics)
Release Information	Command introduced in Junos OS Release 12.1 for the QFX Series.
Description	Display FCoE VLAN information from the Fibre Channel switch or FCoE forwarder (FCF).
Options	enodes —Display VLAN discovery information for each ENode. statistics —Display VLAN discovery information statistics.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> clear fip vlan-discovery statistics on page 375
List of Sample Output	show fip vlan-discovery enodes on page 403 show fip vlan-discovery statistics (QFX3500) on page 403 show fip vlan-discovery statistics (QFabric Systems) on page 403
Output Fields	Table 33 on page 402 lists the output fields for the show fip vlan-discovery command. Output fields are listed in the approximate order in which they appear.

Table 33: show fip vlan-discovery Output Fields

Field Name	Field Description	Level of Output
Enode-MAC	Media access control (MAC) address of the ENode.	enodes
Interface	Name of the interface.	enodes
Unsolicited notification count	Number of unsolicited VLAN discovery notifications.	All
Solicited notification count	Number of solicited VLAN discovery notifications.	statistics
Node Group Name	Displays the name of the Node group on QFabric systems.	statistics
Request count	Number of VLAN discovery requests sent by the ENode. This number should match the Solicited notification count number.	statistics
VLAN tags	Tags of the FIP-enabled VLANs.	enodes

Sample Output

show fip vlan-discovery enodes

```
user@switch> show fip vlan-discovery enodes
```

Enode-MAC	Interface	Unsolicited Notification Count	Vlan Tags
00:10:94:00:00:02	xe-0/0/9.0	0	400

show fip vlan-discovery statistics (QFX3500)

```
user@switch> show fip vlan-discovery statistics
```

```
Request count: 0
Solicited notification count: 0
Unsolicited notification count: 1
```

show fip vlan-discovery statistics (QFabric Systems)

```
user@switch> show fip vlan-discovery statistics
```

```
NW-NG-0:
```

```
-----
Request count: 0
Solicited notification count: 0
Unsolicited notification count: 1
```

```
BBAK0399:
```

```
-----
Request count: 0
Solicited notification count: 0
Unsolicited notification count: 1
```

```
FCG001:
```

```
-----
Request count: 0
Solicited notification count: 0
Unsolicited notification count: 1
```

show dcbx neighbors

Syntax	<pre>show dcbx neighbors <interface interface-name> <terse></pre>
Release Information	<p>Command introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Command introduced in Junos OS Release 11.3 for EX Series switches.</p>
Description	Display information about Data Center Bridging Capability Exchange protocol (DCBX) neighbor interfaces.
Options	<p>none—Display information about all DCBX neighbor interfaces.</p> <p>interface-name—(Optional) Display information for the specified interface.</p> <p>terse—Display the specified level of output.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring DCBX Autonegotiation on page 305 • Example: Configuring DCBX Application Protocol TLV Exchange on page 316 • Example: Configuring an FCoE Transit Switch • Example: Configuring DCBX to Support an iSCSI Application • Understanding DCB Features and Requirements on page 292 • Understanding Data Center Bridging Capability Exchange Protocol for EX Series Switches • Understanding DCBX on Junos Fusion Data Center • dcbx on page 571
List of Sample Output	<p>show dcbx neighbors interface (Junos Fusion Data Center, DCBX Version 1.01 Mode) on page 419</p> <p>show dcbx neighbors interface (QFX Series, DCBX Version 1.01 Mode) on page 423</p> <p>show dcbx neighbors interface (QFX Series, IEEE DCBX Mode) on page 424</p> <p>show dcbx neighbors terse (QFX Series) on page 427</p> <p>show dcbx neighbors (EX4500 Switch: FCoE Interfaces on Both Local and Peer with PFC Configured Compatibly) on page 427</p> <p>show dcbx neighbors (EX4500 Switch: DCBX Interfaces on Local and Peer Are Configured Compatibly with iSCSI Application) on page 428</p> <p>show dcbx neighbors (EX4500 Switch: Includes ETS) on page 429</p>
Output Fields	<p>Table 34 on page 405 lists the output fields for the show dcbx neighbors command. Output fields are listed in the approximate order in which they appear.</p>

Table 34: show dcbx neighbors Output Fields

Field Name	Field Description
Interface	Name of the interface.
Parent Interface	Name of the link aggregation group (LAG) interface to which the DCBX interface belongs.
Active-application-map	Name of the application map applied to the interface.
Protocol-Mode	<p>(QFX Series) DCBX protocol mode the interface uses:</p> <ul style="list-style-type: none"> • IEEE DCBX Version—The interface uses IEEE DCBX mode. • DCBX Version 1.01—The interface uses DCBX version 1.01. <p>NOTE: On interfaces that use the IEEE DCBX mode, the show dcbx neighbors interface <i>interface-name</i> operational command does not include application, PFC, or ETS operational state in the output.</p>
Protocol-State	<p>(DCBX Version 1.01 only) DCBX protocol state synchronization status:</p> <ul style="list-style-type: none"> • in-sync—The local interface received an acknowledge message from the peer to indicate that the peer received a state change message sent by the local interface. • ack-pending—The local interface has not yet received an acknowledge message from the peer to indicate that the peer received a state change message sent by the local interface.

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Local-Advertisement	<p>(DCBX Version 1.01 only)</p> <p>Status of advertisements that the local interface sends to the peer.</p>
Operational version	Version of the DCBX standard used.
sequence-number	<p>Number of state change messages sent to the peer.</p> <p>If the interface Protocol-State value is in-sync, this number should match the acknowledge-id number in the Peer-Advertisement section.</p> <p>If the interface Protocol-State value is ack-pending, this number does not match the acknowledge-id number in the Peer-Advertisement section.</p> <p>On Junos Fusion Data Center, this field represents the number of DCBX state changes maintained by an aggregation device, which might differ among the aggregation devices in the system. Satellite devices acting as proxy DCBX peers for the aggregation devices maintain a local sequence number (see satellite sequence-number output field) that maps to this value for each aggregation device. In this way, the satellite device presents a consistent sequence number for DCBX TLV traffic to and from the DCBX peer.</p>
acknowledge-id	<p>Number of acknowledge messages received from the peer.</p> <p>If the Protocol-State value is in-sync, this number should match the sequence-number value in the Peer-Advertisement section.</p> <p>If the Protocol-State value is ack-pending, this number does not match the sequence-number value in the Peer-Advertisement section.</p> <p>Similar to the sequence-number field, this field represents the number of received DCBX acknowledge messages maintained by an aggregation device on Junos Fusion Data Center, which might differ among the aggregation devices in the system. Satellite devices acting as proxy DCBX peers for the aggregation devices map acknowledge-id values in received DCBX packets to the equivalent sequence-number value actually being acknowledged for each aggregation device.</p>
satellite sequence-number	

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
	<p>(Junos Fusion Data Center only) Count of state change messages to the DCBX peer maintained locally on the Junos Fusion satellite device, as compared to the count maintained on the aggregation device displayed in this section's sequence-number output field. Satellite devices act as proxy DCBX peers for the aggregation devices, and map received DCBX acknowledge-id values (corresponding to local satellite sequence number values) to the equivalent aggregation device sequence-number value being acknowledged for each aggregation device. The satellite sequence-number field shows the local satellite device sequence number value actually being exchanged with the DCBX peer.</p>
peer-chassis sequence-number	<p>(Junos Fusion Data Center, starting in Junos OS Release 17.2R1 up until Junos OS Release 18.1R2-S2) Count of state change messages to the DCBX peer maintained by the other aggregation device in the system, as compared to the sequence-number output field in this section. Satellite devices acting as proxy DCBX peers for the aggregation devices map received DCBX acknowledge-id values to the equivalent sequence-number value being acknowledged for each aggregation device. The satellite sequence-number field shows the local satellite device sequence number value actually being exchanged with the DCBX peer.</p> <p>This field is not displayed starting with Junos OS Release 18.1R2-S2 on Junos Fusion Data Center.</p>

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Peer-Advertisement	(DCBX Version 1.01 only) Status of advertisements that the peer sends to the local interface.
Operational version	Version of the DCBX standard used.
sequence-number	<p>Number of state change messages the peer sent to the local interface.</p> <p>If this number matches the acknowledge-id number in the Local-Advertisement field, this indicates that the local interface has acknowledged all of the peer's state change messages and is synchronized.</p> <p>If this number does not match the acknowledge-id number in the Local-Advertisement field, this indicates that the peer has not yet received an acknowledgment for a state change message from the local interface.</p>
acknowledge-id	<p>Number of acknowledge messages the peer has received from the local interface.</p> <p>If this number matches the sequence-number value in the Local-Advertisement field, this indicates that the peer has acknowledged all of the local interface's state change messages and is in synchronization.</p> <p>If this number does not match the sequence-number value in the Local-Advertisement field, this indicates that the peer has not yet sent an acknowledgment for a state change message from the local interface.</p>

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Feature: PFC	Priority-based flow control (PFC) feature DCBX state information.
Protocol-State	(DCBX Version 1.01 only) DCBX protocol state synchronization status: <ul style="list-style-type: none"> • ack-pending—The local interface has not yet received an acknowledge message from the peer to indicate that the peer received a PFC state change message sent by the local interface. • in-sync—The local interface received an acknowledge message from the peer to indicate that the peer received a PFC state change message sent by the local interface. • not-applicable—PFC autonegotiation is disabled.
Operational State	(DCBX Version 1.01 only) Operational state of the feature: enabled or disabled .
Local-Advertisement	Status of advertisements that the local interface sends to the peer.
Enable	(DCBX Version 1.01 only) State that the local interface advertises to the peer: <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
Willing	Willingness of the local interface to learn the PFC configuration from the peer using DCBX: <ul style="list-style-type: none"> • Yes—The local interface is willing to learn the PFC configuration from the peer. • No—The local interface is not willing to learn the PFC configuration from the peer.
Mac auth Bypass Capability	(IEEE DCBX only) (QFX Series) Media access controller (MAC) authentication bypass provides access to devices based on MAC address authentication. This is not supported, so the only value seen in the local advertisement field is no .
Error	(DCBX Version 1.01 only) Configuration compatibility error status: <ul style="list-style-type: none"> • No—No error detected. Local and peer configuration are compatible. • Yes—Error detected. Local and peer configuration are not compatible.

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Operational State	<p>PFC operational state on the interface:</p> <ul style="list-style-type: none"> • Enabled—PFC is enabled on the interface • Disabled—PFC is disabled on the interface
Maximum Traffic Classes capable to support PFC	<p>Largest number of traffic classes the local interface supports for PFC:</p> <ul style="list-style-type: none"> • 6 (EX Series switches) • 6 (QFX Series)
Code Point	<p>PFC code point, which is specified in the 3-bit class-of-service field in the VLAN header.</p>
Admin Mode	<p>PFC administrative state for each code point on the local interface:</p> <ul style="list-style-type: none"> • Enabled—PFC is enabled for the code point. • Disabled—PFC is disabled for the code point.
Operational Mode	<p>(QFX Series) PFC operational mode for each code point:</p> <ul style="list-style-type: none"> • Enable—PFC is enabled on the code point. • Disable—PFC is disabled on the code point.
Peer-Advertisement	<p>Status of advertisements that the peer sends to the local interface.</p>
Enable	<p>(DCBX Version 1.01 only)</p> <p>State that the peer advertises to the local interface:</p> <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
Willing	<p>Willingness of the peer to learn the PFC configuration from the local interface using DCBX:</p> <ul style="list-style-type: none"> • Yes—The peer is willing to learn the PFC configuration from the local interface. • No—The peer is not willing to learn the PFC configuration from the local interface.
Error	<p>(DCBX Version 1.01 only)</p> <p>Configuration compatibility error status:</p> <ul style="list-style-type: none"> • No—No error detected. Local and peer configuration are compatible. • Yes—Error detected. Local and peer configuration are not compatible.

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Operational State	<p>PFC operational state on the interface:</p> <ul style="list-style-type: none"> • Enabled—PFC is enabled on the interface • Disabled—PFC is disabled on the interface
Mac auth Bypass Capability	<p>(IEEE DCBX only)</p> <p>(QFX Series) Media access controller (MAC) authentication bypass provides access to devices based on MAC address authentication. Although the QFX Series does not support this feature, the connected peer might support it. This field reports the peer state:</p> <ul style="list-style-type: none"> • Yes—The connected peer supports MAC authentication bypass. • No—The connected peer does not support MAC authentication bypass.
Maximum Traffic Classes capable to support PFC	<p>Largest number of traffic classes the peer supports for PFC:</p> <ul style="list-style-type: none"> • 6 (EX Series switches) • 8 (QFX Series)
Code Point	<p>PFC code point, which is specified in the 3-bit class-of-service field in the VLAN header.</p>
Admin Mode	<p>PFC administrative state for each code point on the peer:</p> <ul style="list-style-type: none"> • Enabled—PFC is enabled for the code point. • Disabled—PFC is disabled for the code point.

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Feature: Application	State information for the DCBX application.
Protocol-State	<p>(DCBX Version 1.01 only)</p> <p>DCBX protocol state synchronization status:</p> <ul style="list-style-type: none"> • in-sync—The local interface received an acknowledge message from the peer to indicate that the peer received an FCoE state change message sent by the local interface. • ack-pending—The local interface has not yet received an acknowledge message from the peer to indicate that the peer received an FCoE state change message sent by the local interface. • not-applicable—The local interface is set to no-auto-negotiation (autonegotiation is disabled). If the interface is associated with an FCoE forwarding class, the interface advertises FCoE capability even if the connected peer does not advertise FCoE capability.
Local-Advertisement	<p>Status of advertisements that the local interface sends to the peer.</p> <p>If the local interface is set to no-auto-negotiation (autonegotiation is disabled), the local advertisement portion of the output is not shown.</p>
Enable	<p>(DCBX Version 1.01 only)</p> <p>State that the local interface advertises to the peer:</p> <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
Willing	<p>(DCBX Version 1.01 only)</p> <p>Willingness of the local interface to learn the FCoE interface state from the peer using DCBX:</p> <ul style="list-style-type: none"> • Yes—The local interface is willing to learn the FCoE interface state from the peer. • No—The local interface is not willing to learn the FCoE interface state from the peer.
Error	<p>(DCBX Version 1.01 only)</p> <p>Configuration compatibility error status:</p> <ul style="list-style-type: none"> • No—No error detected. The local and peer configuration are compatible. • Yes—Error detected. The local and peer configuration are not compatible.
Appl-Name	Name of the application:

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Ethernet-Type	<p>(DCBX Version 1.01 only)</p> <p>Ethernet type (EtherType) of the application. For example, 0x8906 indicates the EtherType for the FCoE application. Either the EtherType (for Layer 2 applications) or the Socket Number (for Layer 4 applications) of the application is displayed in the output.</p>
Socket-Number	<p>Destination port socket number of the application, if applicable. Either the EtherType (for Layer 2 applications) or the Socket Number (for Layer 4 applications) of the application is displayed in the output.</p>
Priority-Field or Priority-Map	<p>Priority assigned to the application.</p> <p>For EX Series switches, the priority of the FCoE application is determined by the PFC congestion notification profile that has been configured and associated with the FCoE interface. For other applications, the priority is based on the application map.</p>
Status	<p>(DCBX Version 1.01 only)</p> <p>Local status when autonegotiation is enabled:</p> <ul style="list-style-type: none"> • Enabled—The application feature is enabled on both the local interface and the peer interface. (The local configuration and the peer configuration match.) • Disabled—The local configuration and the peer configuration do not match. <p>NOTE: If there is a configuration mismatch in one application between the switch and the peer, all the other applications including FCoE are disabled.</p>
Peer-Advertisement	<p>Status of advertisements that the peer sends to the local interface.</p>
Enable	<p>(DCBX Version 1.01 only)</p> <p>State that the peer advertises to the local interface:</p> <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
Willing	<p>(DCBX Version 1.01 only)</p> <p>Willingness of the peer to learn the FCoE interface state from the local interface using DCBX:</p> <ul style="list-style-type: none"> • Yes—The peer is willing to learn the FCoE interface state from the local interface. • No—The peer is not willing to learn the FCoE interface state from the local interface.

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Error	(DCBX Version 1.01 only) Configuration compatibility error status: <ul style="list-style-type: none"> • No—No error detected. Local and peer configuration are compatible. • Yes—Error detected. Local and peer configuration are not compatible.
Appl-Name	Name of the application: <ul style="list-style-type: none"> • FCoE—Fibre Channel over Ethernet
Ethernet-Type	Ethernet type (EtherType) of the application. For example, 0x8906 indicates the EtherType for the FCoE application. Either the EtherType (for Layer 2 applications) or the Socket-Number (for Layer 4 applications) of the application is displayed in the output.
Socket-Number	Destination port socket number of the application, if applicable. Either the EtherType (for Layer 2 applications) or the Socket Number (for Layer 4 applications) of the application is displayed in the output.
Priority-Field or Priority-Map	Priority assigned to the application.
Status	(DCBX Version 1.01 only) Peer interface status: <ul style="list-style-type: none"> • Enabled—The application feature is enabled on both the local interface and the peer interface. (The local configuration and the peer configuration match.) • Disabled—The local configuration and the peer configuration do not match.

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Feature: ETS	Enhanced Transmission Selection (ETS) DCBX state information.
Protocol-State	(DCBX Version 1.01 only) ETS protocol state synchronization status: <ul style="list-style-type: none"> • in-sync—The local interface received an acknowledge message from the peer to indicate that the peer received an ETS state change message sent by the local interface. • ack-pending—The local interface has not yet received an acknowledge message from the peer to indicate that the peer received an ETS state change message sent by the local interface.
Operational State	(DCBX Version 1.01 only) Operational state of the feature, enabled or disabled .
Local-Advertisement	Status of advertisements that the local interface sends to the peer.
Enable	(DCBX Version 1.01 only) State that the local interface advertises to the peer: <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
TLV Type	(IEEE DCBX only) Type of ETS TLV: <ul style="list-style-type: none"> • Configuration—Advertises the Configuration TLV, which communicates the local ETS configuration to the peer but does not ask the peer to use the configuration. • Recommendation—Advertises the Recommendation TLV, which communicates the local ETS configuration to the peer, and if the peer is “willing,” configures the peer interface to match the local ETS configuration. • Recommendation-or-Configuration—Advertises both TLVs.
Willing	Willingness of the local interface to learn the ETS state from the peer using DCBX (EX Series switches always advertise No for this field): <ul style="list-style-type: none"> • Yes—Local interface is willing to learn the ETS state from the peer. • No—Local interface is not willing to learn the ETS state from the peer.
Credit Based Shaper	

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
	(IEEE DCBX only) Alternative method of flow control to buffer-to-buffer credit. The QFX Series does not support a credit-based shaper, so the value of this field is always No .
Error	(DCBX Version 1.01 only) Configuration error status: <ul style="list-style-type: none"> • No—No error. This should always be the switch ETS error state. • Yes—Error detected.
Maximum Traffic Classes capable to support PFC	(DCBX Version 1.01 only) Largest number of traffic classes the local interface supports for PFC.
Maximum Traffic Classes supported	(IEEE DCBX only) Largest number of traffic classes the local interface supports for ETS. (EX Series switches support only one traffic class for ETS. However, a different value might be shown for this field.)
Code Point	PFC code point, which is specified in the 3-bit class-of-service field in the VLAN header.
Priority-Group	Class-of-service (CoS) priority group (forwarding class set) identification number.
Percentage B/W	Configured minimum percentage of link bandwidth allocated to the priority group. Only explicitly configured values appear in this output column. If the link bandwidth is the default percentage, it is not shown. (EX Series switches allocate 100% of link bandwidth to the default priority group, group 7.)
Transmission Selection Algorithm	(IEEE DCBX only) The transmission selection algorithm used by the interface. The QFX Series supports ETS but does not support using the credit-based shaper algorithm, so the only value shown in this field is ETS .
Peer-Advertisement	Status of advertisements that the peer sends to the local interface.
Enable	

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
	(DCBX Version 1.01 only) State that the peer advertises to the local interface: <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
TLV Type	(IEEE DCBX only) Type of ETS TLV: <ul style="list-style-type: none"> • Configuration—Advertises the Configuration TLV, which communicates the local ETS configuration to the peer but does not ask the peer to use the configuration. • Recommendation—Advertises the Recommendation TLV, which communicates the local ETS configuration to the peer, and if the peer is “willing,” configures the peer interface to match the local ETS configuration. • Configuration/Recommendation—Advertises both TLVs.
Willing	Willingness of the peer to learn the ETS state from the local interface using DCBX: <ul style="list-style-type: none"> • Yes—Peer is willing to learn the ETS state from the local interface. • No—Peer is not willing to learn the ETS state from the local interface.
Credit Based Shaper	(IEEE DCBX only) Alternative method of flow control to buffer-to-buffer credit. The QFX Series does not support a credit-based shaper, so the value of this field is always No .
Error	(DCBX Version 1.01 only) Configuration error status of the peer: <ul style="list-style-type: none"> • No—No error in peer ETS TLV. • Yes—Error in peer ETS TLV.
Maximum Traffic Classes capable to support PFC	(DCBX Version 1.01 only) Largest number of traffic classes the local interface supports for PFC.
Maximum Traffic Classes supported	(IEEE DCBX only) Largest number of traffic classes the local interface supports for ETS. (EX Series switches support only one traffic class for ETS. However, a different value might be shown for this field.)
Code Point	

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
	PFC code point, which is specified in the 3-bit class-of-service field in the VLAN header.
Priority-Group	CoS priority group (forwarding class set) identification number.
Percentage B/W	Configured minimum percentage of link bandwidth allocated to the priority group. (EX Series switches allocate 100% of link bandwidth to the default priority group, group 7.)
Transmission Selection Algorithm	(IEEE DCBX only) Transmission selection algorithm used by the interface. The QFX Series supports ETS but does not support using the credit-based shaper algorithm, so the only value shown in this field is ETS .
PFC	(QFX Series, terse option only) DCBX TLV advertisement state for PFC: <ul style="list-style-type: none"> • Disabled—PFC configuration matches the configuration on the connected peer and PFC is disabled • Enabled—PFC configuration matches the configuration on the connected peer and PFC is enabled • Not Advt—Interface does not advertise PFC to the connected peer
ETS	(terse option only) Local DCBX TLV advertisement state for ETS: <ul style="list-style-type: none"> • Advt—Interface advertises ETS TLVs • Disabled—ETS is disabled on the interface (interface does not advertise ETS)
ETS Rec	(terse option only) DCBX TLV peer advertisement state for ETS (state received from the connected DCBX peer): <ul style="list-style-type: none"> • Advt—Peer interface advertises ETS TLVs • Not Advt—Peer interface does not advertise ETS <p>NOTE: When the DCBX mode is DCBX version 1.01, no peer information is displayed.</p>

Table 34: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Version	<p>(terse option only) The DCBX version used on the interface and whether the DCBX version was autonegotiated or explicitly configured:</p> <ul style="list-style-type: none"> • IEEE—The interface uses IEEE DCBX. • 1.01—The interface uses DCBX version 1.01. <p>When the DCBX version used is the result of autonegotiation, the term (Auto) appears next to the version. For example, IEEE (Auto) indicates that the interface autonegotiated with the connected peer to use IEEE DCBX. Autonegotiation is enabled by default.</p>

Sample Output

show dcbx neighbors interface (Junos Fusion Data Center, DCBX Version 1.01 Mode)

```

user@aggregation-device> show dcbx neighbors interface xe-0/0/0
Interface : xe-103/0/10.0 - Parent Interface: ae2.0
Active-application-map: iscsi-map
Protocol Mode: DCBX Version 1.01
Protocol-State: in-sync

Local-Advertisement:
  Operational version: 0
  sequence-number: 1, acknowledge-id: 6
  satellite sequence-number: 2

Peer-Advertisement:
  Operational version: 0
  sequence-number: 6, acknowledge-id: 1

Feature: PFC, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:
  Enable: Yes, Willing: No, Error: No
  Maximum Traffic Classes capable to support PFC: 8

Code Point      Admin Mode
000             Disabled
001             Disabled
010             Disabled
011             Enabled
100             Enabled
101             Disabled
110             Disabled
111             Disabled

Peer-Advertisement:
  Enable: Yes, Willing: No, Error: No
  Maximum Traffic Classes capable to support PFC: 8

```

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

App1-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iSCSI		3260	00010000	Enabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

App1-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iSCSI		3260	00010000	Enabled

Feature: ETS, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	0
001	6
010	6
011	1
100	2
101	6
110	6
111	6

Priority-Group	Percentage B/W
0	35%
1	40%
2	25%
6	0%

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	0

001	6
010	6
011	1
100	2
101	6
110	6
111	6

Priority-Group	Percentage B/W
0	35%
1	40%
2	25%
6	0%

Interface : xe-103/0/3.0 - Parent Interface: ae2.0

Active-application-map: iscsi-map

Protocol Mode: DCBX Version 1.01

Protocol-State: in-sync

Local-Advertisement:

Operational version: 0

sequence-number: 1, acknowledge-id: 5

satellite sequence-number: 2

Peer-Advertisement:

Operational version: 0

sequence-number: 5, acknowledge-id: 1

Feature: PFC, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iSCSI		3260	00010000	Enabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iSCSI		3260	00010000	Enabled

Feature: ETS, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	0
001	6
010	6
011	1
100	2
101	6
110	6
111	6

Priority-Group	Percentage B/W
0	35%
1	40%
2	25%
6	0%

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	0
001	6
010	6
011	1
100	2
101	6
110	6
111	6

Priority-Group	Percentage B/W
0	35%

1	40%
2	25%
6	0%

show dcbx neighbors interface (QFX Series, DCBX Version 1.01 Mode)

```
user@switch> show dcbx neighbors interface xe-0/0/0
```

```
Interface : xe-0/0/0.0 - Parent Interface: ae0.0
```

```
Active-application-map: app-map-1
```

```
Protocol-State: in-sync
```

```
Protocol-Mode: DCBX Version 1.01
```

```
Local-Advertisement:
```

```
Operational version: 1
```

```
sequence-number: 130, acknowledge-id: 102
```

```
Peer-Advertisement:
```

```
Operational version: 1
```

```
sequence-number: 102, acknowledge-id: 130
```

```
Feature: PFC, Protocol-State: in-sync
```

```
Operational State: Enabled
```

```
Local-Advertisement:
```

```
Enable: Yes, Willing: No, Error: No
```

```
Maximum Traffic Classes capable to support PFC: 8
```

Code Point	Admin Mode	Operational Mode
000	Disabled	Disable
001	Disabled	Disable
010	Disabled	Disable
011	Enabled	Enable
100	Enabled	Enable
101	Disabled	Disable
110	Disabled	Disable
111	Disabled	Disable

```
Peer-Advertisement:
```

```
Enable: Yes, Willing: No, Error: No
```

```
Maximum Traffic Classes capable to support PFC: 8
```

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

```
Feature: Application, Protocol-State: in-sync
```

```
Local-Advertisement:
```

```
Enable: Yes, Willing: No, Error: No
```

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001110	Enabled

iSCSI	3260	10000000	Enabled
-------	------	----------	---------

Peer-Advertisement:

Enable: Yes, Willing: Yes, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906	N/A	00001110	Enabled

Feature: ETS, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes capable to support PFC: 8

Code Point	Priority-Group
000	0
001	7
010	7
011	7
100	0
101	1
110	1
111	7

Priority-Group	Percentage B/W
0	40%
1	5%

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes capable to support PFC: 8

Code Point	Priority-Group
000	0
001	7
010	7
011	7
100	0
101	1
110	1
111	7

Priority-Group	Percentage B/W
0	40%
1	5%

show dcbx neighbors interface (QFX Series, IEEE DCBX Mode)

user@switch> show dcbx neighbors interface xe-0/0/0

Interface : xe-0/0/0.0 - Parent Interface: ae0.0
 Active-application-map: app-map-1

Protocol-Mode: IEEE-DCBX Version

Feature: PFC

Local-Advertisement:

Willing: No
Mac auth Bypass Capability: No
Operational State: Enabled

Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Peer-Advertisement:

Willing: No
Mac auth Bypass Capability: No
Operational State: Enabled

Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Feature: Application

Local-Advertisement:

Appl-Name	Ethernet-Type	Socket-Number	Priority-field
FCoE	0x8906		00001110
iSCSI		3260	10000000

Peer-Advertisement:

Appl-Name	Ethernet-Type	Socket-Number	Priority-field
FCoE	0x8906	N/A	00001110

Feature: ETS

Local-Advertisement:

TLV Type: Configuration/Recommendation
Willing: No
Credit Based Shaper: No
Maximum Traffic Classes supported: 3

Code Point	Priority-Group
000	0

001	7
010	7
011	7
100	0
101	1
110	1
111	7

Priority-Group	Percentage B/W
0	40%
1	5%

Priority-Group	Transmission Selection Algorithm
0	Enhanced Transmission Selection
1	Enhanced Transmission Selection

Peer-Advertisement:

TLV Type: Configuration

Willing: No

Credit Based Shaper: No

Code Point	Priority-Group
000	0
001	7
010	7
011	7
100	0
101	1
110	1
111	7

Priority-Group	Percentage B/W
0	40%
1	5%

Priority-Group	Transmission Selection Algorithm
0	Enhanced Transmission Selection
1	Enhanced Transmission Selection

Peer-Advertisement:

TLV Type: Recommendation

Code Point	Priority-Group
000	0
001	7
010	7
011	7
100	0
101	1
110	1
111	7

Priority-Group	Percentage B/W
0	40%
1	5%

Priority-Group	Transmission Selection Algorithm
0	Enhanced Transmission Selection

1 Enhanced Transmission Selection

show dcbx neighbors terse (QFX Series)

```
user@switch> show dcbx neighbors terse
```

Interface	Parent Interface	PFC	ETS	ETS	Version Rec
xe-0/0/8.0	-	Enabled	Advt	Advt	IEEE (Auto)
xe-0/0/9.0	-	Disabled	Disabled		1.01
xe-0/0/11.0	ae0.0	Enabled	Advt	Advt	IEEE (Auto)
xe-0/0/12.0	ae0.0	Enabled	Advt	Advt	IEEE (Auto)
xe-0/0/32.0	-	Enabled	Advt	Not Advt	IEEE
xe-0/0/36.0	-	Not Advt	Advt	Advt	IEEE

show dcbx neighbors (EX4500 Switch: FCoE Interfaces on Both Local and Peer with PFC Configured Compatibly)

```
user@switch> show dcbx neighbors interface xe-0/0/14
```

```
Interface : xe-0/0/14.0 - Parent Interface: ae0.0
Protocol-State: in-sync
```

Local-Advertisement:

```
Operational version: 0
sequence-number: 6, acknowledge-id: 6
```

Peer-Advertisement:

```
Operational version: 0
sequence-number: 6, acknowledge-id: 6
```

```
Feature: PFC, Protocol-State: in-sync
```

```
Operational State: Enabled
```

Local-Advertisement:

```
Enable: Yes, Willing: No, Error: No
Maximum Traffic Classes capable to support PFC: 6
```

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Disabled
101	Disabled
110	Disabled
111	Disabled

Peer-Advertisement:

```
Enable: Yes, Willing: No, Error: No
Maximum Traffic Classes capable to support PFC: 6
```

Code Point	Admin Mode
------------	------------

```

000      Disabled
001      Disabled
010      Disabled
011      Enabled
100      Disabled
101      Disabled
110      Disabled
111      Disabled

```

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No <<< Error bit will not be set as there is no miss configuration between local and peer.

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Status	Appl-Name	Ethernet-Type	Socket-Number	Priority-Map
Enabled	FCoE	0x8906		00001000

show dcbx neighbors (EX4500 Switch: DCBX Interfaces on Local and Peer Are Configured Compatibly with iSCSI Application)

```
user@switch> show dcbx neighbors interface xe-0/0/14
```

Interface : xe-0/0/14.0 - Parent Interface: ae0.0

Protocol-State: in-sync

Active-application-map: iscsi-map

Local-Advertisement:

Operational version: 0
sequence-number: 9, acknowledge-id: 12

Peer-Advertisement:

Operational version: 0
sequence-number: 12, acknowledge-id: 9

Feature: PFC, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No
Maximum Traffic Classes capable to support PFC: 6

Code	Point	Admin Mode
	000	Disabled
	001	Disabled
	010	Disabled
	011	Enabled
	100	Disabled
	101	Disabled
	110	Disabled
	111	Disabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes capable to support PFC: 6

Code	Point	Admin Mode
	000	Disabled
	001	Disabled
	010	Disabled
	011	Enabled
	100	Disabled
	101	Disabled
	110	Disabled
	111	Disabled

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iscsi		3260	00100000	Enabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iscsi		3260	00100000	Enabled

show dcbx neighbors (EX4500 Switch: Includes ETS)

user@switch> show dcbx neighbors interface xe-0/0/3

Interface : xe-0/0/3.0
 Protocol-State: in-sync
 Active-application-map: map_iscsi

Local-Advertisement:

Operational version: 0
 sequence-number: 1, acknowledge-id: 5

Peer-Advertisement:

Operational version: 0
sequence-number: 5, acknowledge-id: 1

Feature: PFC, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No
Maximum Traffic Classes capable to support PFC: 6

Code Point	Admin Mode
000	Enabled
001	Enabled
010	Disabled
011	Disabled
100	Disabled
101	Disabled
110	Disabled
111	Disabled

Peer-Advertisement:

Enable: Yes, Willing: Yes, Error: No
Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Enabled
001	Disabled
010	Disabled
011	Disabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00000001	Enabled
iscsi		3260	00000010	Enabled

Peer-Advertisement:

Enable: Yes, Willing: Yes, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iscsi		3260	00010000	Enabled

Feature: ETS, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No
Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	7
001	7
010	7
011	7
100	7
101	7
110	7
111	7

Priority-Group	Percentage B/W
7	100%

Peer-Advertisement:

Enable: Yes, Willing: Yes, Error: No
Maximum Traffic Classes supported : 8

Code Point	Priority-Group
000	0
001	1
010	0
011	0
100	2
101	0
110	0
111	0

Priority-Group	Percentage B/W
0	30%
1	40%
2	30%

CHAPTER 8

Configuration Statements for Fibre Channel and FCoE-FC Gateways

- [auto-load-rebalance](#) on page 434
- [bb-sc-n](#) on page 435
- [description \(Fibre Channel Fabrics\)](#) on page 436
- [fabric-id](#) on page 437
- [fabric-interfaces](#) on page 438
- [fabric-type](#) on page 439
- [fc2](#) on page 439
- [fc-fabrics](#) on page 440
- [fc-map](#) on page 442
- [fc-options](#) on page 443
- [fibre-channel \(Family Interfaces\)](#) on page 444
- [fibre-channel \(Port\)](#) on page 445
- [fibrechannel-options](#) on page 446
- [fip](#) on page 447
- [fka-adv-period](#) on page 448
- [interface \(Fibre Channel Fabric\)](#) on page 449
- [interface \(FIP\)](#) on page 450
- [load-balance-algorithm](#) on page 451
- [loopback \(Fibre Channel Interface\)](#) on page 452
- [max-login-sessions](#) on page 453
- [max-login-sessions-per-node](#) on page 454
- [max-sessions-per-enode](#) on page 455
- [no-fabric-wwn-verify](#) on page 456
- [no-fip-snooping-scaling](#) on page 457
- [port-mode \(Fibre Channel Interfaces\)](#) on page 458
- [port-range](#) on page 459

- [priority \(FIP\) on page 460](#)
- [protocols \(FIP\) on page 461](#)
- [proxy \(Fibre Channel\) on page 462](#)
- [speed \(Fibre Channel Interfaces\) on page 463](#)
- [traceoptions \(FC-2 Fibre Channel\) on page 464](#)
- [traceoptions \(Fibre Channel\) on page 466](#)
- [traceoptions \(FIP Protocol Fibre Channel\) on page 469](#)
- [traceoptions \(Proxy Fibre Channel\) on page 471](#)

auto-load-rebalance

Syntax	<code>auto-load-rebalance;</code>
Hierarchy Level	<code>[edit fc-fabrics <i>fabric-name</i> proxy]</code>
Release Information	Command introduced in Junos OS Release 12.3 for the QFX Series.
Description	Configure the system to rebalance NP_Port link loads automatically on an FCoE-FC gateway proxy fabric if the link loads become unbalanced. Load rebalancing is a disruptive action that forces some or all sessions (depending on the configured load-balancing algorithm) to log out and then log in again. When sessions log in again, they are placed on NP_Port interfaces so that the link loads are balanced.
Required Privilege Level	<code>storage</code> —To view this statement in the configuration. <code>storage-control</code> —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Defining the Proxy Load-Balancing Algorithm on page 283• Example: Configuring Automated Fibre Channel Interface Load Rebalancing on page 285• Simulating On-Demand Fibre Channel Link Load Rebalancing (Dry Run Test) on page 285• Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267• Monitoring Fibre Channel Interface Load Balancing on page 474


bb-sc-n

Syntax	<code>bb-sc-n <i>bb-sc-n</i>;</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> fibrenchannel-options]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Configure the buffer-to-buffer credit state change number to prevent the permanent loss of Fibre Channel credits over time (buffer-to-buffer credit recovery).
Options	<p>bb-sc-n—Number of buffer-to-buffer state change credits.</p> <p>Range: 0 through 15</p> <p>Default: 0 (disabled)</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel interfaces on page 537 • Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239 • Converting an Ethernet Interface To a Fibre Channel Interface on page 255 • Configuring a Physical Fibre Channel Interface on page 254 • Understanding Interfaces on an FCoE-FC Gateway on page 226

description (Fibre Channel Fabrics)

Syntax	<code>description <i>description</i></code>
Hierarchy Level	<code>[edit fc-fabrics <i>fabric-name</i>]</code>
Description	Text string that describes the Fibre Channel fabric. The text string has no effect on the operation of the fabric.
Options	<i>description</i> —Text that describes the fabric. Text can include letters, numbers, and hyphens (-) and can be up to 255 characters in length. If the text includes spaces, enclose the entire text string in quotation marks.
Required Privilege Level	storage—To view this statement in the configuration. storage-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show fibre-channel fabric on page 500

fabric-id

Syntax	<code>fabric-id <i>fc-fabric-id</i>;</code>
Hierarchy Level	[edit fc-fabrics <i>fc-fabric-name</i>]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Configure a unique identifier for the FC fabric.
	<div>  <p>NOTE: Changing the ID of an FC fabric causes all logins to drop and forces the ENodes to log in again.</p> </div>
Options	<i>fc-fabric-id</i> —Unique identifier of the FC fabric.
Required Privilege Level	storage—To view this statement in the configuration. storage-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel fabric on page 500 • Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195 • Understanding an FCoE-FC Gateway on page 190

fabric-interfaces

Syntax	<pre>fabric-interfaces { node-group (node-group-name all) { oxid (enable disable); } }</pre>
Hierarchy Level	[edit forwarding-options hash-key family fcoe]
Release Information	Statement introduced in Junos OS Release 13.2X52-D10 for the QFX Series.
Description	Specify that you are enabling or disabling OxID hash control on the fabric ports of a QFabric system Node group. OxID hash control is enabled or disabled on the fabric ports that face an FCoE forwarder (FCF).
Options	The remaining statements are explained separately. See CLI Explorer .
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Enabling and Disabling CoS OxID Hash Control for FCoE Traffic on QFabric Systems on page 83• Understanding OxID Hash Control for FCoE Traffic Load Balancing on QFabric Systems on page 79

fabric-type

Syntax	<code>fabric-type proxy;</code>
Hierarchy Level	<code>[edit fc-fabrics <i>fc-fabric-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Specify that the FC fabric be an FCoE-FC gateway fabric.
Options	proxy —Specify that the switch be an FCoE-FC gateway fabric.
Required Privilege Level	storage—To view this statement in the configuration. storage-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel fabric on page 500 • Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195 • Understanding an FCoE-FC Gateway on page 190

fc2

Syntax	<pre>fc2 { traceoptions { file <i>filename</i> <replace> <size size> <files number> <no-stamp>; <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier>; } }</pre>
Hierarchy Level	<code>[edit fc-fabrics <i>fc-fabric-name</i>]</code>
Description	Fibre Channel network layer (FC2) configuration.
Options	The remaining statements are explained separately. See CLI Explorer .
Required Privilege Level	storage—To view this statement in the configuration. storage-control—To add this statement to the configuration.

fc-fabrics

```
Syntax fc-fabrics {
    fc-fabric-name {
        description
        fabric-id fc-fabric-id;
        fabric-type proxy;
        interface {
            interface-name {
                max-login-sessions max-login-sessions;
            }
            interface-name {
                max-login-sessions max-login-sessions;
            }
            <...>;
            max-login-sessions max-login-sessions;
        }
        vlan.interface-name;
    }
    fc2 {
        traceoptions {
            file filename <replace> <size size> <files number> <no-stamp>;
            <world-readable | no-world-readable>;
            flag flag <flag-modifier>;
        }
    }
    max-login-sessions max-login-sessions;
    protocols {
        fip {
            fcoe-trusted;
            fc-map fc-map-value;
            fka-adv-period milliseconds;
            interface {
                interface-name {
                    fka-adv-period milliseconds;
                    priority priority;
                }
            }
            max-sessions-per-enode max-sessions-per-enode;
            priority priority;
            traceoptions {
                file filename <replace> <size size> <files number> <no-stamp>;
                <world-readable | no-world-readable>;
                flag flag <flag-modifier> <disable>;
            }
        }
    }
    proxy {
        auto-load-rebalance
        load-balance-algorithm (simple | enode-based | flogi-based);
        no-fabric-wwn-verify;
        traceoptions {
            file filename <replace> <size size> <files number> <no-stamp>;

```



```

    <world-readable | no-world-readable>;
    flag flag <flag-modifier> <disable>;
  }
}
}
}

```

Hierarchy Level [\[edit\]](#)

Release Information Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description Configure an FC fabric. You can configure a maximum of 12 FC fabrics, one per native FC port.



NOTE: Changing the name of an FC fabric causes all logins to drop and forces the ENodes to log in again.

Options *fc-fabric-name* —Unique name of the FC fabric.

The other statements are explained separately.

Required Privilege Level storage—To view this statement in the configuration.
storage-control—To add this statement to the configuration.

Related Documentation

- [show fibre-channel fabric on page 500](#)
- [Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108](#)
- [Configuring a Physical Fibre Channel Interface on page 254](#)
- [Converting an Ethernet Interface To a Fibre Channel Interface on page 255](#)
- [Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258](#)
- [Assigning Interfaces to a Fibre Channel Fabric on page 262](#)
- [Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195](#)
- [Configuring FIP on an FCoE-FC Gateway on page 216](#)
- [Configuring DCBX Autonegotiation on page 305](#)
- [Overview of Fibre Channel on page 26](#)
- [Understanding FCoE-FC Gateway Functions on page 196](#)

fc-map

Syntax `fc-map fc-map-value;`

Hierarchy Level Original CLI

[edit ethernet-switching options secure-access-port vlan (all | *vlan-name*) examine-fip]

ELS CLI for Platforms that Support FCoE

[edit vlans *vlan-name* forwarding-options **fip-security**]



NOTE: The `fc-map` configuration statement is in a different hierarchy on the original CLI than on the Enhanced Layer 2 Software (ELS) CLI.

QFX Series that Support FCoE-FC Gateway Configuration

[edit **fc-fabrics** *fc-fabric-name* **protocols fip**]

Release Information Statement introduced in Junos OS Release 10.4 for EX Series switches.
Statement introduced in Junos OS Release 11.1 for the QFX Series.
Statement introduced for the ELS CLI in Junos OS Release 13.2 for the QFX Series.

Description Set the FCoE mapped address prefix (FC-MAP) value for the FCoE VLAN to match the FC switch (or FCoE forwarder) FC-MAP value for the FC fabric. The FC-MAP value is a unique MAC address prefix an FC switch uses to identify FCoE traffic for a given FC fabric (traffic on a particular FCoE VLAN).

You can configure the FC-MAP value or use the default value. The default FC-MAP value is different for VN_Port to VF_Port (VN2VF_Port) FIP snooping (0x0EFC00) than for VN_Port to VN_Port (VN2VN_Port) FIP snooping.

The FC switch provides the FC-MAP value to FCoE nodes (ENodes) in the FIP discovery advertisement message. If the EX Series switch or the QFX Series FCoE VLAN FC-MAP value does not match the FC switch FC-MAP value, neither device discovers the FC switch on that VLAN, and the ENodes on that VLAN cannot access the FC switch. The FC switch accepts only FCoE traffic that uses the correct FC-MAP value as part of the VN_Port MAC address.

When the QFX Series acts as an FCoE-FC gateway, the FC-MAP value for the gateway and the FCoE devices must match the FC switch FC-MAP value in order to communicate with the FC switch.



NOTE: Changing the FC-MAP value causes all logins to drop and forces the ENodes to log in again.

Options	<p><i>fc-map-value</i>—FC-MAP value, hexadecimal value preceded by “0x”.</p> <p>Range: 0x0EFC00 through 0x0EFCFF</p> <p>Default: 0x0EFC00 for VN2VF_Port FIP snooping 0x0EFD00 for VN2VN_Port FIP snooping</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>examine-fip</i> • show fip snooping on page 377 • <i>Example: Configuring an FCoE Transit Switch</i> • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108

fc-options

Syntax	<pre>fc-options max-login-sessions-per-node max-login-sessions-per-node; no-fip-snooping-scaling; traceoptions { file filename <replace> <size size> <files number> <no-stamp>; <world-readable no-world-readable>; flag flag <flag-modifier> <disable>; }</pre>
Hierarchy Level	[edit]
Release Information	<p>Statement introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Statement no-fip-snooping-scaling introduced in Junos OS Release 13.2X52-D10 for the QFabric system.</p>
Description	Set Fibre Channel options.
Required Privilege Level	<p>storage—To view this statement in the configuration.</p> <p>storage-control—To add this statement to the configuration.</p>

fibre-channel (Family Interfaces)

Syntax	<pre>fibre-channel { port-mode (f-port np-port); }</pre>
Hierarchy Level	[edit interfaces vlan unit <i>logical-unit-number</i> family], [edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> family]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Configure the port mode for FCoE VLAN interfaces and native FC interfaces.
Options	The remaining statements are explained separately. See CLI Explorer .
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239• Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258• Converting an Ethernet Interface To a Fibre Channel Interface on page 255• show fibre-channel interfaces on page 537• show vlans• Understanding Interfaces on an FCoE-FC Gateway on page 226

fibre-channel (Port)

Syntax	<pre>fibre-channel { port-range { port-range-low port-range-high; } }</pre>
Hierarchy Level	[edit chassis (QFX Series) fpc <i>fpc-id</i> pic <i>pic-id</i>]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Specify a range of ports to carry FC traffic when the switch is configured as an FCoE-FC gateway.
Options	The remaining statement is explained separately. See CLI Explorer .
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239 • Configuring a Physical Fibre Channel Interface on page 254 • show fibre-channel interfaces on page 537 • Understanding Interfaces on an FCoE-FC Gateway on page 226

fibrenchannel-options

Syntax	<pre>fibrenchannel-options { bb-sc-n (loopback no-loopback); speed (auto-negotiation 2g 4g 8g); }</pre>
Hierarchy Level	[edit interfaces <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Configure FC interface properties such as speed and loopback mode.
Options	The remaining statements are explained separately. See CLI Explorer .
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show fibre-channel interfaces on page 537• Converting an Ethernet Interface To a Fibre Channel Interface on page 255

fip

Syntax

```
fip {
  fcoe-trusted;
  fc-map fc-map-value;
  fka-adv-period milliseconds;
  interface {
    interface-name {
      fka-adv-period milliseconds;
      priority priority;
    }
  }
  max-sessions-per-enode max-sessions-per-enode;
  priority priority;
  traceoptions {
    file filename <replace> <size size> <files number> <no-stamp>;
    <world-readable | no-world-readable>;
    flag flag <flag-modifier> <disable>;
  }
}
```

Hierarchy Level [edit [fc-fabrics](#) *fc-fabric-name* [protocols](#)]

Release Information Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description Configure global or interface-specific FIP options. Individual interface settings override global settings.

Options The remaining statements are explained separately. See [CLI Explorer](#).

Required Privilege Level storage—To view this statement in the configuration.
storage-control—To add this statement to the configuration.

Related Documentation

- [show fibre-channel fip on page 506](#)
- [Configuring FIP on an FCoE-FC Gateway on page 216](#)
- [Overview of FIP on page 41](#)

fka-adv-period

Syntax	<code>fka-adv-period <i>milliseconds</i>;</code>
Hierarchy Level	<code>[edit fc-fabrics <i>fc-fabric-name</i> protocols fip],</code> <code>[edit fc-fabrics <i>fc-fabric-name</i> protocols fip interface <i>interface-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Set the global or interface-specific interval between periodic FIP keepalive advertisements. An interval set at the interface level overrides the global setting.
Options	<i>milliseconds</i> —Time in milliseconds between FIP keepalive advertisements. Range: 250 through 90000 milliseconds Default: 8000 milliseconds
Required Privilege Level	storage —To view this statement in the configuration. storage-control —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show fibre-channel fip on page 506• show fibre-channel fip interface on page 522• Overview of FIP on page 41

interface (Fibre Channel Fabric)

Syntax	<pre> interface { interface-name { max-login-sessions max-login-sessions; } interface-name { max-login-sessions max-login-sessions; } <...> { max-login-sessions max-login-sessions; } vlan.interface-name; } </pre>
Hierarchy Level	[edit fc-fabrics <i>fc-fabric-name</i>]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Associate one or more native Fibre Channel (FC) interfaces with an FC fabric and one VLAN interface for FCoE traffic. An FC interface can be associated with only one FC fabric.
Options	<p>interface-name—Name of the native FC interface. You can assign one or more FC interfaces to an FC fabric.</p> <p>vlan.vlan-interface-name—Name of the VLAN interface for FCoE traffic. You can assign one VLAN interface to an FC fabric.</p> <p>The remaining statement is explained separately. See CLI Explorer.</p>
Required Privilege Level	<p>storage—To view this statement in the configuration.</p> <p>storage-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239 • Converting an Ethernet Interface To a Fibre Channel Interface on page 255 • Configuring a Physical Fibre Channel Interface on page 254 • Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258 • Understanding Interfaces on an FCoE-FC Gateway on page 226

interface (FIP)

Syntax

```
interface {  
  interface-name {  
    fka-adv-period milliseconds;  
    priority priority;  
  }  
}
```

Hierarchy Level [edit [fc-fabrics](#) *fc-fabric-name* [protocols fip](#)]

Release Information Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description Configure FIP options on a per-interface basis. (Override global FIP configuration for a specified interface.)

Options *interface-name*—Name of the interface.


The remaining statements are explained separately. See [CLI Explorer](#).

Required Privilege Level storage—To view this statement in the configuration.
storage-control—To add this statement to the configuration.

Related Documentation

- [show fibre-channel fip on page 506](#)
- [Configuring FIP on an FCoE-FC Gateway on page 216](#)
- [Overview of FIP on page 41](#)

load-balance-algorithm

Syntax	<code>load-balance-algorithm (simple enode-based flogi-based);</code>
Hierarchy Level	<code>[edit fc-fabrics <i>fabric-name</i> proxy]</code>
Release Information	Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Set the load-balancing algorithm that the QFX Series uses to distribute FCoE sessions (FLOGI and FDISC sessions from the FCoE devices in the Ethernet network) among the NP_Port links to the FC switch.
<div>  <p>NOTE: Changing the load-balancing algorithm when FCoE sessions are running forces the FCoE sessions to log out, then log in again.</p> </div>	
Options	<p>simple—Load balancing is based on the weighted utilization (load) of the NP_Ports connected to an FC fabric. Each new FLOGI or FDISC is assigned to the least-loaded link. When a link load rebalance occurs, the system minimizes disruption by using an algorithm to log out only the sessions that need to be moved to other links to balance the link load. To further minimize disruption, the algorithm logs out the sessions with the fewest dependencies (for example, FDISC sessions are logged out before FLOGI sessions). When the sessions log in again, they are placed on NP_Port interfaces in a manner that balances the link loads. This is the default load-balancing algorithm.</p> <p>enode-based—Load balancing is based on the ENode FLOGI. When an ENode logs in to the fabric, all subsequent FDISC sessions (VN_Port sessions) associated with that ENode are placed on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link. When a link load rebalance occurs, the system logs off all sessions. The sessions log in again and are placed on NP_Port interfaces in a balanced manner.</p> <p>flogi-based—FLOGI-based load balancing is similar to ENode-based load balancing, but the behavior when the loads are rebalanced is different. Load balancing is based on the ENode FLOGI. When an ENode logs in to the fabric, all subsequent FDISC sessions associated with that ENode are placed on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link. When a link load rebalance occurs, the system minimizes disruption by using an algorithm to log out only the sessions that need to be moved to other links to balance the link load. When the logged out sessions log back in, they are placed on NP_Port interfaces in a manner that balances the link loads.</p>
Required Privilege Level	<p>storage—To view this statement in the configuration.</p> <p>storage-control—To add this statement to the configuration.</p>

- Related Documentation**
- [Defining the Proxy Load-Balancing Algorithm on page 283](#)
 - [Example: Configuring Automated Fibre Channel Interface Load Rebalancing on page 285](#)
 - [Simulating On-Demand Fibre Channel Link Load Rebalancing \(Dry Run Test\) on page 285](#)
 - [Monitoring Fibre Channel Interface Load Balancing on page 474](#)
 - [Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267](#)


loopback (Fibre Channel Interface)

Syntax	(loopback no-loopback);
Hierarchy Level	[edit interfaces <i>interface-name</i> fibrechannel-options]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Enable or disable loopback mode for FC interfaces.
Default	By default, loopback mode is disabled on FC interfaces.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show fibre-channel interfaces on page 537• Converting an Ethernet Interface To a Fibre Channel Interface on page 255


max-login-sessions

Syntax	<code>max-login-sessions <i>max-login-sessions</i>;</code>
Hierarchy Level	<code>[edit fc-fabrics <i>fc-fabric-name</i>];</code> <code>[edit fc-fabrics <i>fc-fabric-name</i> interface <i>interface-name</i>];</code>
Release Information	Statement introduced in Junos OS Release 12.2 for the QFX Series.
Description	<p>Set the maximum number of FCoE initialization protocol (FIP) session logins permitted for an individual NP_Port interface in an FCoE-FC gateway fabric (FC fabric) or for the entire FCoE-FC gateway fabric. You can set a maximum FIP session limit for each NP_Port interface connected to an FC switch. You can also set a maximum FIP session limit for the entire FC fabric. The sum of the maximum login sessions permitted on the NP_Port interfaces in an FC fabric should not exceed the maximum login sessions configured for that FC fabric.</p> <p>The maximum number of FIP sessions (the combined total of all VN2VF_Port and VN2VN_Port sessions on the system) is 2500 sessions.</p>
Options	<p><i>max-login-sessions</i>—Maximum number of FIP login sessions.</p> <p>Range: 128 through 2500</p> <p>Default: 2500</p>
Required Privilege Level	<p>storage—To view this statement in the configuration.</p> <p>storage-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • max-login-sessions-per-node on page 454 • Setting the Maximum Number of FIP Login Sessions per FC Interface on page 220 • Setting the Maximum Number of FIP Login Sessions per FC Fabric on page 221 • Understanding Interfaces on an FCoE-FC Gateway on page 226


max-login-sessions-per-node

Syntax	<code>max-login-sessions-per-node <i>max-login-sessions-per-node</i>;</code>
Hierarchy Level	[edit fc-options]
Release Information	Statement introduced in Junos OS Release 12.2 for the QFX Series.
Description	<p>Set the maximum number of FCoE initialization protocol (FIP) session logins permitted on a Node device. (This is the combined total of all VN2VF_Port and VN2VN_Port sessions on the Node device.)</p> <p>On a QFX3500 switch, the max-login-sessions-per-node command sets the maximum FIP session login limit for all of the FC fabrics configured on the device. The combined number of FIP sessions on all FC fabrics on the device should not exceed this limit.</p> <p>On a QFabric system, the max-login-sessions-per-node command globally sets the maximum FIP session login limit for each QFabric system Node device in the QFabric system. For example, if you set the Node limit to 2000 login sessions, then each QFabric Node device supports up to 2000 FIP login sessions. The total configured maximum number of login sessions of all of the FC fabrics on a Node device should not exceed the Node session limit.</p>
	<div>  <p>NOTE: FIP login session limits configured at the FC fabric level or at the FC fabric interface level might limit a Node device to fewer total sessions than the configured Node limit.</p> </div>
Options	<p>max-login-sessions-per-node—Maximum number of FIP login sessions.</p> <p>Range: 128 through 2500</p> <p>Default: 2500</p>
Required Privilege Level	<p>storage—To view this statement in the configuration.</p> <p>storage-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • max-login-sessions on page 453 • Setting the Maximum Number of FIP Login Sessions per Node Device on page 222 • Understanding Interfaces on an FCoE-FC Gateway on page 226

max-sessions-per-enode

Syntax	<code>max-sessions-per-enode <i>max-sessions-per-enode</i>;</code>
Hierarchy Level	[edit fc-fabrics <i>fc-fabric-name</i> protocols fip]
Release Information	Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Set the maximum number of FCoE login sessions (FLOGI plus FDISC) from a single ENode allowed on the gateway FC fabric (the fabric configured on the QFabric system). The maximum number of logins per ENode is 2000 sessions.
	<p> NOTE: A session is a FLOGI or FDISC login to the FC SAN fabric. Session does not refer to end-to-end storage sessions. There is no limit to the number of end-to-end storage sessions.</p>
Options	<p><i>max-sessions-per-enode</i>—Maximum number of FCoE sessions a single ENode can establish on the switch.</p> <p>Range: 32 through 2000</p> <p>Default: 32</p>
Required Privilege Level	<p>storage—To view this statement in the configuration.</p> <p>storage-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • fcoe-trusted on page 364 • show fibre-channel fip on page 506 • Configuring FIP on an FCoE-FC Gateway on page 216 • Understanding FIP Parameters on an FCoE-FC Gateway on page 212

no-fabric-wwn-verify

Syntax	no-fabric-wwn-verify;
Hierarchy Level	[edit fc-fabrics <i>fabric-name</i> proxy]
Release Information	Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	<p>Disable the fabric worldwide name (WWN) verification check in the fabric login accept message (FLOGI-ACC) for implicit FLOGIs. If you enable this option, when a QFX Series NP_Port performs a FLOGI to the FC fabric, the QFX Series does not verify the fabric WWN in the FLOGI-ACC against the current fabric WWN.</p> <div><div></div><div>NOTE: Disabling or enabling the fabric WWN verification check logs out all FCoE sessions.</div></div>
Default	Disabled. By default, all implicit FLOGIs from the QFX Series NP_Ports to the FC fabric are verified against the current fabric WWN.
Required Privilege Level	storage—To view this statement in the configuration. storage-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show fibre-channel proxy fabric-state on page 544• Understanding FCoE-FC Gateway Functions on page 196


no-fip-snooping-scaling

Syntax	no-fip-snooping-scaling
Hierarchy Level (FCoE-FC gateway)	[edit fc-options]
Hierarchy Level (FCoE Transit Switch)	[edit ethernet-switching-options secure-access-port vlan (all <i>vlan-name</i>) examine-fip]
Release Information	Statement introduced in Junos OS Release 13.2X52-D10 for the QFX Series.
Description	<p>Disable FIP snooping scaling on all FCoE VLANs on an FCoE-FC gateway, or disable FIP snooping scaling on the specified FCoE VLAN on an FCoE transit switch.</p> <p>Disabling FIP snooping scaling reduces the maximum number of FIP snooping sessions from 2,500 sessions (the maximum with FIP snooping scaling enabled) to 376 sessions. FIP snooping scaling is enabled by default.</p> <p>Use this statement to disable FIP snooping scaling if you want to configure an FCoE LAG on an FCoE-FC gateway that contains one or more untrusted FC fabrics. Untrusted FC fabrics do not support FIP snooping scaling.</p> <p>On an FCoE transit switch, you can use this statement to disable FIP snooping scaling on a specified FCoE VLAN.</p>
Default	FIP snooping scaling is enabled by default.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • fcoe-lag on page 362 • Configuring an FCoE LAG on page 63 • Configuring VN2VF_Port FIP Snooping and FCoE Trusted Interfaces on an FCoE Transit Switch on page 108 • Configuring VLANs for FCoE Traffic on an FCoE Transit Switch on page 85 • Understanding FCoE LAGs on page 57

port-mode (Fibre Channel Interfaces)

Syntax	<code>port-mode (f-port np-port);</code>
Hierarchy Level	<code>[edit interfaces vlan unit <i>unit</i> family fibre-channel],</code> <code>[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> family fibre-channel]</code>
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Configure the FCoE VLAN interface port mode to F_Port to connect the switch to FCoE initiators, or configure the native FC interface port mode to proxy N_Port (NP_Port) to connect the switch to an FC switch fabric port (F_Port).
Options	f-port —Configure an FCoE VLAN interface to connect to FCoE initiator Virtual N_Ports (VN_Ports). np-port —Configure a native FC port to connect to an FC switch F_Port.
Required Privilege Level	routing —To view this statement in the configuration. routing-control —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show fibre-channel interfaces on page 537• Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239• Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258• Converting an Ethernet Interface To a Fibre Channel Interface on page 255• Understanding Interfaces on an FCoE-FC Gateway on page 226

port-range

Syntax	<code>port-range <i>port-range-low</i> <i>port-range-high</i>;</code>
Hierarchy Level	<code>[edit chassis (QFX Series) fpc <i>fpc-id</i> pic <i>pic-id</i> fibre-channel]</code>
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	<p>Configure a contiguous block of ports as FC ports. You can configure the FC-capable ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5, and ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47 to create blocks of native FC interfaces. You cannot individually configure a single port as a native FC interface. Within these port blocks, you cannot mix FC interfaces with Ethernet interfaces. All of the ports in a block must be either native FC interfaces or Ethernet interfaces.</p> <p>You can configure:</p> <ul style="list-style-type: none"> • Six native FC interfaces by configuring either ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5, or ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47. • Twelve native FC interfaces by configuring ports xe-0/0/0 through xe-0/0/5 as fc-0/0/0 through fc-0/0/5 and ports xe-0/0/42 through xe-0/0/47 as fc-0/0/42 through fc-0/0/47. • No native FC interfaces by leaving ports xe-0/0/0 through xe-0/0/5 and ports xe-0/0/42 through xe-0/0/47 in their default state as Ethernet interfaces.
Options	<p><i>port-range-low</i>—Lowest-numbered port in the block of native FC interfaces, either 0 or 42.</p> <p><i>port-range-high</i>—Highest-numbered port in the block of native FC interfaces. The value is 5 if the <i>port-range-low</i> value is 0. The value is 47 if the <i>port-range-low</i> value is 42.</p>
	<p> NOTE: Only a complete block of ports, xe-0/0/0 through xe-0/0/5, xe-0/0/42 through xe-0/0/47, or both, can be configured as FC ports.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel interfaces on page 537 • Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239

- [Configuring a Physical Fibre Channel Interface on page 254](#)
- [Understanding Interfaces on an FCoE-FC Gateway on page 226](#)

priority (FIP)

Syntax	<code>priority <i>priority</i>;</code>
Hierarchy Level	[edit fc-fabrics <i>fc-fabric-name</i> protocols fip], [edit fc-fabrics <i>fc-fabric-name</i> protocols fip interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Sets the global or interface-specific priority value associated with the switch FCF-MAC. CNAs use the priority value to determine the switch with which they will perform FIP FLOGI. The lower the value, the higher the priority. The switch advertises this value to the server ENodes on the FCoE network. A priority value set at the interface level overrides the global setting.
Options	priority —Value that determines the FCF an ENode selects to perform FIP FLOGI. The lower the priority number, the higher the priority of the FCF. Range: 0 through 255 Default: 128
Required Privilege Level	storage—To view this statement in the configuration. storage-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show fibre-channel fip on page 506• show fibre-channel fip interface on page 522• Overview of FIP on page 41• Configuring FIP on an FCoE-FC Gateway on page 216

protocols (FIP)

Syntax

```
protocols {
  fip {
    fcoe-trusted;
    fc-map fc-map-value;
    fka-adv-period milliseconds;
    interface {
      interface-name {
        fka-adv-period milliseconds;
        priority priority;
      }
    }
    max-sessions-per-enode max-sessions-per-enode;
    priority priority;
    traceoptions {
      file filename <replace> <size size> <files number> <no-stamp>;
      <world-readable | no-world-readable>;
      flag flag <flag-modifier> <disable>;
    }
  }
}
```

Hierarchy Level [edit [fc-fabrics](#) *fc-fabric-name*]

Release Information Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description Configure global or interface-specific FC protocol options. Individual interface settings override global settings.

Options The remaining statements are explained separately. See [CLI Explorer](#).

Required Privilege Level storage—To view this statement in the configuration.
storage-control—To add this statement to the configuration.

Related Documentation

- [show fibre-channel fip on page 506](#)
- [Configuring FIP on an FCoE-FC Gateway on page 216](#)
- [Overview of FIP on page 41](#)

proxy (Fibre Channel)

Syntax	<pre>proxy { auto-load-rebalance load-balance-algorithm (simple enode-based flog-based); no-fabric-wwn-verify; traceoptions { file <i>filename</i> <replace> <size <i>size</i>> <files <i>number</i>> <no-stamp> <world-readable no-world-readable>; flag <i>flag</i> <<i>flag-modifier</i>> <disable>; } }</pre>
Hierarchy Level	[edit fc-fabrics <i>fabric-name</i>]
Description	Configure proxy fabric operations.
Options	The remaining statement is explained separately. See CLI Explorer .
Required Privilege Level	storage—To view this statement in the configuration. storage-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Understanding FCoE-FC Gateway Functions on page 196

speed (Fibre Channel Interfaces)

Syntax	<code>speed (auto-negotiation 2g 4g 8g);</code>
Hierarchy Level	[edit interfaces <i>interface-name</i> fibrechannel-options]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	Configure FC interface speed.
Options	<p>auto-negotiation—Automatically negotiate interface speed to match the speed of the attached link (2 Gbps, 4 Gbps, 8 Gbps).</p> <p>2g—2 Gbps link speed</p> <p>4g—4 Gbps link speed</p> <p>8g—8 Gbps link speed</p> <p>Default: auto-negotiation</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel interfaces on page 537 • Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239 • Converting an Ethernet Interface To a Fibre Channel Interface on page 255 • Configuring a Physical Fibre Channel Interface on page 254 • Understanding Interfaces on an FCoE-FC Gateway on page 226

traceoptions (FC-2 Fibre Channel)

Syntax

```
traceoptions {
    file filename <replace> <size size> <files number> <no-stamp>;
    <world-readable | no-world-readable>;
    flag flag <flag-modifier>;
}
```

Hierarchy Level [edit [fc-fabrics](#) *fabric-name* [fc2](#)]

Release Information Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description Set FC-2 protocol tracing options.



NOTE: The `traceoptions` statement is not supported on the QFabric system.

Default Traceoptions is disabled.

Options **file *name***—Name of the file to receive the tracing operation output. Enclose the name in quotation marks. Traceoption output files are located in the `/var/log/` directory.

files *number*—(Optional) Maximum number of trace files. When a trace file named ***trace-file*** reaches its maximum size, it is renamed ***trace-file.0***. The traceoption output continues in a second trace file named ***trace-file.1***. When ***trace-file.1*** reaches its maximum size, output continues in a third file named ***trace-file.2***, and so on. When the maximum number of trace files is reached, the oldest trace file is overwritten.

If you specify a maximum number of files, you must also specify a maximum file size with the **size** option.

Range: 2 through 1000 files

Default: 1 trace file

flag—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements:

- **all**—Trace all operations.
- **error**—Trace all error events
- **normal**—Trace all normal events.

Default: If you do not specify the **normal** option, only unusual or abnormal operations are traced.

- **parse**—Trace configuration parsing.

- **rx-frame**—(Optional) Trace received frames.
- **rx-frame-header**—(Optional) Trace received frame headers.
- **tx-frame**—(Optional) Trace transmitted frames.
- **tx-frame-header**—(Optional) Trace transmitted frame headers.

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Prevent any user from reading the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches its maximum size, it is renamed **trace-file.O**. Incoming tracefile data is logged in the now empty **trace-file**. When **trace-file** again reaches its maximum size, **trace-file.O** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.O**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also specify a maximum number of trace files with the **files** option.

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 10 KB through the maximum file size of 4 GB (the maximum is lower if 4 GB is not supported on your system)

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	storage —To view this statement in the configuration. storage-control —To add this statement to the configuration.
---------------------------------	---

traceoptions (Fibre Channel)

Syntax

```
traceoptions {
  file filename <replace> <size size> <files number> <no-stamp>
  <world-readable | no-world-readable>;
  flag flag <flag-modifier>;
}
```

Hierarchy Level [edit [fc-options](#)]

Release Information Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description Set FC protocol tracing options.



NOTE: The `traceoptions` statement is not supported on the QFabric system.

Default Traceoptions is disabled.

Options **file *name***—Name of the file to receive the tracing operation output. Enclose the name in quotation marks. Traceoption output files are located in the `/var/log/` directory.

files *number*—(Optional) Maximum number of trace files. When a trace file named ***trace-file*** reaches its maximum size, it is renamed ***trace-file.0***. The traceoption output continues in a second trace file named ***trace-file.1***. When ***trace-file.1*** reaches its maximum size, output continues in a third file named ***trace-file.2***, and so on. When the maximum number of trace files is reached, the oldest trace file is overwritten.

If you specify a maximum number of files, you must also specify a maximum file size with the **size** option.

Range: 2 through 1000 files

Default: 1 trace file

flag—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements:

- **all**—Trace all operations.
- **fabric**—Trace virtual fabric events.
- **fc2**—Trace the FC2 (network layer protocols) events.
- **fip**—Trace the Fibre Channel over Ethernet (FCoE) Initialization Protocol events.
- **flogi**—Trace the fabric login server events.

- **forwarding-database**—Trace the forwarding database and next-hop events.
- **interface**—Trace the interface events.
- **krt**—Trace the communication over the routing socket.
- **lib**—Trace library calls.
- **lif**—Trace Fibre Channel logical interface (fc-lif) events.
- **vswitch**—Trace virtual switch events.

The following are the global tracing options:

- **all**—All trace operations.
- **config-internal**—Trace configuration internals.
- **general**—Trace general events.
- **normal**—All normal events.

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **parse**—Trace configuration parsing.
- **state**—Trace state transitions.
- **task**—Trace protocol task processing.
- **timer**—Trace protocol task timer processing.

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Prevent any user from reading the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches its maximum size, it is renamed **trace-file.0**. Incoming tracefile data is logged in the now empty **trace-file**. When **trace-file** again reaches its maximum size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also specify a maximum number of trace files with the **files** option.

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify GB

Range: 10 KB through the maximum file size of 4 GB (maximum is lower if 4 GB is not supported on your system)

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege	storage—To view this statement in the configuration.
Level	storage-control—To add this statement to the configuration.

traceoptions (FIP Protocol Fibre Channel)

Syntax

```
traceoptions {
  file filename <replace> <size size> <files number> <no-stamp>
  <world-readable | no-world-readable>;
  flag flag <flag-modifier>
}
```

Hierarchy Level [edit [fc-fabrics fabric-name protocols fip](#)]

Release Information Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description Set proxy FC protocol tracing options.



NOTE: The `traceoptions` statement is not supported on the QFabric system.

Default Traceoptions is disabled.

Options **file *name***—Name of the file to receive the tracing operation output. Enclose the name in quotation marks. Traceoption output files are located in the `/var/log/` directory.

files *number* —(Optional) Maximum number of trace files. When a trace file named ***trace-file*** reaches its maximum size, it is renamed ***trace-file.0***. The traceoption output continues in a second trace file named ***trace-file.1***. When ***trace-file.1*** reaches its maximum size, output continues in a third file named ***trace-file.2***, and so on. When the maximum number of trace files is reached, the oldest trace file is overwritten.

If you specify a maximum number of files, you must also specify a maximum file size with the size option.

Range: 2 through 1000 files

Default: 1 trace file

flag—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements:

- **all**—Trace all operations.
- **error**—Trace all error events
- **normal**—Trace all normal events.

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **packet**—Trace packet decoding operations

- **parse**—Trace configuration parsing.

- **state**—Trace state transitions.

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Prevent any user from reading the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches its maximum size, it is renamed **trace-file.0**. Incoming tracefile data is logged in the now empty **trace-file**. When **trace-file** again reaches its maximum size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also specify a maximum number of trace files with the **files** option.

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 10 KB through the maximum file size of 4 GB (maximum is lower if 4 GB is not supported on your system)

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege	storage—To view this statement in the configuration.
Level	storage-control—To add this statement to the configuration.

traceoptions (Proxy Fibre Channel)

Syntax

```
traceoptions {
  file filename <replace> <size size> <files number> <no-stamp>
  <world-readable | no-world-readable>;
  flag flag <flag-modifier>
}
```

Hierarchy Level [edit [fc-fabrics](#) *fabric-name* [proxy](#)]

Release Information Statement introduced in Junos OS Release 11.1 for the QFX Series.

Description Set proxy FC protocol tracing options.



NOTE: The `traceoptions` statement is not supported on the QFabric system.

Default Traceoptions is disabled.

Options **file *name***—Name of the file to receive the tracing operation output. Enclose the name in quotation marks. Traceoption output files are located in the `/var/log/` directory.

files *number*—(Optional) Maximum number of trace files. When a trace file named ***trace-file*** reaches its maximum size, it is renamed ***trace-file.0***. The traceoption output continues in a second trace file named ***trace-file.1***. When ***trace-file.1*** reaches its maximum size, output continues in a third file named ***trace-file.2***, and so on. When the maximum number of trace files is reached, the oldest trace file is overwritten.

If you specify a maximum number of files, you must also specify a maximum file size with the **size** option.

Range: 2 through 1000 files

Default: 1 trace file

flag—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements:

- **all**—Trace all operations.
- **error**—Trace all error events.
- **interface**—Trace the interface events.
- **normal**—Trace all normal events.

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **packet**—Trace packet decoding operations
- **parse**—Trace configuration parsing.
- **state**—Trace state transitions.

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Prevent any user from reading the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches its maximum size, it is renamed **trace-file.0**. Incoming tracefile data is logged in the now empty **trace-file**. When **trace-file** again reaches its maximum size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also specify a maximum number of trace files with the **files** option.

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 10 KB through the maximum file size of 4 GB (maximum is lower if 4 GB is not supported on your system)

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege	storage—To view this statement in the configuration.
Level	storage-control—To add this statement to the configuration.

CHAPTER 9

Operational Commands for Fibre Channel and FCoE-FC Gateways

- [Monitoring Fibre Channel Interface Load Balancing on page 474](#)
- `clear fibre-channel fc2 statistics`
- `clear fibre-channel fip enode`
- `clear fibre-channel fip statistics`
- `clear fibre-channel fip vn-port`
- `clear fibre-channel flogi statistics`
- `clear fibre-channel proxy statistics`
- `clear fip vlan-discovery statistics`
- `request fibre-channel proxy load-rebalance`
- `restart`
- `show fibre-channel fabric`
- `show fibre-channel fc2 sessions`
- `show fibre-channel fc2 statistics`
- `show fibre-channel fip`
- `show fibre-channel fip enode`
- `show fibre-channel fip fabric`
- `show fibre-channel fip fcf`
- `show fibre-channel fip interface`
- `show fibre-channel fip statistics`
- `show fibre-channel flogi fport`
- `show fibre-channel flogi nport`
- `show fibre-channel flogi statistics`
- `show fibre-channel interfaces`
- `show fibre-channel next-hops`
- `show fibre-channel routes`
- `show fibre-channel proxy fabric-state`

- [show fibre-channel proxy login-table](#)
- [show fibre-channel proxy np-port](#)
- [show fibre-channel proxy statistics](#)
- [show fip vlan-discovery](#)
- [show route forwarding-table family fibre-channel](#)

Monitoring Fibre Channel Interface Load Balancing

You can use operational mode commands to monitor load balancing when the switch is in FCoE-FC gateway mode:

1. [Monitoring the Interface Load-Balancing State on page 474](#)
2. [Monitoring the Fabric Load-Balancing Algorithm on page 475](#)

Monitoring the Interface Load-Balancing State

Purpose Monitor the number of sessions, whether load balancing is enabled or disabled, and the load-balancing weight for each native Fibre Channel (FC) interface.



NOTE: A session is a FLOGI or FDISC login to the FC SAN fabric. Session does not refer to end-to-end storage sessions.

Action To monitor the load-balancing state of the native FC interfaces in the CLI, enter the following CLI command:

```
user@switch> show fibre-channel proxy np-port
```

For example:

```
user@switch> show fibre-channel proxy np-port

Fabric: sanfab1, Fabric-id: 10
NP-Port    State      Sessions    LB state    LB weight
fc-0/0/0.0 online      5           ON          4
fc-0/0/1.0 online      5           ON          4
fc-0/0/2.0 online     10          ON          8

Fabric: fc_fab2, Fabric-id: 200
NP-Port    State      Sessions    LB state    LB weight
fc-0/0/44.0 isolated  0           OFF         0

Fabric: fc_fabric_100, Fabric-id: 100
NP-Port    State      Sessions    LB state    LB weight
fc-0/0/46.0 online      1           ON          8
```

Meaning [Table 35 on page 475](#) summarizes key output fields for the FC interface load-balancing state.

Table 35: Summary of Key FC Interface Load-Balancing Output Fields

Field	Values
Fabric	Name of the fabric.
Fabric-id	Fabric ID number.
NP-Port	NP_Port interface connected to the FCoE forwarder (FCF) or the FC switch.
State	FCID state of the NP_Port interface: <ul style="list-style-type: none"> • online—The port is online and connected to the FC switch. FCoE devices can log in to the FC switch using this port. • isolated—The port is isolated and is not part of the load-balancing function. FCoE devices cannot log in to the FC switch using this port. • offline—The port is offline.
Sessions	Number of active sessions on the NP_Port interface.
LB state	Load-balancing state: <ul style="list-style-type: none"> • On—Load balancing is on • Off—Load balancing is off.
LB weight	Load-balancing weight, which reflects the port speed: <ul style="list-style-type: none"> • 2—Port speed is 2 Gbps. • 4—Port speed is 4 Gbps. • 8—Port speed is 8 Gbps.

The gateway determines the least-loaded interface using the following weighted round-robin (WRR) algorithm:

$$(\text{number-of-sessions} * \text{max-weight}) / \text{weight}$$

where *max-weight* is an internal constant. If the load on the FC interfaces is equal, the session is assigned to the interface with the highest link speed (the greatest weight).

Monitoring the Fabric Load-Balancing Algorithm

Purpose Monitor the type of load-balancing algorithm (simple, ENode-based, or FLOGI-based) used on the native FC interfaces, whether or not automated load rebalancing is enabled, and the load rebalancing state of the fabric.

Action To monitor the load-balancing algorithm used on the native FC interfaces and the load rebalancing state in the CLI, enter the following CLI command:

```
user@switch> show fibre-channel proxy fabric-state
```

For example:

```
user@switch> show fibre-channel proxy fabric-state
```

```
Fabric: sanfab1, Fabric-id: 10
Proxy load balance algorithm: Simple, Fabric WWN verification: Yes
Auto load rebalance enabled : No
Last rebalance start-time   : Never
Last rebalance end-time     : Never
Last rebalance trigger      : Link-up
Last rebalance trigger-time  : Mon Sep 10 21:42:30 2012 usec: 814602
Last rebalance trigger-result: Not-configured

Fabric: fc_fab2, Fabric-id: 200
Proxy load balance algorithm: ENode based, Fabric WWN verification: Yes
Auto load rebalance enabled : No
Last rebalance start-time   : Never
Last rebalance end-time     : Never
Last rebalance trigger      : Link-up
Last rebalance trigger-time  : Mon Sep 17 17:23:35 2012 usec: 619684
Last rebalance trigger-result: Not-configured

Fabric: fc_fabric_100, Fabric-id: 100
Proxy load balance algorithm: FLOGI based, Fabric WWN verification: No
Auto load rebalance enabled : Yes
Last rebalance start-time   : Never
Last rebalance end-time     : Never
Last rebalance trigger      : Config-CLI
Last rebalance trigger-time  : Fri Nov 2 08:56:16 2012 usec: 004487
Last rebalance trigger-result: Not-required
```

Meaning You can configure each local FC fabric on an FCoE-FC gateway to use one of three types of load-balancing algorithms, *simple*, *ENode-based*, or *FLOGI-based*. All of the native FC interfaces (NP_Ports) in a particular gateway FC fabric use the same load-balancing algorithm (the load-balancing algorithm is applied on a per-fabric basis).

[Table 36 on page 476](#) summarizes key output fields for the FC interface load-balancing algorithm and state.

Table 36: show fibre-channel proxy fabric-state Output Fields

Field Name	Field Description
Fabric	Name of the fabric.
Fabric-id	Fabric ID number.

Table 36: show fibre-channel proxy fabric-state Output Fields (continued)

Field Name	Field Description
Proxy load balance algorithm	<p>Load-balancing algorithm used on the FCoE-FC gateway FC fabric:</p> <ul style="list-style-type: none"> • Simple—Load balancing is based on the weighted utilization (load) of the NP_Ports connected to an FC fabric. Each new FLOGI or FDISC is assigned to the least-loaded link. <p>On a link load rebalance, only the sessions that need to be moved to another link are logged out. When those sessions log in again, they are placed on active NP_Port interfaces in a balanced manner.</p> <ul style="list-style-type: none"> • ENode-based—Load balancing is based on the ENode FLOGI. When an ENode logs in to the fabric, all subsequent FDISC sessions (VN_Port sessions) associated with that ENode are placed on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link. <p>On a link load rebalance, all sessions are logged out. When the sessions log in again, they are placed on active NP_Port interfaces in a balanced manner.</p> <ul style="list-style-type: none"> • FLOGI-based—Load balancing is based on the ENode FLOGI. When an ENode logs in to the fabric, all subsequent FDISC sessions (VN_Port sessions) associated with that ENode are placed on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link. <p>On a link load rebalance, only the sessions that need to be moved to another link are logged out. When those sessions log in again, they are placed on active NP_Port interfaces in a balanced manner.</p>
Fabric WWN verification	<p>Fabric worldwide name (WWN) verification check state on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> • Yes—Fabric WWN verification check is enabled. • No—Fabric WWN verification check is disabled.
Auto load rebalance enabled	<p>Automated link load rebalancing configuration for the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> • No—Automated load balancing is disabled (default state). • Yes—Automated load balancing is enabled.
Last rebalance start-time	<p>Time that the last link load rebalance began on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> • Never—The link load has never been rebalanced. • Timestamp value—Time the last link load rebalancing started.
Last rebalance end-time	<p>Time that the last link load rebalance ended on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> • Never—The link load has never been rebalanced. • Timestamp value—Time the last link load rebalancing ended.

Table 36: *show fibre-channel proxy fabric-state* Output Fields (continued)

Field Name	Field Description
Last rebalance trigger	<p>Event that triggered the last link load rebalance on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> • None—The link load has never been rebalanced. • Config-CLI—Configure (enable) automated load balancing. • Request-CLI—Rebalance requested from the CLI using the request fibre-channel proxy load-rebalance fabric <i>fabric-name</i> operational command. • Preview-CLI—Rebalancing <i>dry run</i> requested from the CLI using the request fibre-channel proxy load-rebalance dry-run fabric <i>fabric-name</i> operational command. Indicates that the switch completed the dry run. A dry run simulates a link load rebalance and displays a list of sessions that might be affected if you request an actual rebalance. • Link-up—New FC link (NP_Port) up on the FCoE-FC gateway fabric, which causes a rebalance to distribute sessions to the new link. • Restore-complete—If the FC process on the switch restarts, the switch attempts to restore the session state that existed before the restart. When automated rebalance is enabled, restore-complete indicates that the sessions have been restored and rebalanced.
Last rebalance trigger-time	<p>Time that the last link load rebalance was triggered on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> • Never—Link load rebalancing has never been triggered. • Timestamp value—Time the last link load rebalancing was triggered.
Last rebalance trigger-result	<p>Result of the last trigger event on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> • Never—Link load rebalancing has never been triggered. • Not-configured—Automated rebalancing is not configured on the FCoE-FC gateway fabric. • Not-required—Last rebalance trigger did not require rebalancing the link load (the link load was already balanced across the active NP_Port links). • In-progress—Link load rebalancing is in progress and has not finished yet. • Restore-in-progress—The switch is recovering from an FC process restart and is in the process of restoring the sessions to the active NP_Port links. • Success—Link load rebalancing was successful. • Logged-out-all—All sessions have been logged out. • Preview-complete—The switch has finished simulating a dry run rebalancing request from the CLI (request fibre-channel proxy load-rebalance dry-run fabric <i>fabric-name</i> operational command) and reported the sessions that might be affected if you request an actual link load rebalance. • Fabric-deletion-in-progress—FCoE-FC gateway fabric is in the process of being deleted. <p>NOTE: A trigger event does not necessarily result in a rebalance action. Link load rebalancing only occurs if the NP_Port interface session load is not balanced at the time of the trigger event.</p>

Related Documentation

- [show fibre-channel proxy fabric-state on page 544](#)
- [show fibre-channel proxy np-port on page 551](#)

- [Converting an Ethernet Interface To a Fibre Channel Interface on page 255](#)
- [Defining the Proxy Load-Balancing Algorithm on page 283](#)
- [Example: Configuring Automated Fibre Channel Interface Load Rebalancing on page 285](#)
- [Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267](#)
- [Understanding FCoE-FC Gateway Functions on page 196](#)

clear fibre-channel fc2 statistics

Syntax `clear fibre-channel fc2 statistics`
 `<fabric fabric-name>`

Release Information Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Clear FC-2 (network layer) Fibre Channel statistics globally or on a specified Fibre Channel fabric.

Options `fabric fabric-name`—(Optional) Clear FC-2 statistics only on the specified fabric.

Required Privilege Level view

Related Documentation

- [show fibre-channel fc2 statistics on page 504](#)
- [show fibre-channel fc2 sessions on page 502](#)

List of Sample Output [clear fibre-channel fc2 statistics on page 480](#)

Sample Output

clear fibre-channel fc2 statistics

```
user@switch> clear fibre-channel fc2 statistics
```


clear fibre-channel fip enode

Syntax	<code>clear fibre-channel fip enode <i>enode-mac</i></code>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Clear Fibre Channel over Ethernet (FCoE) node (ENode) information for a specified ENode. This operation deletes the ENode state from the switch database and from the FIP snooping firewall filters, which causes the ENode to lose the connection to the Fibre Channel (FC) fabric and to log in to the fabric again. If you clear an ENode, all VN_Ports associated with that ENode are also cleared and lose their connection to the FC fabric and must log in to the fabric again.
Options	<i>enode-mac</i> —MAC address of the ENode.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel fip enode on page 512 • clear fibre-channel fip statistics on page 482 • clear fibre-channel fip vn-port on page 483
List of Sample Output	clear fibre-channel fip enode on page 481

Sample Output

clear fibre-channel fip enode

```
user@switch> clear fibre-channel fip enode 00:10:94:00:00:02
```

clear fibre-channel fip statistics

Syntax `clear fibre-channel fip statistics`
 `<fabric fabric-name>`

Release Information Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Clear Fibre Channel over Ethernet (FCoE) initialization protocol (FIP) statistics.

Options `fabric fabric-name`—(Optional) Clear FIP statistics only on the specified fabric.

Required Privilege Level view

Related Documentation

- [show fibre-channel fip statistics on page 526](#)
- [show fibre-channel fip on page 506](#)

List of Sample Output [clear fibre-channel fip statistics on page 482](#)

Sample Output

clear fibre-channel fip statistics

```
user@switch> clear fibre-channel fip statistics
```

clear fibre-channel fip vn-port

Syntax	<code>clear fibre-channel fip vn-port <i>vn-port--mac</i></code>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Clear virtual N_Port (VN_Port) information for a specified VN_Port. This operation deletes the VN_Port state from the switch database and from the FIP snooping firewall filters, which causes the VN_Port to lose its connection to the Fibre Channel fabric and to log in to the fabric again. When you clear a VN_Port, other VN_Ports associated with the same Fibre Channel over Ethernet (FCoE) Node (ENode) are not affected and are not cleared.
Options	<i>vn-port-mac</i> —MAC address of the VN_Port.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel fip enode on page 512 • clear fibre-channel fip enode on page 481 • clear fibre-channel fip statistics on page 482
List of Sample Output	clear fibre-channel fip vn-port on page 483

Sample Output

clear fibre-channel fip vn-port

```
user@switch> clear fibre-channel fip vn-port 00:10:94:00:00:08
```

clear fibre-channel flogi statistics

Syntax	<code>clear fibre-channel flogi statistics</code> <code><fabric <i>fabric-name</i>></code>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Clear fabric login (FLOGI) statistics globally or on a specified Fibre Channel fabric.
Options	<code>fabric <i>fabric-name</i></code> —(Optional) Clear FLOGI statistics only on the specified fabric.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none">• show fibre-channel flogi statistics on page 534• show fibre-channel flogi fport on page 530• show fibre-channel flogi nport on page 532
List of Sample Output	clear fibre-channel flogi statistics on page 484

Sample Output

clear fibre-channel flogi statistics

```
user@switch> clear fibre-channel flogi statistics
```

clear fibre-channel proxy statistics

Syntax	<code>clear fibre-channel proxy statistics</code> <code><fabric <i>fabric-name</i>></code>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Clear Fibre Channel gateway statistics globally or on a specified Fibre Channel fabric.
Options	<code>fabric <i>fabric-name</i></code> —(Optional) Clear proxy statistics only on the specified fabric.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel proxy statistics on page 555 • show fibre-channel proxy login-table on page 548 • show fibre-channel proxy np-port on page 551
List of Sample Output	clear fibre-channel proxy statistics on page 485

Sample Output

clear fibre-channel proxy statistics

```
user@switch> clear fibre-channel proxy statistics
```

clear fip vlan-discovery statistics

Syntax	<code>clear fip vlan-discovery statistics</code>
Release Information	Command introduced in Junos OS Release 12.1 for the QFX Series.
Description	Clear FIP VLAN discovery statistics.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none">• show fip vlan-discovery on page 402
List of Sample Output	clear fip vlan-discovery statistics on page 486

Sample Output

clear fip vlan-discovery statistics

```
user@switch> clear fip vlan-discovery statistics
```

request fibre-channel proxy load-rebalance

Syntax request fibre-channel proxy load-rebalance
 <dry-run>
 fabric <fabric-name>
 <brief | detail>

Release Information Command introduced in Junos OS Release 12.3 for the QFX Series.

Description Rebalance the link load on one or more FCoE-FC gateway proxy fabrics (local Fibre Channel fabrics on the gateway) on demand. Load rebalancing is a disruptive action that forces some or all sessions (depending on the configured load-balancing algorithm) to log out and then log in again. When sessions log in again, they are placed on NP_Port interfaces so that the link loads are balanced.

Link load rebalancing occurs 10 seconds after you run the rebalancing command, unless another rebalancing trigger occurs before the 10 seconds elapse. If another rebalancing event occurs before the 10-second timer elapses, the timer is extended. Rebalancing occurs a maximum of 30 seconds after you run the rebalancing command, regardless of whether more rebalancing events occur.

You can also perform a *dry run* to see a list of sessions that might be affected (logged out) if you request a load rebalance. A dry run does not rebalance the link loads; it only lists the sessions that might be affected if you rebalance.

Options **dry-run**—(Optional) Simulates performing link load rebalancing and displays a list of sessions that might be affected if you rebalance the link loads.

fabric fabric-name—Name of the fabric on which you want to rebalance the link loads. If you do not specify a fabric name with the fabric keyword, all fabrics on the FCoE-FC gateway rebalance their link loads.

brief | detail—(Optional) Display the specified level of output.

Additional Information Requesting link load rebalancing is a one-time, on-demand operation. You must explicitly request load rebalancing every time you want to rebalance the link loads. Alternatively, you can configure automated load rebalancing if you want the NP_Port links to be rebalanced automatically whenever a load-rebalancing trigger occurs.

Required Privilege Level maintenance

Related Documentation

- [Monitoring Fibre Channel Interface Load Balancing on page 474](#)
- [Simulating On-Demand Fibre Channel Link Load Rebalancing \(Dry Run Test\) on page 285](#)
- [Defining the Proxy Load-Balancing Algorithm on page 283](#)

- [Example: Configuring Automated Fibre Channel Interface Load Rebalancing on page 285](#)
- [Understanding Load Balancing in an FCoE-FC Gateway Proxy Fabric on page 267](#)

List of Sample Output [request fibre-channel proxy load-rebalance dry-run fabric fc_fabric_100 on page 488](#)

Output Fields [Table 37 on page 488](#) lists the output fields for the **request fibre-channel proxy load-rebalance dry-run** command. Output fields are listed in the approximate order in which they appear.

Table 37: request fibre-channel proxy load-rebalance dry-run Output Fields

Field Name	Field Description
Fabric	Name of the fabric.
Fabric-id	Fabric ID number.
F-Port	FCoE VLAN interface (VF_Port interface to the FCoE network).
FCID	VN_Port Fibre Channel identifier provided by the Fibre Channel over Ethernet Forwarder (FCoE forwarder) or the Fibre Channel switch.
Port-WWN	Unique worldwide name (WWN) of the VN_Port.
NP-Port	Name of the native Fibre Channel interface.

Sample Output

[request fibre-channel proxy load-rebalance dry-run fabric fc_fabric_100](#)

```

user@host> request fibre-channel proxy load-rebalance dry-run fabric fc_fabric_100
Fabric: fc_fabric_100, Fabric-id: 100
F-Port      FCID      Port-WWN      NP-Port
vlan.100    0x8a013a  02:01:00:64:00:00:00:2a  fc-0/0/1.0
vlan.100    0x8a013c  02:01:00:64:00:00:00:2b  fc-0/0/1.0
vlan.100    0x8a0146  02:01:00:64:00:00:00:2e  fc-0/0/1.0
vlan.100    0x8a014c  02:01:00:64:00:00:00:2f  fc-0/0/1.0

```


restart

- List of Syntax**
- Syntax on page 489
 - Syntax (ACX Series Routers) on page 489
 - Syntax (EX Series Switches) on page 489
 - Syntax (MX Series Routers) on page 490
 - Syntax (QFX Series) on page 490
 - Syntax (Routing Matrix) on page 490
 - Syntax (TX Matrix Routers) on page 491
 - Syntax (TX Matrix Plus Routers) on page 491
 - Syntax (QFX Series) on page 491

Syntax restart
 <adaptive-services | ancpd-service | application-identification | audit-process |
 auto-configuration | captive-portal-content-delivery | ce-l2tp-service | chassis-control |
 class-of-service | clksyncd-service | database-replication | datapath-trace-service
 | dhcp-service | diameter-service | disk-monitoring | dynamic-flow-capture |
 ecc-error-logging | ethernet-connectivity-fault-management
 | ethernet-link-fault-management | event-processing | firewall
 | general-authentication-service | gracefully | iccp-service | idp-policy | immediately
 | interface-control | ipsec-key-management | kernel-replication | l2-learning | l2cpd-service
 | l2tp-service | l2tp-universal-edge | lacp | license-service | link-management
 | local-policy-decision-function | mac-validation | mib-process | mounstd-service
 | mpls-traceroute | mspd | multicast-snooping | named-service | nfsd-service |
 packet-triggered-subscribers | peer-selection-service | pgm | pic-services-logging | pki-service
 | ppp | ppp-service | pppoe | protected-system-domain-service |
 redundancy-interface-process | remote-operations | root-system-domain-service | routing
 <logical-system *logical-system-name* > | sampling | sbc-configuration-process | sdk-service
 | service-deployment | services | snmp | soft | static-subscribers | statistics-service |
 subscriber-management | subscriber-management-helper | tunnel-oamd | usb-control |
 vrrp | web-management >
 <gracefully | immediately | soft >

Syntax (ACX Series Routers) restart
 <adaptive-services | audit-process | auto-configuration | autoinstallation | chassis-control |
 class-of-service | clksyncd-service | database-replication | dhcp-service | diameter-service
 | disk-monitoring | dynamic-flow-capture | ethernet-connectivity-fault-management
 | ethernet-link-fault-management | event-processing | firewall
 | general-authentication-service | gracefully | immediately | interface-control |
 ipsec-key-management | l2-learning | lacp | link-management | mib-process | mounstd-service
 | mpls-traceroute | mspd | named-service | nfsd-service | pgm | pki-service | ppp | pppoe |
 redundancy-interface-process | remote-operations | routing | sampling | sdk-service
 | secure-neighbor-discovery | service-deployment | services | snmp | soft | statistics-service |
 subscriber-management | subscriber-management-helper | tunnel-oamd | vrrp >

Syntax (EX Series Switches) restart
 <autoinstallation | chassis-control | class-of-service | database-replication | dhcp |
 dhcp-service | diameter-service | dot1x-protocol | ethernet-link-fault-management |
 ethernet-switching | event-processing | firewall | general-authentication-service |

Syntax (MX Series Routers)

```
interface-control | kernel-replication | l2-learning | lacp | license-service | link-management
| lldpd-service | mib-process | mounstd-service | multicast-snooping | pgm |
redundancy-interface-process | remote-operations | routing | secure-neighbor-discovery
| service-deployment | sflow-service | snmp | vrrp | web-management>
```

```
restart
<adaptive-services | ancpd-service | application-identification | audit-process |
auto-configuration | bbe-stats-service | captive-portal-content-delivery | ce-l2tp-service
| chassis-control | class-of-service | clksyncd-service | database-replication |
datapath-trace-service | dhcp-service | diameter-service | disk-monitoring |
dynamic-flow-capture | ecc-error-logging | ethernet-connectivity-fault-management |
ethernet-link-fault-management | event-processing | firewall |
general-authentication-service | gracefully | iccp-service | idp-policy | immediately
| interface-control | ipsec-key-management | kernel-replication | l2-learning | l2cpd-service
| l2tp-service | l2tp-universal-edge | lacp | license-service | link-management |
local-policy-decision-function | mac-validation | mib-process | mounstd-service |
mpls-traceroute | mspd | multicast-snooping | named-service | nfsd-service |
packet-triggered-subscribers | peer-selection-service | pgm | pic-services-logging |
pki-service | ppp | ppp-service | pppoe | protected-system-domain-service |
redundancy-interface-process | remote-operations | root-system-domain-service | routing
| routing <logical-system logical-system-name> | sampling | sbc-configuration-process |
sdk-service | service-deployment | services | snmp | soft | static-subscribers
| statistics-service | subscriber-management | subscriber-management-helper | tunnel-oamd
| usb-control | vrrp | web-management>
<all-members>
<gracefully | immediately | soft>
<local>
<member member-id>
```

Syntax (QFX Series)

```
restart
<adaptive-services | audit-process | chassis-control | class-of-service | dialer-services |
diameter-service | dls | ethernet-connectivity | event-processing | fibre-channel | firewall
| general-authentication-service | igmp-host-services | interface-control |
ipsec-key-management | isdn-signaling | l2ald | l2-learning | l2tp-service | mib-process |
named-service | network-access-service | nstrace-process | pgm | ppp | pppoe |
redundancy-interface-process | remote-operations | logical-system-name> | routing |
sampling | secure-neighbor-discovery | service-deployment | snmp | usb-control |
web-management>
<gracefully | immediately | soft>
```

Syntax (Routing Matrix)

```
restart
<adaptive-services | audit-process | chassis-control | class-of-service | disk-monitoring |
dynamic-flow-capture | ecc-error-logging | event-processing | firewall | interface-control
| ipsec-key-management | kernel-replication | l2-learning | l2tp-service | lacp |
link-management | mib-process | pgm | pic-services-logging | ppp | pppoe |
redundancy-interface-process | remote-operations | routing <logical-system
logical-system-name> | sampling | service-deployment | snmp>
<all | all-lcc | lcc number>
<gracefully | immediately | soft>
```

Syntax (TX Matrix Routers)	<pre>restart <adaptive-services audit-process chassis-control class-of-service dhcp-service diameter-service disk-monitoring dynamic-flow-capture ecc-error-logging event-processing firewall interface-control ipsec-key-management kernel-replication l2-learning l2tp-service lacp link-management mib-process pgm pic-services-logging ppp pppoe redundancy-interface-process remote-operations routing <logical-system logical-system-name> sampling service-deployment snmp statistics-service> <all-chassis all-lcc lcc number scc> <gracefully immediately soft></pre>
Syntax (TX Matrix Plus Routers)	<pre>restart <adaptive-services audit-process chassis-control class-of-service dhcp-service diameter-service disk-monitoring dynamic-flow-capture ecc-error-logging event-processing firewall interface-control ipsec-key-management kernel-replication l2-learning l2tp-service lacp link-management mib-process pgm pic-services-logging ppp pppoe redundancy-interface-process remote-operations routing <logical-system logical-system-name> sampling service-deployment snmp statistics-service> <all-chassis all-lcc all-sfc lcc number sfc number> <gracefully immediately soft></pre>
Syntax (QFX Series)	<pre>restart <adaptive-services audit-process chassis-control class-of-service dialer-services diameter-service dlsw ethernet-connectivity event-processing fibre-channel firewall general-authentication-service igmp-host-services interface-control ipsec-key-management isdn-signaling l2ald l2-learning l2tp-service mib-process named-service network-access-service nstrace-process pgm ppp pppoe redundancy-interface-process remote-operations logical-system-name> routing sampling secure-neighbor-discovery service-deployment snmp usb-control web-management> <gracefully immediately soft></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Command introduced in Junos OS Release 12.2 for ACX Series routers.</p> <p>Command introduced in Junos OS Release 14.1X53-D20 for the OCX Series.</p> <p>Options added:</p> <ul style="list-style-type: none"> • dynamic-flow-capture in Junos OS Release 7.4. • dlsw in Junos OS Release 7.5. • event-processing in Junos OS Release 7.5. • ppp in Junos OS Release 7.5. • l2ald in Junos OS Release 8.0. • link-management in Junos Release 8.0. • pgcp-service in Junos OS Release 8.4.

- **sbc-configuration-process** in Junos OS Release 9.5.
- **services pgcp gateway** in Junos OS Release 9.6.
- **sfc** and **all-sfc** for the TX Matrix Router in Junos OS Release 9.6.
- **bbe-stats-service** in Junos OS Release 18.4R1 on MX Series routers.

Description Restart a Junos OS process.



CAUTION: Never restart a software process unless instructed to do so by a customer support engineer. A restart might cause the router or switch to drop calls and interrupt transmission, resulting in possible loss of data.

Options **none**—Same as **gracefully**.

adaptive-services—(Optional) Restart the configuration management process that manages the configuration for stateful firewall, Network Address Translation (NAT), intrusion detection services (IDS), and IP Security (IPsec) services on the Adaptive Services PIC.

all-chassis—(TX Matrix and TX Matrix Plus routers only) (Optional) Restart the software process on all chassis.

all-lcc—(TX Matrix and TX Matrix Plus routers only) (Optional) For a TX Matrix router, restart the software process on all T640 routers connected to the TX Matrix router. For a TX Matrix Plus router, restart the software process on all T1600 routers connected to the TX Matrix Plus router.

all-members—(MX Series routers only) (Optional) Restart the software process for all members of the Virtual Chassis configuration.

all-sfc—(TX Matrix Plus routers only) (Optional) For a TX Matrix Plus router, restart the software processes for the TX Matrix Plus router (or switch-fabric chassis).

ancpd-service—(Optional) Restart the Access Node Control Protocol (ANCP) process, which works with a special Internet Group Management Protocol (IGMP) session to collect outgoing interface mapping events in a scalable manner.

application-identification—(Optional) Restart the process that identifies an application using intrusion detection and prevention (IDP) to allow or deny traffic based on applications running on standard or nonstandard ports.

audit-process—(Optional) Restart the RADIUS accounting process that gathers statistical data that can be used for general network monitoring, analyzing, and tracking usage patterns, for billing a user based on the amount of time or type of services accessed.

auto-configuration—(Optional) Restart the Interface Auto-Configuration process.

autoinstallation—(EX Series switches only) (Optional) Restart the autoinstallation process.

bbe-stats-service—(MX Series routers only) (Optional) Restart bbe-statsd, the BBE statistics collection and management process.

captive-portal-content-delivery—(Optional) Restart the HTTP redirect service by specifying the location to which a subscriber's initial Web browser session is redirected, enabling initial provisioning and service selection for the subscriber.

ce-l2tp-service—(M10, M10i, M7i, and MX Series routers only) (Optional) Restart the Universal Edge Layer 2 Tunneling Protocol (L2TP) process, which establishes L2TP tunnels and Point-to-Point Protocol (PPP) sessions through L2TP tunnels.

chassis-control—(Optional) Restart the chassis management process.

class-of-service—(Optional) Restart the class-of-service (CoS) process, which controls the router's or switch's CoS configuration.

clksyncd-service—(Optional) Restart the external clock synchronization process, which uses synchronous Ethernet (SyncE).

database-replication—(EX Series switches and MX Series routers only) (Optional) Restart the database replication process.

datapath-trace-service—(Optional) Restart the packet path tracing process.

dhcp—(EX Series switches only) (Optional) Restart the software process for a Dynamic Host Configuration Protocol (DHCP) server. A DHCP server allocates network IP addresses and delivers configuration settings to client hosts without user intervention.

dhcp-service—(Optional) Restart the Dynamic Host Configuration Protocol process.

dialer-services—(EX Series switches only) (Optional) Restart the ISDN dial-out process.

diameter-service—(Optional) Restart the diameter process.

disk-monitoring—(Optional) Restart disk monitoring, which checks the health of the hard disk drive on the Routing Engine.

dls—(QFX Series only) (Optional) Restart the data link switching (DLSw) service.

dot1x-protocol—(EX Series switches only) (Optional) Restart the port-based network access control process.

dynamic-flow-capture—(Optional) Restart the dynamic flow capture (DFC) process, which controls DFC configurations on Monitoring Services III PICs.

ecc-error-logging—(Optional) Restart the error checking and correction (ECC) process, which logs ECC parity errors in memory on the Routing Engine.

ethernet-connectivity-fault-management—(Optional) Restart the process that provides IEEE 802.1ag Operation, Administration, and Management (OAM) connectivity fault

management (CFM) database information for CFM maintenance association end points (MEPs) in a CFM session.

ethernet-link-fault-management—(EX Series switches and MX Series routers only) (Optional) Restart the process that provides the OAM link fault management (LFM) information for Ethernet interfaces.

ethernet-switching—(EX Series switches only) (Optional) Restart the Ethernet switching process.

event-processing—(Optional) Restart the event process (eventd).

fibre-channel—(QFX Series only) (Optional) Restart the Fibre Channel process.

firewall—(Optional) Restart the firewall management process, which manages the firewall configuration and enables accepting or rejecting packets that are transiting an interface on a router or switch.

general-authentication-service—(EX Series switches and MX Series routers only) (Optional) Restart the general authentication process.

gracefully—(Optional) Restart the software process.

iccp-service—(Optional) Restart the Inter-Chassis Communication Protocol (ICCP) process.

idp-policy—(Optional) Restart the intrusion detection and prevention (IDP) protocol process.

immediately—(Optional) Immediately restart the software process.

interface-control—(Optional) Restart the interface process, which controls the router's or switch's physical interface devices and logical interfaces.

ipsec-key-management—(Optional) Restart the IPsec key management process.

isdn-signaling—(QFX Series only) (Optional) Restart the ISDN signaling process, which initiates ISDN connections.

kernel-replication—(Optional) Restart the kernel replication process, which replicates the state of the backup Routing Engine when graceful Routing Engine switchover (GRES) is configured.

l2-learning—(Optional) Restart the Layer 2 address flooding and learning process.

l2cpd-service—(Optional) Restart the Layer 2 Control Protocol process, which enables features such as Layer 2 protocol tunneling and nonstop bridging.

l2tp-service—(M10, M10i, M7i, and MX Series routers only) (Optional) Restart the Layer 2 Tunneling Protocol (L2TP) process, which sets up client services for establishing Point-to-Point Protocol (PPP) tunnels across a network and negotiating Multilink PPP if it is implemented.

l2tp-universal-edge—(MX Series routers only) (Optional) Restart the L2TP process, which establishes L2TP tunnels and PPP sessions through L2TP tunnels.

lACP—(Optional) Restart the Link Aggregation Control Protocol (LACP) process. LACP provides a standardized means for exchanging information between partner systems on a link to allow their link aggregation control instances to reach agreement on the identity of the LAG to which the link belongs, and then to move the link to that LAG, and to enable the transmission and reception processes for the link to function in an orderly manner.

lcc *number*—(TX Matrix and TX Matrix Plus routers only) (Optional) For a TX Matrix router, restart the software process for a specific T640 router that is connected to the TX Matrix router. For a TX Matrix Plus router, restart the software process for a specific router that is connected to the TX Matrix Plus router.

Replace *number* with the following values depending on the LCC configuration:

- 0 through 3, when T640 routers are connected to a TX Matrix router in a routing matrix.
- 0 through 3, when T1600 routers are connected to a TX Matrix Plus router in a routing matrix.
- 0 through 7, when T1600 routers are connected to a TX Matrix Plus router with 3D SIBs in a routing matrix.
- 0, 2, 4, or 6, when T4000 routers are connected to a TX Matrix Plus router with 3D SIBs in a routing matrix.

license-service—(EX Series switches only) (Optional) Restart the feature license management process.

link-management— (TX Matrix and TX Matrix Plus routers and EX Series switches only) (Optional) Restart the Link Management Protocol (LMP) process, which establishes and maintains LMP control channels.

lldpd-service—(EX Series switches only) (Optional) Restart the Link Layer Discovery Protocol (LLDP) process.

local—(MX Series routers only) (Optional) Restart the software process for the local Virtual Chassis member.

local-policy-decision-function— (Optional) Restart the process for the Local Policy Decision Function, which regulates collection of statistics related to applications and application groups and tracking of information about dynamic subscribers and static interfaces.

mac-validation— (Optional) Restart the Media Access Control (MAC) validation process, which configures MAC address validation for subscriber interfaces created on demux interfaces in dynamic profiles on MX Series routers.

member *member-id*—(MX Series routers only) (Optional) Restart the software process for a specific member of the Virtual Chassis configuration. Replace *member-id* with a value of 0 or 1.

mib-process—(Optional) Restart the Management Information Base (MIB) version II process, which provides the router's MIB II agent.

mobile-ip—(Optional) Restart the Mobile IP process, which configures Junos OS Mobile IP features.

mountd-service—(EX Series switches and MX Series routers only) (Optional) Restart the service for NFS mount requests.

mpls-traceroute—(Optional) Restart the MPLS Periodic Traceroute process.

mspd—(Optional) Restart the Multiservice process.

multicast-snooping—(EX Series switches and MX Series routers only) (Optional) Restart the multicast snooping process, which makes Layer 2 devices, such as VLAN switches, aware of Layer 3 information, such as the media access control (MAC) addresses of members of a multicast group.

named-service—(Optional) Restart the DNS Server process, which is used by a router or a switch to resolve hostnames into addresses.

network-access-service—(QFX Series only) (Optional) Restart the network access process, which provides the router's Challenge Handshake Authentication Protocol (CHAP) authentication service.

nfsd-service—(Optional) Restart the Remote NFS Server process, which provides remote file access for applications that need NFS-based transport.

packet-triggered-subscribers—(Optional) Restart the packet-triggered subscribers and policy control (PTSP) process, which allows the application of policies to dynamic subscribers that are controlled by a subscriber termination device.

peer-selection-service—(Optional) Restart the Peer Selection Service process.

pgcp-service—(Optional) Restart the pgcpd service process running on the Routing Engine. This option does not restart pgcpd processes running on mobile station PICs. To restart pgcpd processes running on mobile station PICs, use the **services pgcp gateway** option.

pgm—(Optional) Restart the process that implements the Pragmatic General Multicast (PGM) protocol for assisting in the reliable delivery of multicast packets.

pic-services-logging—(Optional) Restart the logging process for some PICs. With this process, also known as fsad (the file system access daemon), PICs send special logging information to the Routing Engine for archiving on the hard disk.

pki-service—(Optional) Restart the PKI Service process.

ppp—(Optional) Restart the Point-to-Point Protocol (PPP) process, which is the encapsulation protocol process for transporting IP traffic across point-to-point links.

ppp-service—(Optional) Restart the Universal edge PPP process, which is the encapsulation protocol process for transporting IP traffic across universal edge routers.

pppoe—(Optional) Restart the Point-to-Point Protocol over Ethernet (PPPoE) process, which combines PPP that typically runs over broadband connections with the Ethernet link-layer protocol that allows users to connect to a network of hosts over a bridge or access concentrator.

protected-system-domain-service—(Optional) Restart the Protected System Domain (PSD) process.

redundancy-interface-process—(Optional) Restart the ASP redundancy process.

remote-operations—(Optional) Restart the remote operations process, which provides the ping and traceroute MIBs.

root-system-domain-service—(Optional) Restart the Root System Domain (RSD) service.

routing—(ACX Series routers, QFX Series, EX Series switches, and MX Series routers only) (Optional) Restart the routing protocol process.

routing <logical-system *logical-system-name*>—(Optional) Restart the routing protocol process, which controls the routing protocols that run on the router or switch and maintains the routing tables. Optionally, restart the routing protocol process for the specified logical system only.

sampling—(Optional) Restart the sampling process, which performs packet sampling based on particular input interfaces and various fields in the packet header.

sbc-configuration-process—(Optional) Restart the session border controller (SBC) process of the border signaling gateway (BSG).

scc—(TX Matrix routers only) (Optional) Restart the software process on the TX Matrix router (or switch-card chassis).

sdk-service—(Optional) Restart the SDK Service process, which runs on the Routing Engine and is responsible for communications between the SDK application and Junos OS. Although the SDK Service process is present on the router, it is turned off by default.

secure-neighbor-discovery—(QFX Series, EX Series switches, and MX Series routers only) (Optional) Restart the secure Neighbor Discovery Protocol (NDP) process, which provides support for protecting NDP messages.

sfc *number*—(TX Matrix Plus routers only) (Optional) Restart the software process on the TX Matrix Plus router (or switch-fabric chassis). Replace *number* with 0.

service-deployment—(Optional) Restart the service deployment process, which enables Junos OS to work with the Session and Resource Control (SRC) software.

services—(Optional) Restart a service.

services pgcp gateway *gateway-name*—(Optional) Restart the pgcpd process for a specific border gateway function (BGF) running on an MS-PIC. This option does not restart the pgcpd process running on the Routing Engine. To restart the pgcpd process on the Routing Engine, use the **pgcp-service** option.

sflow-service—(EX Series switches only) (Optional) Restart the flow sampling (sFlow technology) process.

snmp—(Optional) Restart the SNMP process, which enables the monitoring of network devices from a central location and provides the router's or switch's SNMP master agent.

soft—(Optional) Reread and reactivate the configuration without completely restarting the software processes. For example, BGP peers stay up and the routing table stays constant. Omitting this option results in a graceful restart of the software process.

static-subscribers—(Optional) Restart the static subscribers process, which associates subscribers with statically configured interfaces and provides dynamic service activation and activation for these subscribers.

statistics-service—(Optional) Restart the process that manages the Packet Forwarding Engine statistics.

subscriber-management—(Optional) Restart the Subscriber Management process.

subscriber-management-helper—(Optional) Restart the Subscriber Management Helper process.

tunnel-oamd—(Optional) Restart the Tunnel OAM process, which enables the Operations, Administration, and Maintenance of Layer 2 tunneled networks. Layer 2 protocol tunneling (L2PT) allows service providers to send Layer 2 protocol data units (PDUs) across the provider's cloud and deliver them to Juniper Networks EX Series Ethernet Switches that are not part of the local broadcast domain.

usb-control—(MX Series routers) (Optional) Restart the USB control process.

vrrp—(ACX Series routers, EX Series switches, and MX Series routers only) (Optional) Restart the Virtual Router Redundancy Protocol (VRRP) process, which enables hosts on a LAN to make use of redundant routing platforms on that LAN without requiring more than the static configuration of a single default route on the hosts.

web-management—(QFX Series, EX Series switches, and MX Series routers only) (Optional) Restart the Web management process.

Required Privilege Level reset

Related Documentation • [Overview of Junos OS CLI Operational Mode Commands](#)

List of Sample Output [restart interface-control gracefully on page 499](#)

Output Fields When you enter this command, you are provided feedback on the status of your request.

Sample Output

[restart interface-control gracefully](#)

```
user@host> restart interface-control gracefully
Interface control process started, pid 41129
```

show fibre-channel fabric

Syntax `show fibre-channel fabric`
`<extensive | summary>`
`<fabric-name>`
`<sort-by (name | fabric-id)>`

Release Information Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Display Fibre Channel fabric information.

Options *fabric-name*—(Optional) Display output only for the specified fabric.
extensive | summary—(Optional) Display the specified level of output.
sort-by (name | fabric-id)—(Optional) Sort output by fabric name or fabric ID.

Required Privilege Level view

Related Documentation

- [fc-fabrics on page 440](#)
- [Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195](#)

List of Sample Output [show fibre-channel fabric on page 501](#)
[show fibre-channel fabric extensive on page 501](#)

Output Fields [Table 38 on page 500](#) lists the output fields for the **show fibre-channel fabric** command. Output fields are listed in the approximate order in which they appear.

Table 38: show fibre-channel fabric Output Fields

Field Name	Field Description	Level of Output
Fabric	Name of the fabric.	All
Fabric-ID	Identification number of the fabric.	All
Type	Type of fabric. All fabrics are PROXY fabrics.	All
Interfaces	Native Fibre Channel interfaces and FCoE interfaces assigned to the fabric.	All
Created at	Date and time the fabric was created.	extensive
Internal Index	Fabric index internal to Junos OS.	extensive
Origin	Origin information internal to Junos OS.	extensive

Table 38: show fibre-channel fabric Output Fields (continued)

Field Name	Field Description	Level of Output
Description	Text description of the fabric.	extensive
Fabric WWN	Unique WWN of the fabric generated by the FCF.	extensive
Login sessions	Number of FIP login sessions currently running on the fabric.	extensive
Configured max login sessions	Configured maximum number of FIP login sessions permitted on the fabric.	extensive

Sample Output

show fibre-channel fabric

```
user@switch> show fibre-channel fabric
```

Fabric	Fabric-ID	Type	Interfaces
proxy2	200	PROXY	fc-0/0/0.0 fc-0/0/1.0

show fibre-channel fabric extensive

```
user@switch> show fibre-channel fabric extensive
```

```
Fabric: proxy2, Created at: Mon Apr 19 14:02:58 2010
Fabric-ID: 200, Internal index: 2, Origin: Static
Description: srv-fabric, Type: PROXY, Fabric WWN: 10:00:00:05:33:51:d7:cd
Login sessions: 200, Configured max login sessions: 500
    fc-0/0/0.0, (untagged)
    fc-0/0/1.0, (untagged)
```

show fibre-channel fc2 sessions

Syntax `show fibre-channel fc2 sessions`
`<fabric fabric-name>`
`<brief | detail>`

Release Information Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Display Fibre Channel FC-2 information.



NOTE: A session is a FLOGI or FDISC login to the FC SAN fabric. Session does not refer to end-to-end storage sessions.

Options `fabric fabric-name`—(Optional) Display output only for the specified fabric.
`brief | detail`—(Optional) Display the specified level of output.

Required Privilege Level view

Related Documentation

- [show fibre-channel fc2 statistics on page 504](#)
- [clear fibre-channel fc2 statistics on page 480](#)

List of Sample Output [show fibre-channel fc2 sessions on page 503](#)
[show fibre-channel fc2 sessions detail on page 503](#)

Output Fields [Table 39 on page 502](#) lists the output fields for the **show fibre-channel fc2 sessions** command. Output fields are listed in the approximate order in which they appear.

Table 39: show fibre-channel fc2 sessions Output Fields

Field Name	Field Description	Level of Output
Fabric	Name of the fabric.	All
Fabric-id	Identification number of the fabric.	All
Interface Name	Name of the interface.	All
Local FCID	Address of the local end of the connection.	All
Far FCID	Address of the far (remote) end of the connection.	All

Table 39: show fibre-channel fc2 sessions Output Fields (continued)

Field Name	Field Description	Level of Output
# Pending Exchanges	Number of pending exchanges for the session.	All
Flags	Flags internal to Junos OS.	detail
Refcount	Reference count internal to Junos OS.	detail
Users	Information internal to Junos OS.	detail

Sample Output

show fibre-channel fc2 sessions

```

user@switch> show fibre-channel fc2 sessions

Fabric: fip-proxy, Fabric-id: 1
Interface      Local    Far      # Pending
Name           FCID     FCID     Exchanges
fc-0/0/0.0     *        0xfffffe 0
fc-0/0/1.0     *        0xfffffe 0
fc-0/0/2.0     *        0xfffffe 0

```

show fibre-channel fc2 sessions detail

```

user@switch> show fibre-channel fc2 sessions detail

Fabric: fip-proxy, Fabric-id: 1
Interface Name  fc-0/0/0.0
Local FCID:    *
Far FCID:      0xfffffe
Exchanges:     0
Flags:         SELF_LOCK USER_SYNCED
Refcount:      2
Users:         1

Interface Name  fc-0/0/1.0
Local FCID:    *
Far FCID:      0xfffffe
Exchanges:     0
Flags:         SELF_LOCK USER_SYNCED
Refcount:      2

Interface Name  fc-0/0/2.0
Local FCID:    *
Far FCID:      0xfffffe
Exchanges:     0
Flags:         SELF_LOCK USER_SYNCED
Refcount:      2
Users:         1

```

show fibre-channel fc2 statistics

Syntax	<code>show fibre-channel fc2 statistics</code> <code><fabric fabric-name></code>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel FC-2 statistics.
Options	<code>fabric fabric-name</code> —(Optional) Display output only for the specified fabric.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel fc2 sessions on page 502 • clear fibre-channel fc2 statistics on page 480
List of Sample Output	show fibre-channel fc2 statistics on page 505
Output Fields	Table 40 on page 504 lists the output fields for the show fibre-channel fc2 statistics command. Output fields are listed in the approximate order in which they appear.

Table 40: show fibre-channel fc2 statistics Output Fields

Field Name	Field Description
Global statistics	Statistics for all fabrics.
Frame buffers allocated	Number of frame buffers currently allocated to all fabrics.
Frame buffers freed	Number of frame buffers freed.
Frames dropped	Number of dropped frames.
Fabric statistics	Fabric-specific statistics.
Fabric	Name of the fabric.
Fabric-id	Identification number of the fabric.
Tx-FRJT	Number of fabric frame rejects (F_RJT).
Tx-PRJT	Number of port frame rejects (P_RJT).
Tx-LSRJT	Number of link service rejections.

Table 40: show fibre-channel fc2 statistics Output Fields (continued)

Field Name	Field Description
Tx-ABTS	Number of abort sequence frames sent.
Rx-Drops	Number of received frames dropped.
Rx-ABTS	Number of abort sequence frames received.

Sample Output

show fibre-channel fc2 statistics

```
user@switch> show fibre-channel fc2 statistics
```

```
Global statistics:
```

```
Frame buffers allocated: 60
Frame buffers freed:    60
Frames dropped:         0
```

```
Fabric statistics:
```

```
Fabric : fip-proxy, Fabric-id: 1
```

```
Tx-FRJT: 0
Tx-PRJT: 0
Tx-LSRJT: 0
Tx-ABTS: 0
Rx-Drops: 0
Rx-ABTS: 0
```

show fibre-channel fip

Syntax	<code>show fibre-channel fip <brief detail></code>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel over Ethernet Initialization Protocol (FIP) information.
Options	brief detail —(Optional) Display the specified level of output.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring FIP on an FCoE-FC Gateway on page 216 • show fibre-channel fip enode on page 512 • show fibre-channel fip fabric on page 516 • show fibre-channel fip fcf on page 519 • show fibre-channel fip interface on page 522 • show fibre-channel fip statistics on page 526 • clear fibre-channel fip statistics on page 482
List of Sample Output	show fibre-channel fip on page 509 show fibre-channel fip detail on page 510
Output Fields	Table 41 on page 506 lists the output fields for the show fibre-channel fip command. Output fields are listed in the approximate order in which they appear. A session is a FLOGI or FDISC login to the FC SAN fabric. Session does not refer to end-to-end storage sessions.

Table 41: show fibre-channel fip Output Fields

Field Name	Field Description	Level of Output
Configured max FIP sessions per Node Device	<p>Configured maximum number of FIP sessions permitted on the Node device.</p> <p>For QFabric systems, this is the maximum number of FIP sessions permitted on each Node device in the fabric.</p> <p>For QFX3500 devices, this is the maximum number of FIP sessions permitted on the device.</p>	detail
Node Device	Node device identifier.	detail

Table 41: *show fibre-channel fip* Output Fields (continued)

Field Name	Field Description	Level of Output
Total FIP sessions	Total number of FIP sessions on the FCoE-FC gateway switch.	detail
Total FCoE filters	Total number of FIP filters on the FCoE-FC gateway switch.	detail
Fabric Name	Name of the fabric and in parentheses the fabric ID.	All
FC-MAP	FCoE mapped address prefix of the FCoE forwarder for the fabric.	detail
FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC fabric.	detail
MAX-SESSIONS-PER-ENODE	Maximum number of concurrent sessions (FLOGI and FDISC combined) that each ENode can instantiate.	detail
FCoE trusted	Whether ports on the FC fabric are trusted or untrusted: <ul style="list-style-type: none"> • Yes—Ports on the FC fabric are trusted; FIP snooping is turned off. • No—Ports on the FC fabric are not trusted; FIP snooping is turned on. 	detail

Table 41: *show fibre-channel fip* Output Fields (continued)

Field Name	Field Description	Level of Output
Member	Information about an FCF that is a member of the fabric.	All
• FCF-MAC	MAC address used in discovery advertisements.	All
• FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC interface.	detail
• FKA-ADV-D-BIT	Disable FIP keepalive advertisement monitoring bit. The state is always off .	detail
• Type	Type of interface: • VF_Port Capable —Interface can act as a VF_Port interface.	detail
• Priority	Priority value associated with the switch FCF-MAC. Converged network adapters (CNAs) use the priority value to determine the switch with which they will perform FIP FLOGI. The lower the value, the higher the priority. Value range: 0 through 255.	detail
• State	FIP state on the fabric: • Enable —FIP is enabled on the fabric. • Disable —FIP is disabled on the fabric.	detail

Table 41: show fibre-channel fip Output Fields (continued)

Field Name	Field Description	Level of Output
ENode	Information about a connected FCoE node (ENode).	All
• ENode-MAC	MAC address of the connected ENode.	All
• Enode State	Login state internal to Junos OS.	All
• Configured ENode timer	User-configured FIP keepalive advertisement interval in milliseconds.	detail
• Running ENode timer	Runtime interval in milliseconds of the last FIP keepalive advertisement received. This value changes every time an FKA_ADV is received.	detail
• Active FIP Sessions	Number of active FIP sessions on the ENode.	detail
• VN-Port-MAC	MAC address of a VN_Port on the ENode.	All
• Session State	Session state internal to Junos OS.	detail
• Configured FKA-ADV	User-configured FIP keepalive advertisement interval in milliseconds.	detail
• Running FKA-ADV	Runtime interval in milliseconds of the last FIP keepalive advertisement received. This value changes every time an FKA_ADV is received.	detail
• Configured VN-Port Timer	Configured state of the VN_Port keepalive timer in milliseconds. This value is always 90 and is not user-configurable.	detail
• Running VN-Port Timer	Running state of the VN_Port keepalive timer in milliseconds.	detail
• FCID	Fibre Channel ID of the VN_Port.	detail
• WWN	Unique worldwide name of the VN_Port.	detail

Sample Output

show fibre-channel fip

```
user@switch> show fibre-channel fip
```

```
Fabric Name : proxy2 (200)
Member
FCF-MAC : 00:30:48:b0:ee:d2 (Interface vlan.100)
Enode
Enode-MAC : 00:10:94:00:00:02      State : Logged-in
Session
```

```

VN-Port-MAC          : 0e:fc:00:03:00:02
VN-Port-MAC          : 0e:fc:00:03:00:01
Enode-MAC : 00:10:94:00:00:03      State : Logged-in
Session
VN-Port-MAC          : 0e:fc:00:03:00:04
VN-Port-MAC          : 0e:fc:00:03:00:03

```

show fibre-channel fip detail

```
user@switch> show fibre-channel fip detail
```

```
Configured max FIP sessions per Node Device: 2500
```

```
Node Device: 0 Total FIP sessions: 4 Total FCoE filters: 4
```

```
Fabric Name : proxy2 (200)
```

```
FC-MAP : 0e:fc:00
```

```
FKA-ADV-PERIOD : 90000
```

```
MAX-SESSIONS-PER-ENODE : 32
```

```
FCoE trusted : No
```

Member

```
FCF-MAC: 00:30:48:b0:ee:d2 (Interface vlan.100)
```

```
FKA-ADV-PERIOD : 90000
```

```
FKA-ADV-D-BIT-bit : Off
```

```
Type : VF_Port Capable
```

```
Priority : 86
```

```
State : Enable
```

ENode

```
Enode-MAC : 00:10:94:00:00:02 ENode State : Logged-in
```

```
Configured ENode timer: 8000
```

```
Running ENode timer: 12226
```

```
Active FIP Sessions : 2
```

Session details

```
VN-Port-MAC : 0e:fc:00:03:00:02
```

```
Session state : Up
```

```
Configured FKA-ADV : 90000
```

```
Running FKA-ADV : 0
```

```
Configured VN-Port Timer : 90000
```

```
Running VN-Port Timer : 213193
```

```
FCID : 0x2c1a01
```

```
WWN : 10:00:00:00:c9:a4:a3:cf
```

```
VN-Port-MAC : 0e:fc:00:03:00:01
```

```
Session state : Up
```

```
Configured FKA-ADV : 90000
```

```
Running FKA-ADV : 0
```

```
Configured VN-Port Timer : 90000
```

```
Running VN-Port Timer : 213632
```

```
FCID : 0x2c1a02
```

```
WWN : 10:00:00:00:d9:b4:e3:df
```

ENode

```
Enode-MAC : 00:10:94:00:00:03 ENode State : Logged-in
```

```
Configured ENode timer: 8000
```

```
Running ENode timer: 12254
```

```
Active FIP Sessions : 2
```

Session details

```
VN-Port-MAC : 0e:fc:00:03:00:04
```

```
Session state : Up
```

```
Configured FKA-ADV : 90000
```

```
Running FKA-ADV : 0
```

```
Configured VN-Port Timer : 90000
```

```
Running VN-Port Timer : 213480
FCID                  : 0x2c1a03
WWN                   : 21:00:00:c0:dd:11:09:13

VN-Port-MAC          : 0e:fc:00:03:00:03
Session state         : Up
Configured FKA-ADV    : 90000
Running FKA-ADV       : 0
Configured VN-Port Timer : 90000
Running VN-Port Timer : 214004
FCID                  : 0x2c1a04
WWN                   : 21:00:00:c0:df:12:08:14
```

show fibre-channel fip enode

Syntax	show fibre-channel fip enode <i>enode-mac</i> <brief detail> <vn-port-mac <i>vn-port-mac</i>>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) information for a specified ENode or a specified VN_Port on an ENode.
Options	<p>brief detail—(Optional) Display the specified level of output.</p> <p><i>enode-mac</i>—Display information for the ENode specified by the MAC address.</p> <p>vn-port-mac <i>vn-port-mac</i>—(Optional) Display information only for the specified VN_Port.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring FIP on an FCoE-FC Gateway on page 216 • show fibre-channel fip on page 506 • show fibre-channel fip fabric on page 516 • show fibre-channel fip fcf on page 519 • show fibre-channel fip interface on page 522 • show fibre-channel fip statistics on page 526 • clear fibre-channel fip enode on page 481
List of Sample Output	<p>show fibre-channel fip enode on page 514</p> <p>show fibre-channel fip enode detail on page 515</p>
Output Fields	<p>Table 42 on page 512 lists the output fields for the show fibre-channel fip enode command. Output fields are listed in the approximate order in which they appear. A session is a FLOGI or FDISC login to the FC SAN fabric. Session does not refer to end-to-end storage sessions.</p>

Table 42: show fibre-channel fip enode Output Fields

Field Name	Field Description	Level of Output
Fabric Name	Name of the fabric and in parentheses the fabric ID.	All
FC-MAP	FCoE mapped address prefix of the FCoE forwarder for the fabric.	detail

Table 42: show fibre-channel fip enode Output Fields (continued)

Field Name	Field Description	Level of Output
FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC fabric.	detail
MAX-SESSIONS-PER-ENODE	Maximum number of concurrent sessions (FLOGI and FDISC combined) that each ENode can instantiate.	detail
FCoE trusted	Whether ports on the FC fabric are trusted or untrusted: <ul style="list-style-type: none"> Yes—Ports on the FC fabric are trusted; FIP snooping is turned off. No—Ports on the FC fabric are not trusted; FIP snooping is turned on. 	detail
Member	Information about an FCF that is a member of the fabric.	All
• FCF-MAC	MAC address used in discovery advertisements.	All
• FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC interface.	detail
• FKA-ADV-D-BIT	Disable FIP keepalive advertisement monitoring bit. The state is always off .	detail
• Type	Type of interface: <ul style="list-style-type: none"> VF_Port Capable—Interface can act as a VF_Port interface. 	detail
• Priority	Priority value associated with the switch FCF-MAC. Converged network adapters (CNAs) use the priority value to determine the switch with which they will perform FIP FLOGI. The lower the value, the higher the priority. Value range: 0 through 255.	detail
• State	FIP state on the fabric: <ul style="list-style-type: none"> Enable—FIP is enabled on the fabric. Disable—FIP is disabled on the fabric. 	detail

Table 42: show fibre-channel fip enode Output Fields (continued)

Field Name	Field Description	Level of Output
ENode	Information about a connected FCoE node (ENode).	All
• ENode-MAC	MAC address of the connected ENode.	All
• ENode State	Login state internal to Junos OS.	All
• Configured ENode timer	User-configured FIP keepalive advertisement interval in milliseconds.	detail
• Running ENode timer	Runtime interval in milliseconds of the last FIP keepalive advertisement received. This value changes every time an FKA_ADV is received.	detail
• Active FIP Sessions	Number of active FIP sessions on the ENode.	detail
• VN-Port-MAC	MAC address of a VN_Port on the ENode.	detail
• Session State	Session state internal to Junos OS.	detail
• Configured FKA-ADV	User-configured FIP keepalive advertisement interval in milliseconds.	detail
• Running FKA-ADV	Runtime interval in seconds of the last FIP keepalive advertisement received. This value changes every time an FKA_ADV is received.	detail
• Configured VN-Port Timer	Configured state of the VN_Port keepalive timer in seconds. This value is always 90 and is not user-configurable.	detail
• Running VN-Port Timer	Running state of the VN_Port keepalive timer in seconds.	detail
• FCID	Fibre Channel ID of the VN_Port.	detail
• WWN	Unique worldwide name of the VN_Port.	detail

Sample Output

show fibre-channel fip enode

```

user@switch> show fibre-channel fip enode 00:10:94:00:00:02
Fabric Name : proxy2 (200)
Member
FCF-MAC : 00:30:48:b0:ee:d2 (Interface v1an.100)
Enode
Enode-MAC : 00:10:94:00:00:02      State : Logged-in
Session

```

```

VN-Port-MAC          : 0e:fc:00:03:00:02
VN-Port-MAC          : 0e:fc:00:03:00:01

```

show fibre-channel fip enode detail

```
user@switch> show fibre-channel fip enode 00:10:94:00:00:02 detail
```

```

Fabric Name : proxy2 (200)
FC-MAP      : 0e:fc:00
FKA-ADV-PERIOD : 90000      MAX-SESSIONS-PER-ENODE : 32
FCoE trusted : No

Member
FCF-MAC: 00:30:48:b0:ee:d2 (Interface vlan.100)
FKA-ADV-PERIOD : 90000      FKA-ADV-D-BIT-bit : Off
Type : VF_Port Capable
Priority : 86              State : Enable

ENode
Enode-MAC : 00:10:94:00:00:02  ENode State : Logged-in
Configured ENode timer: 8000    Running ENode timer: 12226
Active FIP Sessions : 2

Session details
VN-Port-MAC          : 0e:fc:00:03:00:02
Session state        : Up
Configured FKA-ADV    : 90000
Running FKA-ADV       : 0
Configured VN-Port Timer : 90000
Running VN-Port Timer  : 213193
FCID                  : 0x2c1a01
WWN                    : 10:00:00:00:c9:a4:a3:cf

VN-Port-MAC          : 0e:fc:00:03:00:01
Session state        : Up
Configured FKA-ADV    : 90000
Running FKA-ADV       : 0
Configured VN-Port Timer : 90000
Running VN-Port Timer  : 213632
FCID                  : 0x2c1a02
WWN                    : 10:00:00:00:d9:b4:e3:df

```

show fibre-channel fip fabric

Syntax	show fibre-channel fip fabric <i>fabric-name</i> <brief detail>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) information for a specified Fibre Channel fabric.
Options	brief detail —(Optional) Display the specified level of output. <i>fabric-name</i> —Display information for the specified fabric.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring FIP on an FCoE-FC Gateway on page 216 • show fibre-channel fip on page 506 • show fibre-channel fip enode on page 512 • show fibre-channel fip fcf on page 519 • show fibre-channel fip interface on page 522 • show fibre-channel fip statistics on page 526
List of Sample Output	show fibre-channel fip fabric proxy2 on page 517 show fibre-channel fip fabric detail on page 518
Output Fields	Table 43 on page 516 lists the output fields for the show fibre-channel fip fabric command. Output fields are listed in the approximate order in which they appear.

Table 43: show fibre-channel fip fabric Output Fields

Field Name	Field Description	Level of Output
Fabric Name	Name of the fabric and in parentheses the fabric ID.	All
FC-MAP	FCoE mapped address prefix of the FCoE forwarder for the fabric.	detail
FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC fabric.	detail

Table 43: show fibre-channel fip fabric Output Fields (continued)

Field Name	Field Description	Level of Output
Member	Information about an FCF that is a member of the fabric.	All
• FCF-MAC	MAC address used in discovery advertisements.	All
• FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC interface.	detail
• FKA-ADV-D-BIT	Disable FIP keepalive advertisement monitoring bit. The state is always off .	detail
• Type	Type of interface: • VF_Port Capable —Interface can act as a VF_Port interface.	detail
ENode	Information about a connected FCoE node (ENode).	All
• ENode-MAC	MAC address of the connected ENode.	All
• State	Login state internal to Junos OS.	All
• VN-Port-MAC	MAC address of a VN_Port on the ENode.	detail
• Session State	Session state internal to Junos OS.	detail
• Configured FKA-ADV	User-configured FIP keepalive advertisement interval in milliseconds.	detail
• Running FKA-ADV	Runtime interval in seconds of the last FIP keepalive advertisement received. This value changes every time an FKA_ADV is received.	detail
• Configured VN-Port Timer	Configured state of the VN_Port keepalive timer in seconds. This value is always 90 and is not user-configurable.	detail
• Running VN-Port Timer	Running state of the VN_Port keepalive timer in seconds.	detail

Sample Output

show fibre-channel fip fabric proxy2

```
user@switch> show fibre-channel fip fabric proxy2
```

```
Fabric Name : proxy2 (200)
Member
FCF-MAC : 00:30:48:b0:ee:d2 (Interface vlan.100)
ENode
```

```

Enode-MAC : 00:10:94:00:00:02      State : Logged-in
Enode-MAC : 00:10:94:00:00:03      State : Logged-in

```

show fibre-channel fip fabric detail

```
user@switch> show fibre-channel fip fabric proxy2 detail
```

```

Fabric Name : proxy2 (200)
FC-MAP      : 0e:fc:00
FKA-ADV-PERIOD : 90000

Member
FCF-MAC: 00:30:48:b0:ee:d2 (Interface vlan.100)
FKA-ADV-PERIOD : 90000      FKA-ADV-D-bit : Off
Type : VF_Port Capable

ENode
Enode-MAC : 00:10:94:00:00:02      State : Logged-in

    Session details
    VN-Port-MAC      : 0e:fc:00:03:00:02
    Session state     : Up
    Configured FKA-ADV : 90000
    Running FKA-ADV    : 0
    Configured VN-Port Timer : 90
    Running VN-Port Timer : 0

    VN-Port-MAC      : 0e:fc:00:03:00:01
    Session state     : Up
    Configured FKA-ADV : 90000
    Running FKA-ADV    : 0
    Configured VN-Port Timer : 90
    Running VN-Port Timer : 0

ENode
Enode-MAC : 00:10:94:00:00:03      State : Logged-in

    Session details
    VN-Port-MAC      : 0e:fc:00:03:00:04
    Session state     : Up
    Configured FKA-ADV : 90000
    Running FKA-ADV    : 0
    Configured VN-Port Timer : 90
    Running VN-Port Timer : 0

    VN-Port-MAC      : 0e:fc:00:03:00:03
    Session state     : Up
    Configured FKA-ADV : 90000
    Running FKA-ADV    : 0
    Configured VN-Port Timer : 90
    Running VN-Port Timer : 0

```

show fibre-channel fip fcf

Syntax	show fibre-channel fip fcf <i>fcf-mac</i> <brief detail> <fabric <i>fabric-name</i>>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) information for a specified FCoE forwarder (FCF).
Options	brief detail —(Optional) Display the specified level of output. fabric <i>fabric-name</i> —(Optional) Display FCF information only for the specified fabric. <i>fcf-mac</i> —Display information for the FCF specified by the MAC address.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring FIP on an FCoE-FC Gateway on page 216 • show fibre-channel fip on page 506 • show fibre-channel fip enode on page 512 • show fibre-channel fip fabric on page 516 • show fibre-channel fip interface on page 522 • show fibre-channel fip statistics on page 526
List of Sample Output	show fibre-channel fip fcf on page 520 show fibre-channel fip fcf detail on page 521
Output Fields	Table 44 on page 519 lists the output fields for the show fibre-channel fip fcf command. Output fields are listed in the approximate order in which they appear.

Table 44: show fibre-channel fip fcf Output Fields

Field Name	Field Description	Level of Output
Fabric Name	Name of the fabric and in parentheses the fabric ID.	All
FC-MAP	FCoE mapped address prefix of the FCoE forwarder for the fabric.	detail
FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC fabric.	detail

Table 44: show fibre-channel fip fcf Output Fields (continued)

Field Name	Field Description	Level of Output
Member	Information about an FCF that is a member of the fabric.	All
• FCF-MAC	MAC address used in discovery advertisements.	All
• FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC interface.	detail
• FKA-ADV-D-BIT	Disable FIP keepalive advertisement monitoring bit. The state is always off .	detail
• Type	Type of interface: • VF_Port Capable —Interface can act as a VF_Port interface.	detail
ENode	Information about a connected FCoE node (ENode).	All
• ENode-MAC	MAC address of the connected ENode.	All
• State	Login state internal to Junos OS.	All
• VN-Port-MAC	MAC address of a VN_Port on the ENode.	detail
• Session State	Session state internal to Junos OS.	detail
• Configured FKA-ADV	User-configured FIP keepalive advertisement interval in milliseconds.	detail
• Running FKA-ADV	Runtime interval in seconds of the last FIP keepalive advertisement received. This value changes every time an FKA_ADV is received.	detail
• Configured VN-Port Timer	Configured state of the VN_Port keepalive timer in seconds. This value is always 90 and is not user-configurable.	detail
• Running VN-Port Timer	Running state of the VN_Port keepalive timer in seconds.	detail

Sample Output

show fibre-channel fip fcf

```

user@switch> show fibre-channel fip fcf 00:30:48:b0:ee:d2
Fabric Name : proxy2 (200)
Member
FCF-MAC : 00:30:48:b0:ee:d2 (Interface vlan.100)
Enode

```



```

Enode-MAC : 00:10:94:00:00:02      State : Logged-in
Enode-MAC : 00:10:94:00:00:03      State : Logged-in

```

show fibre-channel fip fcf detail

```
user@switch> show fibre-channel fip fcf 00:30:48:b0:ee:d2 detail
```

```

Fabric Name : proxy2 (200)
FC-MAP      : 0e:fc:00
FKA-ADV-PERIOD : 90000

Member
FCF-MAC: 00:30:48:b0:ee:d2 (Interface vlan.100)
FKA-ADV-PERIOD : 90000      FKA-ADV-D-bit : Off
Type : VF_Port Capable

ENode
Enode-MAC : 00:10:94:00:00:02      State : Logged-in

    Session details
    VN-Port-MAC      : 0e:fc:00:03:00:02
    Session state    : Up
    Configured FKA-ADV : 90000
    Running FKA-ADV   : 0
    Configured VN-Port Timer : 90
    Running VN-Port Timer : 0

    VN-Port-MAC      : 0e:fc:00:03:00:01
    Session state    : Up
    Configured FKA-ADV : 90000
    Running FKA-ADV   : 0
    Configured VN-Port Timer : 90
    Running VN-Port Timer : 0

ENode
Enode-MAC : 00:10:94:00:00:03      State : Logged-in

    Session details
    VN-Port-MAC      : 0e:fc:00:03:00:04
    Session state    : Up
    Configured FKA-ADV : 90000
    Running FKA-ADV   : 0
    Configured VN-Port Timer : 90
    Running VN-Port Timer : 0

    VN-Port-MAC      : 0e:fc:00:03:00:03
    Session state    : Up
    Configured FKA-ADV : 90000
    Running FKA-ADV   : 0
    Configured VN-Port Timer : 90
    Running VN-Port Timer : 0

```

show fibre-channel fip interface

Syntax	<pre>show fibre-channel fip interface <i>interface-name</i> <brief detail> <enode <i>enode-mac</i>> <fabric <i>fabric-name</i>> <vn-port <i>vn-port-mac</i>></pre>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel over Ethernet (FCoE) Initialization Protocol (FIP) information for a specified interface.
Options	<p>brief detail—(Optional) Display the specified level of output.</p> <p><i>enode-mac</i>—MAC address of the ENode.</p> <p><i>fabric fabric-name</i>—(Optional) Display interface information only for the specified fabric.</p> <p><i>interface-name</i>—Display information for the specified interface.</p> <p><i>vn-port-mac</i>—MAC address of the VN_Port.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring FIP on an FCoE-FC Gateway on page 216 • show fibre-channel fip on page 506 • show fibre-channel fip enode on page 512 • show fibre-channel fip fabric on page 516 • show fibre-channel fip fcf on page 519 • show fibre-channel fip statistics on page 526 • clear fibre-channel fip vn-port on page 483
List of Sample Output	show fibre-channel fip interface on page 524 show fibre-channel fip interface detail on page 524
Output Fields	Table 45 on page 523 lists the output fields for the show fibre-channel fip interface command. Output fields are listed in the approximate order in which they appear.

Table 45: show fibre-channel fip interface Output Fields

Field Name	Field Description	Level of Output
Fabric Name	Name of the fabric and in parentheses the fabric ID.	All
FC-MAP	FCoE mapped address prefix of the FCoE forwarder for the fabric.	detail
FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC fabric.	detail
Member	Information about an FCF that is a member of the fabric.	All
• FCF-MAC	MAC address used in discovery advertisements.	All
• FKA-ADV-PERIOD	Period of time in milliseconds between FIP keepalive advertisements configured for the FC interface.	detail
• FKA-ADV-D-BIT	Disable FIP keepalive advertisement monitoring bit. The state is always off .	detail
• Type	Type of interface: • VF_Port Capable —Interface can act as a VF_Port interface.	detail
ENode	Information about a connected FCoE node (ENode).	All
• ENode-MAC	MAC address of the connected ENode.	All
• State	Login state internal to Junos OS.	All
• VN-Port-MAC	MAC address of a VN_Port on the ENode.	detail
• Session State	Session state internal to Junos OS.	detail
• Configured FKA-ADV	User-configured FIP keepalive advertisement interval in milliseconds.	detail
• Running FKA-ADV	Runtime interval in seconds of the last FIP keepalive advertisement received. This value changes every time an FKA_ADV is received.	detail
• Configured VN-Port Timer	Configured state of the VN_Port keepalive timer in seconds. This value is always 90 and is not user-configurable.	detail
• Running VN-Port Timer	Running state of the VN_Port keepalive timer in seconds.	detail

Sample Output

show fibre-channel fip interface

```
user@switch> show fibre-channel fip interface vlan.100
```

```
Fabric Name : proxy2 (200)
Member
FCF-MAC : 00:30:48:b0:ee:d2 (Interface vlan.100)
ENode
ENode-MAC : 00:10:94:00:00:02      State : Logged-in
ENode-MAC : 00:10:94:00:00:03      State : Logged-in
```

show fibre-channel fip interface detail

```
user@switch> show fibre-channel fip interface vlan.100 detail
```

```
Fabric Name : proxy2 (200)
FC-MAP      : 0e:fc:00
FKA-ADV-PERIOD : 90000

Member
FCF-MAC: 00:30:48:b0:ee:d2 (Interface vlan.100)
FKA-ADV-PERIOD : 90000      FKA-ADV-D-bit : Off
Type : VF_Port Capable

ENode
ENode-MAC : 00:10:94:00:00:02      State : Logged-in

Session details
VN-Port-MAC      : 0e:fc:00:03:00:02
Session state    : Up
Configured FKA-ADV : 90000
Running FKA-ADV   : 0
Configured VN-Port Timer : 90
Running VN-Port Timer : 0

VN-Port-MAC      : 0e:fc:00:03:00:01
Session state    : Up
Configured FKA-ADV : 90000
Running FKA-ADV   : 0
Configured VN-Port Timer : 90
Running VN-Port Timer : 0

ENode
ENode-MAC : 00:10:94:00:00:03      State : Logged-in

Session details
VN-Port-MAC      : 0e:fc:00:03:00:04
Session state    : Up
Configured FKA-ADV : 90000
Running FKA-ADV   : 0
Configured VN-Port Timer : 90
Running VN-Port Timer : 0

VN-Port-MAC      : 0e:fc:00:03:00:03
Session state    : Up
Configured FKA-ADV : 90000
Running FKA-ADV   : 0
```

```
Configured VN-Port Timer : 90  
Running VN-Port Timer   : 0
```

show fibre-channel fip statistics

Syntax `show fibre-channel fip statistics
<fabric fabric-name>`

Release Information Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Display Fibre Channel over Ethernet Initialization Protocol (FIP) statistics.

Options `fabric fabric-name`—(Optional) Display output only for the specified fabric.

Required Privilege Level view

Related Documentation

- [show fibre-channel fip on page 506](#)
- [show fibre-channel fip enode on page 512](#)
- [show fibre-channel fip fabric on page 516](#)
- [show fibre-channel fip fcf on page 519](#)
- [show fibre-channel fip interface on page 522](#)
- [clear fibre-channel fip statistics on page 482](#)

List of Sample Output [show fibre-channel fip statistics on page 528](#)

Output Fields [Table 46 on page 526](#) lists the output fields for the **show fibre-channel fip statistics** command. Output fields are listed in the approximate order in which they appear.

Table 46: show fibre-channel fip statistics Output Fields

Field Name	Field Description
Fabric name	Name of the fabric.
Interface name	Name of the FCoE VLAN interface.

Table 46: show fibre-channel fip statistics Output Fields (continued)

Field Name	Field Description
FIP Message Type	Type of FIP message for the displayed row of statistics..
• MDS	Number of multicast discovery solicitations.
• UDS	Number of unicast discovery solicitations.
• FLOGI	Number of fabric login (FLOGI) messages.
• FDISC	Number of fabric discovery (FDISC) messages.
• LOGO	Number of fabric logout (LOGO) messages.
• ENODE KA	Number of ENode keepalive messages.
• VN_Port KA	Number of VN_Port keepalive messages.
• MDA	Number of multicast discovery advertisements.
• UDA	Number of unicast discovery advertisements.
• FLOGI ACC	Number of fabric login requests accepted.
• FLOGI RJT	Number of fabric login requests rejected.
• FDISC ACC	Number of fabric discovery requests accepted.
• FDISC RJT	Number of fabric discovery requests rejected.
• LOGO ACC	Number of logout requests accepted.
• LOGO RJT	Number of logout requests rejected.
• CVL	Number of clear virtual links (CVL) messages.
• CVL ALL	Number of CVL all messages.
Received	Number of messages received.
Sent	Number of messages sent.
Rx errors	Number of receive errors.

Table 46: show fibre-channel fip statistics Output Fields (continued)

Field Name		Field Description
Dropped		Number of dropped messages. NOTE: One cause of dropped messages is that the system limits the number of discovery solicitations (MDS and UDS) it accepts to a maximum of 100 outstanding requests at any given time. If the system has 100 discovery solicitations outstanding, the system does not respond to new discovery solicitations. Instead, the system drops new discovery solicitations and reports the number of dropped discovery solicitations in this field. When there are fewer than 100 outstanding discovery solicitations, the system responds to new requests as usual with a discovery advertisement.
General Statistics	Number of frames recvd with invalid src-mac	Number of frames received that have an invalid source media access control (MAC) address.
	Number of frames recvd with invalid version	Number of FIP frames received with an Invalid FIP version.
	Number of frames recvd with invalid opcode	Number of FIP validation descriptors with an invalid opcode received.
	Number of frames recvd with invalid subcode	Number of FIP validation descriptors with an invalid subcode received.
	Number of frames recvd on inactive FCF	Number of frames received on a logical interface if FIP is not active on that logical interface (for example, if a WWN is not allocated to that logical interface).

Sample Output

show fibre-channel fip statistics

```
user@switch> show fibre-channel fip statistics
```

```
Fabric name: proxy2
```

```
Interface name: vlan.100
```

FIP Message type	Received	Sent	Rx errors	Dropped
MDS	22236	0	0	17089
UDS	0	0	0	0
FLOGI	1257	0	8	0
FDISC	0	0	0	0
LOGO	0	0	0	0
ENODE KA	455	0	6	0
VN_Port KA	22	0	0	0
MDA	0	243	0	0
UDA	0	5147	0	0
FLOGI ACC	0	376	0	0
FLOGI RJT	0	881	0	0
FDISC ACC	0	0	0	0
FDISC RJT	0	0	0	0
LOGO ACC	0	0	0	0

LOGO RJT	0	0	0	0
CVL	0	374	0	0
CVL ALL	0	380	0	0

General Statistics:

Number of frame recvd with invalid src-mac:	0
Number of frame recvd with invalid version:	0
Number of frame recvd with invalid opcode:	0
Number of frame recvd with invalid subcode:	0
Number of frame recvd on inactive FCF:	0

show fibre-channel flogi fport

Syntax	show fibre-channel flogi fport <fabric fabric-name>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel fabric login (FLOGI) F_Port information.
Options	fabric fabric-name —(Optional) Display output only for the specified fabric.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel flogi nport on page 532 • show fibre-channel flogi statistics on page 534
List of Sample Output	show fibre-channel flogi fport on page 530
Output Fields	Table 47 on page 530 lists the output fields for the show fibre-channel flogi fport command. Output fields are listed in the approximate order in which they appear.

Table 47: show fibre-channel flogi fport Output Fields

Field Name	Field Description
Fabric	Name of the fabric.
Interface	Name of the switch VF_Port interface.
Mac-Address	Media access control (MAC) address of the ENode.
State	Interface physical state: up or down .
Logins	Number of logins to the VF_Port.
NPIV	N_Port ID virtualization (NPIV) state: Yes or No .
FLOGI-Port-WWN	Unique worldwide name (WWN) of the VN_Port performing fabric login (FLOGI) to the switch VF_Port.

Sample Output

show fibre-channel flogi fport

```
user@switch> show fibre-channel flogi fport
```

Fabric: proxy2

Interface	Mac-Address	State	Logins	NPIV	FLOGI-Port-WWN
vlan.100	00:10:94:00:00:02	Up	2	Yes	20:00:10:94:00:01:00:01
vlan.100	00:10:94:00:00:03	Up	2	Yes	20:00:10:94:00:02:00:01

show fibre-channel flogi nport

Syntax	show fibre-channel flogi nport <brief detail> <fabric <i>fabric-name</i>>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel fabric login (FLOGI) VN_Port information.
Options	brief detail —(Optional) Display the specified level of output. fabric <i>fabric-name</i> —(Optional) Display output only for the specified fabric.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel flogi fport on page 530 • show fibre-channel flogi statistics on page 534
List of Sample Output	show fibre-channel flogi nport on page 533 show fibre-channel flogi nport detail on page 533
Output Fields	Table 48 on page 532 lists the output fields for the show fibre-channel flogi nport command. Output fields are listed in the approximate order in which they appear.

Table 48: show fibre-channel flogi nport Output Fields

Field Name	Field Description	Level of Output
Fabric	Name of the fabric.	All
Virtual-switch	Name of the fabric.	detail
Interface	Name of the VF_Port interface.	All
FCID	VN_Port Fibre Channel identifier provided by the Fibre Channel over Ethernet Forwarder (FCoE forwarder) or the Fibre Channel switch.	All
Port-WWN	Unique worldwide name (WWN) of the VN_Port.	All
Node-WWN	Unique WWN of the node hosting the VN_Port.	All
State or Flogi-state	Login state internal to Junos OS.	All

Table 48: `show fibre-channel flogi nport` Output Fields (continued)

Field Name	Field Description	Level of Output
FLOGI-Port-WWN	Unique worldwide name (WWN) of the VN_Port performing fabric login (FLOGI) to the switch VF_Port.	detail

Sample Output

`show fibre-channel flogi nport`

```
user@switch> show fibre-channel flogi nport
```

```
Fabric: proxy2
Interface  FCID      Port-WWN      Node-WWN      State
vlan.100   0x030001  20:00:10:94:00:01:00:01  10:00:10:94:00:00:00:01  online
vlan.100   0x030002  20:00:10:94:00:01:00:05  10:00:10:94:00:00:00:01  online
vlan.100   0x030003  20:00:10:94:00:02:00:01  10:00:10:94:00:00:00:02  online
vlan.100   0x030004  20:00:10:94:00:02:00:05  10:00:10:94:00:00:00:02  online
```

`show fibre-channel flogi nport detail`

```
user@switch> show fibre-channel flogi nport detail
```

```
Fabric: proxy2
  Virtual-switch: proxy2

    Interface: vlan.100
    Flogi-state: online
    FCID: 0x030001
    Port-WWN: 20:00:10:94:00:01:00:01
    Node-WWN: 10:00:10:94:00:00:00:01
    FLOGI-Port-WWN: 20:00:10:94:00:01:00:01

    Interface: vlan.100
    Flogi-state: online
    FCID: 0x030002
    Port-WWN: 20:00:10:94:00:01:00:05
    Node-WWN: 10:00:10:94:00:00:00:01
    FLOGI-Port-WWN: 20:00:10:94:00:01:00:01

    Interface: vlan.100
    Flogi-state: online
    FCID: 0x030003
    Port-WWN: 20:00:10:94:00:02:00:01
    Node-WWN: 10:00:10:94:00:00:00:02
    FLOGI-Port-WWN: 20:00:10:94:00:02:00:01

    Interface: vlan.100
    Flogi-state: online
    FCID: 0x030004
    Port-WWN: 20:00:10:94:00:02:00:05
    Node-WWN: 10:00:10:94:00:00:00:02
    FLOGI-Port-WWN: 20:00:10:94:00:02:00:01
```

show fibre-channel flogi statistics

Syntax	show fibre-channel flogi statistics <fabric fabric-name>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel fabric login (FLOGI) statistics.
Options	fabric fabric-name —(Optional) Display output only for the specified fabric.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel flogi fport on page 530 • show fibre-channel flogi nport on page 532 • clear fibre-channel flogi statistics on page 484
List of Sample Output	show fibre-channel flogi statistics on page 535
Output Fields	Table 49 on page 534 lists the output fields for the show fibre-channel flogi statistics command. Output fields are listed in the approximate order in which they appear.

Table 49: show fibre-channel flogi statistics Output Fields

Field Name	Field Description
Fabric	Name of the fabric.
FLOGI-Server Message type	Type of message: <ul style="list-style-type: none"> • FLOGI—Fabric login (FLOGI) messages. • FDISC—Fabric discovery (FDISC) messages. • FLOGO—Fabric logout messages. • FLOGO-LS-ACC—Fabric logout link service accept messages. • LS-Accept—Link service accept messages. • LS-Reject—Link service reject messages. • invalid—Invalid messages.
Received	Number of messages received for a given message type.
Sent	Number of messages sent for a given message type.
Fabric	Name of the fabric.
Rx errors	Number of receive errors for a given type of message.

Table 49: show fibre-channel flogi statistics Output Fields (continued)

Field Name	Field Description
General Statistics	<ul style="list-style-type: none"> • Number of FC2 Header Parse Errors Number of errors parsing the FC-2 header. • Number of FLOGI Parse Errors Number of errors parsing fabric login requests. • Number of FDISC Parse Errors Number of errors parsing fabric discovery requests. • Number of FLOGO Parse Errors Number of errors parsing fabric logout requests. • Number of Logins Discarded as Domain-ID not available Number of discarded logins due to unavailability of a domain ID. • Number of Logins Discarded as FCID not available Number of discarded logins due to the unavailability of a Fibre Channel ID. • Number of FCID requests deferred Number of deferred FCID requests. • Number of deferred FCID requests failed Number of deferred FCID requests that failed.

Sample Output

show fibre-channel flogi statistics

```

user@switch> show fibre-channel flogi statistics
Fabric: proxy2

FLOGI-Server Message type  Received      Sent      Rx errors
FLOGI                      2          0          0
FDISC                      2          0          0
FLOGO                      0          0          0
FLOGO-LS-ACC               0          0          0
LS-Accept                  0          4          0
LS-Reject                  0          0          0
invalid                    0          0          0

General Statistics:

Number of FC2 Header Parse Errors:           0
Number of FLOGI Parse Errors:                 0
Number of FDISC Parse Errors:                 0
Number of FLOGO Parse Errors:                 0
Number of Logins Discarded as Domain-ID not available: 0
Number of Logins Discarded as FCID not available: 0

```

Number of FCID requests deferred:	0
Number of deferred FCID requests failed:	0

show fibre-channel interfaces

Syntax	<pre><brief detail> <fabric <i>fabric-name</i>> show fibre-channel interfaces <i>interface-name</i></pre>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display information about Fibre Channel (FC) interfaces.
Options	<p>brief detail—(Optional) Display the specified level of output.</p> <p>fabric <i>fabric-name</i>—(Optional) Display output only for the specified fabric.</p> <p><i>interface-name</i>—Display output for the specified interface.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Example: Setting Up Fibre Channel and FCoE VLAN Interfaces in an FCoE-FC Gateway Fabric on page 239 • Configuring a Physical Fibre Channel Interface on page 254 • Configuring an FCoE VLAN Interface on an FCoE-FC Gateway on page 258 • Converting an Ethernet Interface To a Fibre Channel Interface on page 255 • Assigning Interfaces to a Fibre Channel Fabric on page 262
List of Sample Output	<p>show fibre-channel interfaces on page 538</p> <p>show fibre-channel interfaces detail on page 539</p>
Output Fields	Table 50 on page 537 lists the output fields for the show fibre-channel interfaces command. Output fields are listed in the approximate order in which they appear.

Table 50: show fibre-channel interfaces Output Fields

Field Name	Field Description	Level of Output
Interface	Name of the FC interface.	All
Idx or Index	Interface index internal to Junos OS.	All
Type	Type of interface: <ul style="list-style-type: none"> • FC—Native FC interface • FCOE—Fibre Channel over Ethernet interface 	All
Native Fabric-id	Identification number of the QFX Series fabric.	All

Table 50: show fibre-channel interfaces Output Fields (continued)

Field Name	Field Description	Level of Output
NPIV	N_Port ID virtualization (NPIV) state: Yes or No .	All
Config-Mode	User-configured port mode: <ul style="list-style-type: none"> F—The port is configured as a VF_Port, an FCoE port connected to FCoE devices. NP—The port is configured as a proxy N_Port (NP_Port), a native FC port connected to an FC switch. 	All
Oper-Mode	Operational port mode: <ul style="list-style-type: none"> F—The port is operating as a VF_Port, an FCoE port connected to FCoE devices. NP—The port is operating as an NP_Port, a native FC port connected to an FC switch or an FCoE forwarder (FCF). 	All
State	Interface state: up or down .	All
WWN	Unique worldwide name (WWN) of the port.	detail
FSM-State	Finite state machine state, internal to Junos OS.	detail
Class ID	Fibre Channel interface class ID, internal to Junos OS.	detail
BB_SC_N	Buffer-to-buffer state change number.	detail
Tx B2B credits	Number of buffer-to-buffer credits advertised by the neighbor switch that is connected to the FC interface.	detail
Fabric	Name of the fabric.	detail
Remote-MAC	Media access control (MAC) address of the remotely connected FCoE device VN_Port interface.	detail
Tagging	Not used. Value is shown as untagged .	detail
Mode	Logical interface (LIF) mode of operation.	detail
H/W token	Unique identifier for the FCoE VLAN interface, internal to Junos OS.	detail

Sample Output

show fibre-channel interfaces

```
user@switch> show fibre-channel interfaces
```

Interface	Idx	Type	Native Fabric-id	NPIV	Config Mode	Oper Mode	State
fc-0/0/1.0	70	FC	200	YES	NP	NP	up
vlan.100	84	FCOE	200	YES	F	F	up

show fibre-channel interfaces detail

```
user@switch> show fibre-channel interfaces detail
```

```
Interface: fc-0/0/1.0, Index: 70, Type: FC, Native Fabric-id: 200
```

```
NPIV: YES, Config-Mode: NP, Oper-Mode: NP, State: up
```

```
WWN: 10:00:00:15:17:a9:98:64, FSM-State: up, Class ID: 1, BB_SC_N: 0
```

```
Tx B2B credits: 32
```

Fabric	Remote-MAC	Tagging	Mode	Oper state
proxy2	-	untagged	NP	up

```
Interface: vlan.100, Index: 84, Type: FCOE, Native Fabric-id: 200
```

```
NPIV: YES, Config-Mode: F, Oper-Mode: F, State: up
```

```
WWN: 10:00:00:30:48:b0:ee:d2, FSM-State: up
```

```
H/W token: 13
```

Fabric	Remote-MAC	Tagging	Mode	Oper state
proxy2	00:10:94:00:00:02	untagged	VF	up
proxy2	00:10:94:00:00:03	untagged	VF	up

show fibre-channel next-hops

Syntax	<code>show fibre-channel next-hops</code>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel next-hop route information.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel routes on page 542 • show route forwarding-table family fibre-channel on page 560
List of Sample Output	show fibre-channel next-hops on page 540
Output Fields	Table 51 on page 540 lists the output fields for the <code>show fibre-channel next-hops</code> command. Output fields are listed in the approximate order in which they appear.

Table 51: show fibre-channel next-hops Output Fields

Field Name	Field Description
Type	Type of next hop internal to Junos OS.
State	State of the NP_Port interface: <ul style="list-style-type: none"> • Active—The interface is online. • Deleted—The interface is deleted.
Interface	Name of the interface.
Mac-Address	Media access control (MAC) address of the interface.
Index	Next-hop index identifier.
Ref-count	Reference count internal to Junos OS.
Flags	Flags internal to Junos OS.

Sample Output

show fibre-channel next-hops

```
user@switch> show fibre-channel next-hops
```

Type	State	Interface	Mac-Address	Index	Ref-count	Flags
intf	Active	fc-0/0/0.0		0	1	
ucast	Active	vlan.100	00:15:17:a9:98:64	674	1	kernel, self
ucast	Active	vlan.100	0e:fc:00:03:00:01	675	1	kernel, self
ucast	Active	vlan.100	0e:fc:00:03:00:02	676	1	kernel, self
ucast	Active	vlan.100	0e:fc:00:03:00:03	677	1	kernel, self
ucast	Active	vlan.100	0e:fc:00:03:00:04	678	1	kernel, self

show fibre-channel routes

Syntax	<code>show fibre-channel routes</code> <code><fabric fabric-name></code>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel route information.
Options	<code>fabric fabric-name</code> —(Optional) Display output only for the specified fabric.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show fibre-channel next-hops on page 540 • show route forwarding-table family fibre-channel on page 560
List of Sample Output	show fibre-channel routes on page 543
Output Fields	Table 52 on page 542 lists the output fields for the <code>show fibre-channel routes</code> command. Output fields are listed in the approximate order in which they appear.

Table 52: show fibre-channel routes Output Fields

Field Name	Field Description
Fabric	Name of the fabric.
Route-prefix	Route destination.
State	State of the NP_Port interface: <ul style="list-style-type: none"> • Active—The interface is online. • Deleted—The interface is deleted.
Interface	Name of the interface.
Mac-Address	Media access control (MAC) address of the interface.
Index	Next-hop index identifier.
Flags	Flags internal to Junos OS.

Sample Output

show fibre-channel routes

```
user@switch> show fibre-channel routes
```

```
Fabric: proxy2
```

Route-prefix	State	Interface	Mac-Address	Index	Flags
0x030000/24	Active	fc-0/0/0.0	00:15:17:a9:98:64	674	kernel
0x030001/24	Active	vlan.100	0e:fc:00:03:00:01	675	kernel
0x030002/24	Active	vlan.100	0e:fc:00:03:00:02	676	kernel
0x030003/24	Active	vlan.100	0e:fc:00:03:00:03	677	kernel
0x030004/24	Active	vlan.100	0e:fc:00:03:00:04	678	kernel

show fibre-channel proxy fabric-state

Syntax `show fibre-channel proxy fabric-state
<fabric fabric-name>`

Release Information Command introduced in Junos OS Release 12.1 for the QFX Series.

Description Display Fibre Channel (FC) proxy fabric state information.

Options `fabric fabric-name`—(Optional) Display output only for the specified fabric.

Required Privilege Level view

Related Documentation

- [Monitoring Fibre Channel Interface Load Balancing on page 474](#)
- [show fibre-channel proxy login-table on page 548](#)
- [show fibre-channel proxy np-port on page 551](#)
- [show fibre-channel proxy statistics on page 555](#)

List of Sample Output [show fibre-channel proxy fabric-state on page 546](#)
[show fibre-channel proxy fabric-state fabric on page 546](#)

Output Fields [Table 53 on page 544](#) lists the output fields for the `show fibre-channel proxy fabric-state` command. Output fields are listed in the approximate order in which they appear.

Table 53: show fibre-channel proxy fabric-state Output Fields

Field Name	Field Description
Fabric	Name of the fabric.
Fabric-id	Fabric ID number.

Table 53: show fibre-channel proxy fabric-state Output Fields (continued)

Field Name	Field Description
Proxy load balance algorithm	<p>Load-balancing algorithm used on the FCoE-FC gateway FC fabric:</p> <ul style="list-style-type: none"> Simple—Load balancing is based on the weighted utilization (load) of the NP_Ports connected to an FC fabric. Each new FLOGI or FDISC is assigned to the least-loaded link. On a link load rebalance, only the sessions that need to be moved to another link are logged out. When those sessions log in again, they are placed on active NP_Port interfaces in a balanced manner. ENode-based—Load balancing is based on the ENode FLOGI. When an ENode logs in to the fabric, all subsequent FDISC sessions associated with that ENode are placed on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link. On a link load rebalance, all sessions are logged out. When the sessions log in again, they are placed on active NP_Port interfaces in a balanced manner. FLOGI-based—Load balancing is based on the ENode FLOGI. When an ENode logs in to the fabric, all subsequent FDISC sessions associated with that ENode are placed on the same link as the ENode FLOGI session, regardless of the link load. New ENode FLOGIs are placed on the least-loaded link. On a link load rebalance, only the sessions that need to be moved to another link are logged out. When those sessions log in again, they are placed on active NP_Port interfaces in a balanced manner.
Fabric WWN verification	<p>Fabric worldwide name (WWN) verification check state on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> Yes—Fabric WWN verification check is enabled. No—Fabric WWN verification check is disabled.
Auto load rebalance enabled	<p>Automated link load rebalancing configuration for the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> No—Automated load balancing is disabled (default state). Yes—Automated load balancing is enabled.
Last rebalance start-time	<p>Time that the last link load rebalance began on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> Never—The link load has never been rebalanced. Timestamp value—Time the last link load rebalancing started.
Last rebalance end-time	<p>Time that the last link load rebalance ended on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> Never—The link load has never been rebalanced. Timestamp value—Time the last link load rebalancing ended.
Last rebalance trigger	<p>Event that triggered the last link load rebalance on the FCoE-FC gateway fabric:</p> <ul style="list-style-type: none"> None—The link load has never been rebalanced. Config-CLI—Configure (enable) automated load balancing. Request-CLI—Rebalance requested from the CLI using the request fibre-channel proxy load-rebalance fabric fabric-name operational command. Preview-CLI—Rebalancing <i>dry run</i> requested from the CLI using the request fibre-channel proxy load-rebalance dry-run fabric fabric-name operational command. Indicates that the switch completed the dry run. A dry run simulates a link load rebalance and displays a list of sessions that might be affected if you request an actual rebalance. Link-up—New FC link (NP_Port) up on the FCoE-FC gateway fabric, which causes a rebalance to distribute sessions to the new link. Restore-complete—If the FC process on the switch restarts, the switch attempts to restore the session state that existed before the restart. When automated rebalance is enabled, restore-complete indicates that the sessions have been restored and rebalanced.

Table 53: show fibre-channel proxy fabric-state Output Fields (continued)

Field Name	Field Description
Last rebalance trigger-time	Time that the last link load rebalance was triggered on the FCoE-FC gateway fabric: <ul style="list-style-type: none"> Never—Link load rebalancing has never been triggered. Timestamp value—Time the last link load rebalancing was triggered.
Last rebalance trigger-result	Result of the last trigger event on the FCoE-FC gateway fabric: <ul style="list-style-type: none"> Never—Link load rebalancing has never been triggered. Not-configured—Automated rebalancing is not configured on the FCoE-FC gateway fabric. Not-required—Last rebalance trigger did not require rebalancing the link load (the link load was already balanced across the active NP_Port links). In-progress—Link load rebalancing is in progress and has not finished yet. Restore-in-progress—The switch is recovering from an FC process restart and is in the process of restoring the sessions to the active NP_Port links. Success—Link load rebalancing was successful. Logged-out-all—All sessions have been logged out. Preview-complete—The switch has finished simulating a dry run rebalancing request from the CLI (<code>request fibre-channel proxy load-rebalance dry-run fabric fabric-name</code> operational command) and reported the sessions that might be affected if you request an actual link load rebalance. Fabric-deletion-in-progress—FCoE-FC gateway fabric is in the process of being deleted. <p>NOTE: A trigger event does not necessarily result in a rebalance action. Link load rebalancing only occurs if the NP_Port interface session load is not balanced at the time of the trigger event.</p>

Sample Output

show fibre-channel proxy fabric-state

```

user@switch> show fibre-channel proxy fabric-state

Fabric: san_fab1, Fabric-id: 10
Proxy load balance algorithm: Simple, Fabric WVN verification: Yes
Auto load rebalance enabled   : No
Last rebalance start-time    : Never
Last rebalance end-time      : Never
Last rebalance trigger       : Link-up
Last rebalance trigger-time   : Mon Sep 10 21:42:30 2012 usec: 814602
Last rebalance trigger-result: Not-configured

Fabric: san_fab2, Fabric-id: 20
Proxy load balance algorithm: ENode based, Fabric WVN verification: Yes
Auto load rebalance enabled   : No
Last rebalance start-time    : Never
Last rebalance end-time      : Never
Last rebalance trigger       : Link-up
Last rebalance trigger-time   : Mon Sep 17 17:23:35 2012 usec: 619684
Last rebalance trigger-result: Not-configured

```

show fibre-channel proxy fabric-state fabric

```

user@switch> show fibre-channel proxy fabric-state fabric fc_fabric_100

```

```
Fabric: fc_fabric_100, Fabric-id: 100
Proxy load balance algorithm: FLOGI based, Fabric WWN verification: No
Auto load rebalance enabled : Yes
Last rebalance start-time   : Never
Last rebalance end-time     : Never
Last rebalance trigger      : Config-CLI
Last rebalance trigger-time  : Fri Nov 2 08:56:16 2012 usec: 004487
Last rebalance trigger-result: Not-required
```

show fibre-channel proxy login-table

Syntax `show fibre-channel proxy login-table`
`<brief | detail>`
`<fabric fabric-name>`
`<interface interface-name>`

Release Information Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Display Fibre Channel (FC) proxy fabric login table information.

Options `brief | detail`—(Optional) Display the specified level of output.
`fabric fabric-name`—(Optional) Display output only for the specified fabric.
`interface interface-name`—(Optional) Display output only for the specified interface.

Required Privilege Level view

Related Documentation

- [Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195](#)
- [show fibre-channel proxy fabric-state on page 544](#)
- [show fibre-channel proxy np-port on page 551](#)
- [show fibre-channel proxy statistics on page 555](#)

List of Sample Output [show fibre-channel proxy login-table on page 549](#)
[show fibre-channel proxy login-table detail on page 549](#)

Output Fields [Table 54 on page 548](#) lists the output fields for the **show fibre-channel proxy login-table** command. Output fields are listed in the approximate order in which they appear.

Table 54: show fibre-channel proxy login-table Output Fields

Field Name	Field Description	Level of Output
Fabric	Name of the fabric.	All
Fabric-id	Fabric ID number.	All
F-Port	One of the following two values: <ul style="list-style-type: none"> • VF_Port interface connected to the Fibre Channel over Ethernet (FCoE) host, shown as the FCoE VLAN interface. • QFX Series FC port that is logged in to the FC switch, shown by a hyphen (-) to indicate that it is not the FCoE device VN_Port. 	All

Table 54: show fibre-channel proxy login-table Output Fields (continued)

Field Name	Field Description	Level of Output
FCID	VN_Port Fibre Channel identifier provided by the Fibre Channel over Ethernet (FCoE) forwarder (FCF) or the Fibre Channel switch.	All
Port-WWN	Unique worldwide name (WWN) of the VN_Port.	All
Node-WWN	Unique WWN of the node hosting the VN_Ports.	detail
NP-Port	NP_Port interface connected to the FCoE forwarder (FCF) or the Fibre Channel switch.	All
Class	FLOGI service class.	detail
Fabric port WWN	Unique WWN of the fabric port (VF_Port).	detail
Fabric WWN	Unique WWN of the fabric generated by the FCF.	detail

Sample Output

show fibre-channel proxy login-table

```
user@switch> show fibre-channel proxy login-table
```

```
Fabric: proxy2, Fabric-id: 200
```

F-Port	FCID	Port-wwn	NP-Port
-	0x030000	10:00:00:15:17:a9:98:64	fc-0/0/0.0
vlan.100	0x030001	20:00:10:94:00:01:00:01	fc-0/0/0.0
vlan.100	0x030002	20:00:10:94:00:01:00:05	fc-0/0/0.0
vlan.100	0x030003	20:00:10:94:00:02:00:01	fc-0/0/0.0
vlan.100	0x030004	20:00:10:94:00:02:00:05	fc-0/0/0.0

show fibre-channel proxy login-table detail

```
user@switch> show fibre-channel proxy login-table detail
```

```
Fabric: proxy2, Fabric-id: 200
```

```

FCID:          0x030000
F-Port:        -
NP-Port:       fc-0/0/0.0
Port WWN:      10:00:00:15:17:a9:98:64
Node WWN:      20:c8:11:22:33:44:55:66
Class:         3
Fabric port WWN: 10:00:00:15:17:a9:99:48
Fabric WWN:    00:0a:df:ff:0b:11:22:34

```

```

FCID:          0x030001
F-Port:        vlan.100
NP-Port:       fc-0/0/0.0
Port WWN:      20:00:10:94:00:01:00:01
Node WWN:      10:00:10:94:00:00:00:01
Class:         3

```

```
Fabric port WWN: 10:00:00:15:17:a9:99:48
Fabric WWN:      00:0a:df:ff:0b:11:22:34
```

```
FCID:           0x030002
F-Port:         vlan.100
NP-Port:        fc-0/0/0.0
Port WWN:       20:00:10:94:00:01:00:05
Node WWN:       10:00:10:94:00:00:00:01
Class:          3
Fabric port WWN: 10:00:00:15:17:a9:99:48
Fabric WWN:      00:0a:df:ff:0b:11:22:34
```

```
FCID:           0x030003
F-Port:         vlan.100
NP-Port:        fc-0/0/0.0
Port WWN:       20:00:10:94:00:02:00:01
Node WWN:       10:00:10:94:00:00:00:02
Class:          3
Fabric port WWN: 10:00:00:15:17:a9:99:48
Fabric WWN:      00:0a:df:ff:0b:11:22:34
```

```
FCID:           0x030004
F-Port:         vlan.100
NP-Port:        fc-0/0/0.0
Port WWN:       20:00:10:94:00:02:00:05
Node WWN:       10:00:10:94:00:00:00:02
Class:          3
Fabric port WWN: 10:00:00:15:17:a9:99:48
Fabric WWN:      00:0a:df:ff:0b:11:22:34
```

show fibre-channel proxy np-port

Syntax	<pre>show fibre-channel proxy np-port <brief detail> <fabric <i>fabric-name</i>> <interface <i>interface-name</i>></pre>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel gateway fabric proxy Node Port (NP_Port) information.
Options	<p>brief detail—(Optional) Display the specified level of output.</p> <p>fabric <i>fabric-name</i>—(Optional) Display output only for the specified fabric.</p> <p>interface <i>interface-name</i>—(Optional) Display output only for the specified interface.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195 • Monitoring Fibre Channel Interface Load Balancing on page 474 • show fibre-channel proxy fabric-state on page 544 • show fibre-channel proxy login-table on page 548 • show fibre-channel proxy statistics on page 555
List of Sample Output	<p>show fibre-channel proxy np-port on page 552</p> <p>show fibre-channel proxy np-port detail (Junos OS Release 18.1R1 and beyond) on page 553</p> <p>show fibre-channel proxy np-port detail (Junos OS Releases before 18.1R1) on page 553</p>
Output Fields	Table 55 on page 551 lists the output fields for the show fibre-channel proxy np-port command. Output fields are listed in the approximate order in which they appear.

Table 55: show fibre-channel proxy np-port Output Fields

Field Name	Field Description	Level of Output
Fabric	Name of the fabric.	All
Fabric-id	Fabric ID number.	All
NP-Port	NP_Port interface connected to the FCoE forwarder (FCF) or the Fibre Channel switch.	All

Table 55: show fibre-channel proxy np-port Output Fields (continued)

Field Name	Field Description	Level of Output
State	FCID state of the NP_Port interface.	All
Sessions	Number of active sessions on the NP_Port interface. A session is a FLOGI or FDISC login to the FC SAN fabric. Session does not refer to end-to-end storage sessions.	All
(Junos OS Release 18.1R1 and beyond) Supported max login sessions	Maximum number of FIP login sessions supported on the NP_Port interface.	detail
(Junos OS Releases before 18.1R1) Configured max login sessions	NOTE: If the fabric is configured to have a limit on the maximum number of FIP login sessions that is less than the configured maximum for the individual NP_Port displayed by this field, then the actual number of sessions permitted on the NP_Port will be constrained by the fabric limit. See max-login-sessions for more information.	
Enodes	Number of ENodes with sessions on the NP_Port.	detail
LB state	Load-balancing state: <ul style="list-style-type: none"> • On—Load balancing is on • Off—Load balancing is off. 	All
LB weight	Load balance weight, which reflects the port speed: <ul style="list-style-type: none"> • 2—Port speed is 2 Gbps. • 4—Port speed is 4 Gbps. • 8—Port speed is 8 Gbps. 	All
Ref-count	Reference count internal to Junos OS.	detail
Flags	Flags internal to Junos OS. NOTE: When an NP_Port interface reaches its configured maximum number of FIP sessions, the Flags field displays the flag MAX-LOGINS-REACHED .	detail

Sample Output

show fibre-channel proxy np-port

```
user@switch> show fibre-channel proxy np-port
```

```
Fabric: proxy1, Fabric-id: 10
```

```
NP-Port      State      Sessions    LB state    LB weight
```



```

fc-0/0/0.0  online           3           ON           4
fc-0/0/1.0  online           3           ON           4
fc-0/0/2.0  online           3           ON           4
root@junos1> show fibre-channel proxy np-port detail

```

show fibre-channel proxy np-port detail (Junos OS Release 18.1R1 and beyond)

```
user@switch> show fibre-channel proxy np-port detail
```

```
Fabric: my-fabric, Fabric-id: 100
```

```

NP-Port:          fc-0/2/0.0
State:             online
Sessions:          2
Supported max login sessions: 2500
Enodes:            1
LB state:          ON
LB weight:         10
Ref-count:         1
Flags:             UP LB C3

```

```

NP-Port:          fc-0/2/1.0
State:             online
Sessions:          2
Supported max login sessions: 2500
Enodes:            1
LB state:          ON
LB weight:         10
Ref-count:         1
Flags:             UP LB C3

```

```

NP-Port:          fc-0/2/2.0
State:             online
Sessions:          2
Supported max login sessions: 2500
Enodes:            1
LB state:          ON
LB weight:         10
Ref-count:         1
Flags:             UP LB C3

```

show fibre-channel proxy np-port detail (Junos OS Releases before 18.1R1)

```
user@switch> show fibre-channel proxy np-port detail
```

```
Fabric: proxy1, Fabric-id: 10
```

```

NP-Port:          fc-0/0/0.0
State:             online
Sessions:          3
Configured max login sessions: 130
Enodes:            1
LB state:          ON
LB weight:         4
Ref-count:         4
Flags:             UP LB

```

```
NP-Port:          fc-0/0/1.0
State:            online
Sessions:         3
Configured max login sessions: 130
Enodes            2
LB state:         ON
LB weight:        4
Ref-count:        4
Flags:            UP LB

NP-Port:          fc-0/0/2.0
State:            online
Sessions:         130
Configured max login sessions: 130
Enodes            17
LB state:         OFF
LB weight:        4
Ref-count:        131
Flags:            UP MAX-LOGINS-REACHED
```

show fibre-channel proxy statistics

Syntax	show fibre-channel proxy statistics <fabric <i>fabric-name</i>>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series.
Description	Display Fibre Channel proxy fabric statistics.
Options	fabric <i>fabric-name</i> —(Optional) Display output only for the specified fabric.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring an FCoE-FC Gateway Fibre Channel Fabric on page 195 • show fibre-channel proxy fabric-state on page 544 • show fibre-channel proxy login-table on page 548 • show fibre-channel proxy np-port on page 551 • clear fibre-channel proxy statistics on page 485
List of Sample Output	show fibre-channel proxy statistics on page 556
Output Fields	Table 56 on page 555 lists the output fields for the show fibre-channel proxy statistics command. Output fields are listed in the approximate order in which they appear.

Table 56: show fibre-channel proxy statistics Output Fields

Field Name	Field Description
Fabric	Name of the fabric.
Fabric-id	Fabric ID number.

Table 56: show fibre-channel proxy statistics Output Fields (continued)

Field Name	Field Description
NP-Port Transmit Command Statistics	Transmitted command statistics for the NP_Port.
• Command	Type of command issued on the NP_Port: <ul style="list-style-type: none"> • FLOGI—Fabric login commands issued. • FDISC—Fabric discovery commands issued. • LOGO—Logout commands issued. • Others—Other commands issued.
• Tx	Number of times the command type was transmitted.
• Rx-ACC	Number of times the NP_Port transmitted a receive accept message for the command type.
• Rx-RJT	Number of times the NP_Port transmitted a receive reject message for the command type.
• Abort	Number of times the NP_Port transmitted an abort message for the command type.
NP-Port Receive Command Statistics	Received command statistics for the NP_Port.
• Command	The type of command received on the NP_Port: <ul style="list-style-type: none"> • LOGO—Logout commands issued. • Others—Other commands issued.
• Rx	Number of times the command type was received.
• Tx-ACC	Number of times the NP_Port received a transmit accept message for the command type.
• Tx-RJT	Number of times the NP_Port received a transmit reject message for the command type.
• Abort	Number of times the NP_Port received an abort message for the command type.

Sample Output

show fibre-channel proxy statistics

```
user@switch> show fibre-channel proxy statistics
```

```
Fabric: proxy1, Fabric-id: 10
```

```
NP-Port Transmit Command Statistics:
```

Command	Tx	Rx-ACC	Rx-RJT	Abort
FLOGI	3	3	0	0
FDISC	3	3	0	0

LOGO	0	0	0	0
Others	0	0	0	0

NP-Port Receive Command Statistics:

Command	Rx	Tx-ACC	Tx-RJT	Abort
LOGO	0	0	0	0
Others	0	0	0	0

show fip vlan-discovery

Syntax	show fip vlan-discovery (enodes statistics)
Release Information	Command introduced in Junos OS Release 12.1 for the QFX Series.
Description	Display FCoE VLAN information from the Fibre Channel switch or FCoE forwarder (FCF).
Options	enodes —Display VLAN discovery information for each ENode. statistics —Display VLAN discovery information statistics.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> clear fip vlan-discovery statistics on page 375
List of Sample Output	show fip vlan-discovery enodes on page 559 show fip vlan-discovery statistics (QFX3500) on page 559 show fip vlan-discovery statistics (QFabric Systems) on page 559
Output Fields	Table 33 on page 402 lists the output fields for the show fip vlan-discovery command. Output fields are listed in the approximate order in which they appear.

Table 57: show fip vlan-discovery Output Fields

Field Name	Field Description	Level of Output
Enode-MAC	Media access control (MAC) address of the ENode.	enodes
Interface	Name of the interface.	enodes
Unsolicited notification count	Number of unsolicited VLAN discovery notifications.	All
Solicited notification count	Number of solicited VLAN discovery notifications.	statistics
Node Group Name	Displays the name of the Node group on QFabric systems.	statistics
Request count	Number of VLAN discovery requests sent by the ENode. This number should match the Solicited notification count number.	statistics
VLAN tags	Tags of the FIP-enabled VLANs.	enodes

Sample Output

show fip vlan-discovery enodes

```
user@switch> show fip vlan-discovery enodes
```

Enode-MAC	Interface	Unsolicited Notification Count	Vlan Tags
00:10:94:00:00:02	xe-0/0/9.0	0	400

show fip vlan-discovery statistics (QFX3500)

```
user@switch> show fip vlan-discovery statistics
```

```
Request count: 0
Solicited notification count: 0
Unsolicited notification count: 1
```

show fip vlan-discovery statistics (QFabric Systems)

```
user@switch> show fip vlan-discovery statistics
```

```
NW-NG-0:
```

```
-----
Request count: 0
Solicited notification count: 0
Unsolicited notification count: 1
```

```
BBAK0399:
```

```
-----
Request count: 0
Solicited notification count: 0
Unsolicited notification count: 1
```

```
FCG001:
```

```
-----
Request count: 0
Solicited notification count: 0
Unsolicited notification count: 1
```

show route forwarding-table family fibre-channel

Syntax `show route forwarding-table family fibre-channel`
`<brief | detail | extensive>`
`<all>`
`<destination destination-prefix>`
`<interface-name interface-name>`
`<label label>`
`<matching ip-prefix>`
`<multicast>`
`<summary>`
`<table routing-table-name>`
`<vlan vlan-name>`
`<vpn vpn-instance-name>`

Release Information Command introduced in Junos OS Release 11.1 for the QFX Series.

Description Display Fibre Channel family forwarding table route information.

Options `brief | detail | extensive`—(Optional) Display the specified level of output.

`all`—Display all routing forwarding tables.

`destination destination-prefix`—Destination prefix.

`interface-name interface-name`—Name of the interface.

`label label`—Display route entries for the specified label name.

`matching ip-prefix`—Display route entries for the specified IP prefix or length.

`multicast`—Display multicast routes.

`summary`—Display route count instead of details.

`table routing-table-name`—Name of the routing table.

`vlan vlan-name`—Name of the VLAN.

`vpn vpn-instance-name`—Name of the VPN instance.

Required Privilege Level view

Related Documentation

- [show fibre-channel next-hops on page 540](#)
- [show fibre-channel routes on page 542](#)

List of Sample Output [show route forwarding-table family fibre-channel on page 561](#)

Output Fields Table 58 on page 561 lists the output fields for the **show route forwarding-table family fibre-channel** command. Output fields are listed in the approximate order in which they appear.

Table 58: show route forwarding-table family fibre-channel Output Fields

Field Name	Field Description
Routing table	Name of the routing table.
Destination	Route destination.
Type	Type of route internal to Junos OS.
RtRef	Route reference count internal to Junos OS.
Next hop Type	Type of next hop internal to Junos OS.
Index	Next-hop index identifier.
NhRef	Number of routes that refer to the next hop.
Netif	Interface used to reach the next hop.

Sample Output

show route forwarding-table family fibre-channel

```

user@switch> show route forwarding-table family fibre-channel
Routing table: default.fibre-channel
Fibre Channel:
Destination      Type  RtRef  Next hop      Type  Index  NhRef  Netif
default          perm   0
0x30000/24       user   0          ucst    674    2  fc-0/0/0.0
0x30001/24       user   0          ucst    675    2  vlan.100
0x30002/24       user   0          ucst    676    2  vlan.100
0x30003/24       user   0          ucst    677    2  vlan.100
0x30004/24       user   0          ucst    678    2  vlan.100

```


CHAPTER 10

Configuration Statements for Data Center Bridging and PFC

- [application \(Application Maps\) on page 564](#)
- [application \(Applications\) on page 565](#)
- [application-map on page 566](#)
- [application-maps on page 567](#)
- [applications \(Applications\) on page 568](#)
- [applications \(DCBX\) on page 569](#)
- [code-points \(Application Maps\) on page 570](#)
- [dcbx on page 571](#)
- [dcbx-version on page 572](#)
- [destination-port \(Applications\) on page 573](#)
- [disable \(DCBX\) on page 574](#)
- [enhanced-transmission-selection on page 575](#)
- [ether-type on page 576](#)
- [interface \(DCBX\) on page 577](#)
- [no-recommendation-tlv on page 578](#)
- [policy-options on page 579](#)
- [priority-flow-control on page 580](#)
- [protocol \(Applications\) on page 581](#)
- [recommendation-tlv on page 582](#)

application (Application Maps)

Syntax	<pre>application <i>application-name</i> { <i>code-points</i> [<i>aliases</i>] [<i>bit-patterns</i>]; }</pre>
Hierarchy Level	[edit policy-options application-maps <i>application-map-name</i>]
Release Information	Statement introduced in Junos OS Release 12.1 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Add an application to an application map and define the application's code points.
Options	<i>application-name</i> —Name of the application. The remaining statement is explained separately. See CLI Explorer .
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring an Application Map for DCBX Application Protocol TLV Exchange on page 314• Example: Configuring DCBX Application Protocol TLV Exchange on page 316• Example: Configuring DCBX to Support an iSCSI Application• Understanding DCBX Application Protocol TLV Exchange on page 309• Understanding DCBX Application Protocol TLV Exchange on EX Series Switches

application (Applications)

Syntax	<pre> application <i>application-name</i> { <i>destination-port</i> <i>port-value</i>; <i>protocol</i> (tcp udp); <i>ether-type</i> <i>type</i>; } </pre>
Hierarchy Level	[edit applications]
Release Information	<p>Statement introduced in Junos OS Release 12.1 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Configure properties to define an application.
Options	<p><i>application-name</i>—Name of the application.</p> <p>The remaining statements are explained separately. See CLI Explorer.</p>
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Defining an Application for DCBX Application Protocol TLV Exchange on page 313 • Example: Configuring DCBX Application Protocol TLV Exchange on page 316 • Example: Configuring DCBX to Support an iSCSI Application • Understanding DCBX Application Protocol TLV Exchange on page 309 • Understanding DCBX Application Protocol TLV Exchange on EX Series Switches

application-map

Syntax	<code>application-map <i>application-map-name</i>;</code>
Hierarchy Level	[edit protocols <code>dcbx interface</code> <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 12.1 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify an application map to apply to an interface.
Options	<i>application-map-name</i> —Name of the application map.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show dcbx neighbors on page 404• Applying an Application Map to an Interface for DCBX Application Protocol TLV Exchange on page 315• Example: Configuring DCBX Application Protocol TLV Exchange on page 316• Example: Configuring DCBX to Support an iSCSI Application• Understanding DCBX Application Protocol TLV Exchange on page 309• Understanding DCBX Application Protocol TLV Exchange on EX Series Switches

application-maps

Syntax	<pre> application-maps <i>application-map-name</i> { application <i>application-name</i> { code-points [<i>aliases</i>] [<i>bit-patterns</i>]; } } </pre>
Hierarchy Level	[edit policy-options]
Release Information	<p>Statement introduced in Junos OS Release 12.1 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Define an application map by specifying the applications that belong to the application map.
Options	<p><i>application-map-name</i>—Name of the application map.</p> <p>The remaining statements are explained separately. See CLI Explorer.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring an Application Map for DCBX Application Protocol TLV Exchange on page 314 • Example: Configuring DCBX Application Protocol TLV Exchange on page 316 • Example: Configuring DCBX to Support an iSCSI Application • Understanding DCBX Application Protocol TLV Exchange on page 309 • Understanding DCBX Application Protocol TLV Exchange on EX Series Switches

applications (Applications)

Syntax	<pre> applications { application <i>application-name</i> { destination-port <i>port-value</i>; protocol (tcp udp); ether-type <i>type</i>; } } </pre>
Hierarchy Level	[edit]
Release Information	<p>Statement introduced in Junos OS Release 12.1 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Define applications that DCBX advertises.
Options	The remaining statements are explained separately. See CLI Explorer .
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Defining an Application for DCBX Application Protocol TLV Exchange on page 313 • Example: Configuring DCBX Application Protocol TLV Exchange on page 316 • Example: Configuring DCBX to Support an iSCSI Application • Understanding DCBX Application Protocol TLV Exchange on page 309 • Understanding DCBX Application Protocol TLV Exchange on EX Series Switches

applications (DCBX)

Syntax	<pre>applications { fcoe { no-auto-negotiation; } }</pre>
Hierarchy Level	[edit protocols dcbx interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series. Statement introduced in Junos OS Release 12.1 for the EX Series
Description	Configure Data Center Bridging Capability Exchange protocol (DCBX) applications on an interface.
Options	The remaining statements are explained separately. See CLI Explorer .
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • show dcbx neighbors on page 404 • Understanding DCB Features and Requirements on page 292

code-points (Application Maps)

Syntax	<code>code-points [<i>aliases</i>] [<i>bit-patterns</i>];</code>
Hierarchy Level	<code>[edit policy-options application-maps <i>application-map-name</i> application <i>application-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 12.1 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Define one or more code-point aliases or bit sets for an application.
Options	<i>aliases</i> —Name of the alias or aliases. <i>bit-patterns</i> —Value of the code-point bits, in decimal form.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring an Application Map for DCBX Application Protocol TLV Exchange on page 314• Example: Configuring DCBX Application Protocol TLV Exchange on page 316• Example: Configuring DCBX to Support an iSCSI Application• Understanding DCBX Application Protocol TLV Exchange on page 309• Understanding DCBX Application Protocol TLV Exchange on EX Series Switches


dcbx

Syntax	<pre> dcbx { disable; interface (<i>interface-name</i> all) { disable; application-map <i>application-map-name</i>; applications { no-auto-negotiation; } enhanced-transmission-selection { no-auto-negotiation; no-recommendation-tlv; recommendation-tlv { no-auto-negotiation; } } dcbx-version (auto-negotiate ieee-dcbx dcbx-version-1.01); priority-flow-control { no-auto-negotiation; } } } </pre>
Hierarchy Level	[edit protocols]
Release Information	<p>Statement introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 11.3 for EX Series switches.</p> <p>mode and recommendation-tlv statements introduced in Junos OS Release 12.2 for the QFX Series.</p>
Description	Configure DCBX properties. DCBX is an extension of Link Layer Discovery Protocol (LLDP), and LLDP must remain enabled on every interface for which you want to use DCBX. If you attempt to enable DCBX on an interface on which LLDP is disabled, the configuration commit fails.
Options	The remaining statements are explained separately. See CLI Explorer .
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • show dcbx neighbors on page 404 • Understanding DCB Features and Requirements on page 292 • Configuring DCBX Autonegotiation on page 305

dcbx-version

Syntax	<code>dcbx-version (auto-negotiate ieee-dcbx dcbx-version-1.01);</code>
Hierarchy Level	[edit protocols dcbx interface (all <i>interface-name</i>)]
Release Information	Statement introduced in Junos OS Release 12.2 for the QFX Series.
Description	<p>Set the DCBX version for the specified interface or interfaces.</p> <p>QFX3500 switches come up in IEEE DCBX mode and then autonegotiate with the connected peer to set the DCBX version.</p> <p>QFabric system Node devices come up using DCBX version 1.01, and then autonegotiate with the connected peer to set the DCBX mode.</p>
Default	The default DCBX mode is autonegotiation.
Options	<p>auto-negotiate—Automatically negotiate the DCBX version with the connected peer.</p> <p>ieee-dcbx—Force the interface to use IEEE DCBX mode, regardless of the peer configuration.</p> <p>dcbx-version-1.01—Force the interface to use version 1.01 DCBX mode, regardless of the peer configuration.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">• show dcbx neighbors on page 404• Configuring DCBX Autonegotiation on page 305• Understanding DCBX on page 295

destination-port (Applications)

Syntax	<code>destination-port <i>port-value</i>;</code>
Hierarchy Level	<code>[edit applications application <i>application-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 12.1 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Transmission Control Protocol (TCP) or User Datagram Protocol (UDP) destination port number, which combines with protocol to identify an application type. The Internet Assigned Numbers Authority (IANA) assigns port numbers. See the IANA <i>Service Name and Transport Protocol Port Number Registry</i> at http://www.iana.org/assignments/service-names-port-numbers/service-names-port-numbers.xml for a list of assigned port numbers.
<div>  NOTE: To create an application for iSCSI, use the protocol <code>tcp</code> with the destination port number 3260. </div>	
Options	<i>port-value</i> —Identifier for the port.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Defining an Application for DCBX Application Protocol TLV Exchange on page 313 • Example: Configuring DCBX Application Protocol TLV Exchange on page 316 • Example: Configuring DCBX to Support an iSCSI Application • Understanding DCBX Application Protocol TLV Exchange on page 309 • Understanding DCBX Application Protocol TLV Exchange on EX Series Switches


disable (DCBX)

Syntax	disable
Hierarchy Level	[edit protocols dcbx] [edit protocols dcbx interface interface-name]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series. Statement introduced in Junos OS Release 11.3 for EX Series switches.
Description	Disable Data Center Bridging Capability Exchange protocol (DCBX) on one or more 10-Gigabit Ethernet interfaces.
Default	DCBX is enabled by default on all 10-Gigabit or higher Ethernet interfaces. DCBX is enabled by default on all 10-Gigabit Ethernet interfaces on EX4500 CEE-enabled switches.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring DCBX Autonegotiation on page 305• Disabling DCBX to Disable PFC Autonegotiation on EX Series Switches (CLI Procedure)• Understanding DCB Features and Requirements on page 292• Understanding DCB Features and Requirements on EX Series Switches

enhanced-transmission-selection

Syntax	<pre> enhanced-transmission-selection { no-auto-negotiation; no-recommendation-tlv; recommendation-tlv { no-auto-negotiation; } } </pre>
Hierarchy Level	[edit protocols dcbx interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series.
Description	<p>Disable advertising the enhanced transmission selection (ETS) state of the interface to the peer. To disable ETS on the interface, do not enable ETS on the interface in the class-of-service (CoS) configuration.</p> <p>Disabling ETS autonegotiation stops the QFX Series from advertising the ETS Configuration TLV and the ETS Recommendation TLV.</p> <p>Disabling the ETS recommendation TLV stops the QFX Series from advertising the ETS Recommendation TLV, but the ETS Configuration TLV is still advertised.</p>
Options	<p>no-auto-negotiation—Disable automatic negotiation of ETS (Configuration TLV and Recommendation TLV)</p> <p>no-recommendation-tlv—Disable automatic negotiation of the ETS Recommendation TLV</p> <p>recommendation-tlv—Enable automatic negotiation of ETS Recommendation TLV</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • show dcbx neighbors on page 404 • Configuring DCBX Autonegotiation on page 305 • Example: Configuring CoS Hierarchical Port Scheduling (ETS) • Understanding DCB Features and Requirements on page 292

ether-type

Syntax	<code>ether-type <i>ether-type</i>;</code>
Hierarchy Level	<code>[edit applications application <i>application-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 12.1 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Two-octet field in an Ethernet frame that defines the protocol encapsulated in the frame payload. See http://standards.ieee.org/develop/regauth/ethertype/eth.txt for a list of Institute of Electrical and Electronics Engineers (IEEE) EtherTypes.
<div>  NOTE: To create a FIP application, use the EtherType 0x8914. </div>	
Options	type —Identifier for the EtherType.
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Defining an Application for DCBX Application Protocol TLV Exchange on page 313 • Example: Configuring DCBX Application Protocol TLV Exchange on page 316 • Understanding DCBX Application Protocol TLV Exchange on page 309

interface (DCBX)

Syntax	<pre> interface (<i>interface-name</i> all) { disable; application-map <i>application-map-name</i>; applications { no-auto-negotiation; } enhanced-transmission-selection { no-auto-negotiation; no-recommendation-tlv; recommendation-tlv { no-auto-negotiation; } } dcbx-version (auto-negotiate ieee-dcbx dcbx-version-1.01); priority-flow-control { no-auto-negotiation; } } </pre>
Hierarchy Level	[edit protocols dcbx]
Release Information	<p>Statement introduced in Junos OS Release 11.1 for the QFX Series.</p> <p>Statement introduced in Junos OS Release 11.3 for the EX Series switches.</p> <p>Mode and recommendation-tlv statements introduced in Junos OS Release 12.2 for the QFX Series.</p>
Description	Configure DCBX properties on an interface.
Options	<p><i>interface-name</i>—Name of the interface.</p> <p>The remaining statements are explained separately. See CLI Explorer.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • show dcbx neighbors on page 404 • Configuring DCBX Autonegotiation on page 305 • Example: Configuring DCBX to Support an iSCSI Application • Understanding DCB Features and Requirements on page 292 • Understanding DCB Features and Requirements on EX Series Switches • Understanding DCBX Application Protocol TLV Exchange on EX Series Switches

no-recommendation-tlv

Syntax	no-recommendation-tlv;
Hierarchy Level	[edit protocols dcbx interface interface-name enhanced-transmission-selection]
Release Information	Statement introduced in Junos OS Release 12.2 for the QFX Series.
Description	Disable DCBX to send the ETS Recommendation TLV (also known as the Information TLV) on egress. This feature is valid only if the interface DCBX mode is IEEE DCBX. If the interface DCBX mode is DCBX version 1.01, this statement has no effect. (DCBX version 1.01 does not advertise separate TLVs for individual attributes.)
Default	DCBX-enabled interfaces send the ETS recommendation TLV unless it is disabled.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show dcbx neighbors on page 404• Configuring DCBX Autonegotiation on page 305

policy-options

```
Syntax  policy-options
        application-maps application-map-name {
            application application-name {
                code-points [ aliases ] [ bit-patterns ];
            }
        }
        policy-statement policy-name {
            term term-name {
                from {
                    family family-name;
                    match-conditions;
                    policy subroutine-policy-name;
                    prefix-list prefix-list-name;
                    prefix-list-filter prefix-list-name match-type <actions>;
                    route-filter destination-prefix match-type <actions>;
                    source-address-filter source-prefix match-type <actions>;
                }
                to {
                    match-conditions;
                    policy subroutine-policy-name;
                }
                then actions;
            }
        }
    }
```

Hierarchy Level [\[edit\]](#)

Release Information Statement introduced in Junos OS Release 12.1 for the QFX Series.
Statement introduced in Junos OS Release 12.1 for the EX Series.
Statement introduced in Junos OS Release 14.1X53-D20 for the OCX Series.

Description Configure options such as application maps for DCBX application protocol exchange and policy statements.

Required Privilege Level storage—To view this statement in the configuration.
storage-control—To add this statement to the configuration.


Related Documentation

- [Defining an Application for DCBX Application Protocol TLV Exchange on page 313](#)
- [Example: Configuring DCBX Application Protocol TLV Exchange on page 316](#)
- [Example: Configuring DCBX to Support an iSCSI Application](#)
- [Understanding DCBX Application Protocol TLV Exchange on page 309](#)
- [Understanding DCBX Application Protocol TLV Exchange on EX Series Switches](#)

priority-flow-control

Syntax	<pre>priority-flow-control { no-auto-negotiation; }</pre>
Hierarchy Level	[edit protocols dcbx interface (all <i>interface-name</i>)]
Release Information	Statement introduced in Junos OS Release 11.1 for the QFX Series. Statement introduced in Junos OS Release 11.3 for EX Series switches.
Description	Disable autonegotiation of priority-based flow control (PFC) on one or more Ethernet interfaces. Autonegotiation enables PFC on an interface only if the switch and the peer device connected to the switch both support PFC and have the same PFC configuration. Disabling autonegotiation on an interface forces the interface to use the PFC state (enabled or disabled) that is configured on the switch by the configuration and assignment of the congestion notification profile.
Options	no-auto-negotiation —Disable automatic negotiation of PFC.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show dcbx neighbors on page 404• <i>Configuring CoS PFC (Congestion Notification Profiles)</i>• <i>Configuring Priority-Based Flow Control for an EX Series Switch (CLI Procedure)</i>• Configuring DCBX Autonegotiation on page 305• Example: Configuring CoS PFC for FCoE Traffic on page 339• <i>Understanding Data Center Bridging Capability Exchange Protocol for EX Series Switches</i>• <i>Understanding Priority-Based Flow Control</i>• Understanding DCB Features and Requirements on page 292

protocol (Applications)

Syntax	<code>protocol (tcp udp);</code>
Hierarchy Level	<code>[edit applications application <i>application-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 12.1 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Networking protocol type, which combines with destination-port to identify an application type.
<div>  NOTE: To create an application for iSCSI, use the protocol tcp with the destination port number 3260. </div>	
Options	tcp —Transmission Control Protocol udp —User Datagram Protocol
Required Privilege Level	interface —To view this statement in the configuration. interface-control —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Defining an Application for DCBX Application Protocol TLV Exchange on page 313 • Example: Configuring DCBX Application Protocol TLV Exchange on page 316 • Example: Configuring DCBX to Support an iSCSI Application • Understanding DCBX Application Protocol TLV Exchange on page 309 • Understanding DCBX Application Protocol TLV Exchange on EX Series Switches

recommendation-tlv

Syntax	<pre>recommendation-tlv { no-auto-negotiation; }</pre>
Hierarchy Level	[edit protocols dcbx interface <i>interface-name</i> enhanced-transmission-selection]
Release Information	Statement introduced in Junos OS Release 12.2 for the QFX Series.
Description	Enable DCBX to send the ETS Recommendation TLV (also known as the Information TLV) on egress. This feature is valid only if the interface DCBX mode is IEEE DCBX. If the interface DCBX mode is DCBX version 1.01, this statement has no effect. (DCBX version 1.01 does not advertise separate TLVs for individual attributes.)
Default	DCBX-enabled interfaces send the ETS recommendation TLV unless it is disabled.
Options	no-auto-negotiation —Disable sending of the ETS recommendation TLV.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• show dcbx neighbors on page 404• Configuring DCBX Autonegotiation on page 305

CHAPTER 11

Operational Commands for Data Center Bridging

- `show dcbx`
- `show dcbx neighbors`

show dcbx

Syntax	show dcbx
Release Information	Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	List DCBX status (enabled or disabled) and the interfaces on which DCBX is enabled.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show dcbx neighbors on page 404 • Configuring DCBX Autonegotiation on page 305
Output Fields	Table 26 on page 376 lists the output fields for the show dcbx command. Output fields are listed in the approximate order in which they appear.

Table 59: show dcbx output fields

Field Name	Field Description
DCBX	Status of DCBX on the switch or for the specified interface: <ul style="list-style-type: none"> • Enabled—DCBX is enabled on the switch or on the specified interface • Disabled—DCBX is disabled on the switch or on the specified interface
Interface	Name of the interface

Sample Output

show dcbx

```

user@switch> show dcbx
DCBX                               : Enabled
Interface      DCBX
xe-0/0/9.0     enabled
xe-0/0/32.0    enabled
xe-0/0/36.0    enabled

```


show dcbx neighbors

Syntax	show dcbx neighbors <interface <i>interface-name</i>> <terse>
Release Information	Command introduced in Junos OS Release 11.1 for the QFX Series. Command introduced in Junos OS Release 11.3 for EX Series switches.
Description	Display information about Data Center Bridging Capability Exchange protocol (DCBX) neighbor interfaces.
Options	none —Display information about all DCBX neighbor interfaces. <i>interface-name</i> —(Optional) Display information for the specified interface. terse —Display the specified level of output.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • Configuring DCBX Autonegotiation on page 305 • Example: Configuring DCBX Application Protocol TLV Exchange on page 316 • Example: Configuring an FCoE Transit Switch • Example: Configuring DCBX to Support an iSCSI Application • Understanding DCB Features and Requirements on page 292 • Understanding Data Center Bridging Capability Exchange Protocol for EX Series Switches • Understanding DCBX on Junos Fusion Data Center • dcbx on page 571
List of Sample Output	show dcbx neighbors interface (Junos Fusion Data Center, DCBX Version 1.01 Mode) on page 600 show dcbx neighbors interface (QFX Series, DCBX Version 1.01 Mode) on page 604 show dcbx neighbors interface (QFX Series, IEEE DCBX Mode) on page 605 show dcbx neighbors terse (QFX Series) on page 608 show dcbx neighbors (EX4500 Switch: FCoE Interfaces on Both Local and Peer with PFC Configured Compatibly) on page 608 show dcbx neighbors (EX4500 Switch: DCBX Interfaces on Local and Peer Are Configured Compatibly with iSCSI Application) on page 609 show dcbx neighbors (EX4500 Switch: Includes ETS) on page 610
Output Fields	Table 34 on page 405 lists the output fields for the show dcbx neighbors command. Output fields are listed in the approximate order in which they appear.

Table 60: show dcbx neighbors Output Fields

Field Name	Field Description
Interface	Name of the interface.
Parent Interface	Name of the link aggregation group (LAG) interface to which the DCBX interface belongs.
Active-application-map	Name of the application map applied to the interface.
Protocol-Mode	<p>(QFX Series) DCBX protocol mode the interface uses:</p> <ul style="list-style-type: none"> • IEEE DCBX Version—The interface uses IEEE DCBX mode. • DCBX Version 1.01—The interface uses DCBX version 1.01. <p>NOTE: On interfaces that use the IEEE DCBX mode, the show dcbx neighbors interface <i>interface-name</i> operational command does not include application, PFC, or ETS operational state in the output.</p>
Protocol-State	<p>(DCBX Version 1.01 only) DCBX protocol state synchronization status:</p> <ul style="list-style-type: none"> • in-sync—The local interface received an acknowledge message from the peer to indicate that the peer received a state change message sent by the local interface. • ack-pending—The local interface has not yet received an acknowledge message from the peer to indicate that the peer received a state change message sent by the local interface.

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Local-Advertisement	<p>(DCBX Version 1.01 only)</p> <p>Status of advertisements that the local interface sends to the peer.</p>
Operational version	Version of the DCBX standard used.
sequence-number	<p>Number of state change messages sent to the peer.</p> <p>If the interface Protocol-State value is in-sync, this number should match the acknowledge-id number in the Peer-Advertisement section.</p> <p>If the interface Protocol-State value is ack-pending, this number does not match the acknowledge-id number in the Peer-Advertisement section.</p> <p>On Junos Fusion Data Center, this field represents the number of DCBX state changes maintained by an aggregation device, which might differ among the aggregation devices in the system. Satellite devices acting as proxy DCBX peers for the aggregation devices maintain a local sequence number (see satellite sequence-number output field) that maps to this value for each aggregation device. In this way, the satellite device presents a consistent sequence number for DCBX TLV traffic to and from the DCBX peer.</p>
acknowledge-id	<p>Number of acknowledge messages received from the peer.</p> <p>If the Protocol-State value is in-sync, this number should match the sequence-number value in the Peer-Advertisement section.</p> <p>If the Protocol-State value is ack-pending, this number does not match the sequence-number value in the Peer-Advertisement section.</p> <p>Similar to the sequence-number field, this field represents the number of received DCBX acknowledge messages maintained by an aggregation device on Junos Fusion Data Center, which might differ among the aggregation devices in the system. Satellite devices acting as proxy DCBX peers for the aggregation devices map acknowledge-id values in received DCBX packets to the equivalent sequence-number value actually being acknowledged for each aggregation device.</p>
satellite sequence-number	

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
	<p>(Junos Fusion Data Center only) Count of state change messages to the DCBX peer maintained locally on the Junos Fusion satellite device, as compared to the count maintained on the aggregation device displayed in this section's sequence-number output field. Satellite devices act as proxy DCBX peers for the aggregation devices, and map received DCBX acknowledge-id values (corresponding to local satellite sequence number values) to the equivalent aggregation device sequence-number value being acknowledged for each aggregation device. The satellite sequence-number field shows the local satellite device sequence number value actually being exchanged with the DCBX peer.</p>
peer-chassis sequence-number	<p>(Junos Fusion Data Center, starting in Junos OS Release 17.2R1 up until Junos OS Release 18.1R2-S2) Count of state change messages to the DCBX peer maintained by the other aggregation device in the system, as compared to the sequence-number output field in this section. Satellite devices acting as proxy DCBX peers for the aggregation devices map received DCBX acknowledge-id values to the equivalent sequence-number value being acknowledged for each aggregation device. The satellite sequence-number field shows the local satellite device sequence number value actually being exchanged with the DCBX peer.</p> <p>This field is not displayed starting with Junos OS Release 18.1R2-S2 on Junos Fusion Data Center.</p>

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Peer-Advertisement	(DCBX Version 1.01 only) Status of advertisements that the peer sends to the local interface.
Operational version	Version of the DCBX standard used.
sequence-number	<p>Number of state change messages the peer sent to the local interface.</p> <p>If this number matches the acknowledge-id number in the Local-Advertisement field, this indicates that the local interface has acknowledged all of the peer's state change messages and is synchronized.</p> <p>If this number does not match the acknowledge-id number in the Local-Advertisement field, this indicates that the peer has not yet received an acknowledgment for a state change message from the local interface.</p>
acknowledge-id	<p>Number of acknowledge messages the peer has received from the local interface.</p> <p>If this number matches the sequence-number value in the Local-Advertisement field, this indicates that the peer has acknowledged all of the local interface's state change messages and is in synchronization.</p> <p>If this number does not match the sequence-number value in the Local-Advertisement field, this indicates that the peer has not yet sent an acknowledgment for a state change message from the local interface.</p>

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Feature: PFC	Priority-based flow control (PFC) feature DCBX state information.
Protocol-State	(DCBX Version 1.01 only) DCBX protocol state synchronization status: <ul style="list-style-type: none"> • ack-pending—The local interface has not yet received an acknowledge message from the peer to indicate that the peer received a PFC state change message sent by the local interface. • in-sync—The local interface received an acknowledge message from the peer to indicate that the peer received a PFC state change message sent by the local interface. • not-applicable—PFC autonegotiation is disabled.
Operational State	(DCBX Version 1.01 only) Operational state of the feature: enabled or disabled .
Local-Advertisement	Status of advertisements that the local interface sends to the peer.
Enable	(DCBX Version 1.01 only) State that the local interface advertises to the peer: <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
Willing	Willingness of the local interface to learn the PFC configuration from the peer using DCBX: <ul style="list-style-type: none"> • Yes—The local interface is willing to learn the PFC configuration from the peer. • No—The local interface is not willing to learn the PFC configuration from the peer.
Mac auth Bypass Capability	(IEEE DCBX only) (QFX Series) Media access controller (MAC) authentication bypass provides access to devices based on MAC address authentication. This is not supported, so the only value seen in the local advertisement field is no .
Error	(DCBX Version 1.01 only) Configuration compatibility error status: <ul style="list-style-type: none"> • No—No error detected. Local and peer configuration are compatible. • Yes—Error detected. Local and peer configuration are not compatible.

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Operational State	<p>PFC operational state on the interface:</p> <ul style="list-style-type: none"> • Enabled—PFC is enabled on the interface • Disabled—PFC is disabled on the interface
Maximum Traffic Classes capable to support PFC	<p>Largest number of traffic classes the local interface supports for PFC:</p> <ul style="list-style-type: none"> • 6 (EX Series switches) • 6 (QFX Series)
Code Point	<p>PFC code point, which is specified in the 3-bit class-of-service field in the VLAN header.</p>
Admin Mode	<p>PFC administrative state for each code point on the local interface:</p> <ul style="list-style-type: none"> • Enabled—PFC is enabled for the code point. • Disabled—PFC is disabled for the code point.
Operational Mode	<p>(QFX Series) PFC operational mode for each code point:</p> <ul style="list-style-type: none"> • Enable—PFC is enabled on the code point. • Disable—PFC is disabled on the code point.
Peer-Advertisement	<p>Status of advertisements that the peer sends to the local interface.</p>
Enable	<p>(DCBX Version 1.01 only)</p> <p>State that the peer advertises to the local interface:</p> <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
Willing	<p>Willingness of the peer to learn the PFC configuration from the local interface using DCBX:</p> <ul style="list-style-type: none"> • Yes—The peer is willing to learn the PFC configuration from the local interface. • No—The peer is not willing to learn the PFC configuration from the local interface.
Error	<p>(DCBX Version 1.01 only)</p> <p>Configuration compatibility error status:</p> <ul style="list-style-type: none"> • No—No error detected. Local and peer configuration are compatible. • Yes—Error detected. Local and peer configuration are not compatible.

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Operational State	<p>PFC operational state on the interface:</p> <ul style="list-style-type: none"> • Enabled—PFC is enabled on the interface • Disabled—PFC is disabled on the interface
Mac auth Bypass Capability	<p>(IEEE DCBX only)</p> <p>(QFX Series) Media access controller (MAC) authentication bypass provides access to devices based on MAC address authentication. Although the QFX Series does not support this feature, the connected peer might support it. This field reports the peer state:</p> <ul style="list-style-type: none"> • Yes—The connected peer supports MAC authentication bypass. • No—The connected peer does not support MAC authentication bypass.
Maximum Traffic Classes capable to support PFC	<p>Largest number of traffic classes the peer supports for PFC:</p> <ul style="list-style-type: none"> • 6 (EX Series switches) • 8 (QFX Series)
Code Point	<p>PFC code point, which is specified in the 3-bit class-of-service field in the VLAN header.</p>
Admin Mode	<p>PFC administrative state for each code point on the peer:</p> <ul style="list-style-type: none"> • Enabled—PFC is enabled for the code point. • Disabled—PFC is disabled for the code point.

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Feature: Application	State information for the DCBX application.
Protocol-State	<p>(DCBX Version 1.01 only)</p> <p>DCBX protocol state synchronization status:</p> <ul style="list-style-type: none"> • in-sync—The local interface received an acknowledge message from the peer to indicate that the peer received an FCoE state change message sent by the local interface. • ack-pending—The local interface has not yet received an acknowledge message from the peer to indicate that the peer received an FCoE state change message sent by the local interface. • not-applicable—The local interface is set to no-auto-negotiation (autonegotiation is disabled). If the interface is associated with an FCoE forwarding class, the interface advertises FCoE capability even if the connected peer does not advertise FCoE capability.
Local-Advertisement	<p>Status of advertisements that the local interface sends to the peer.</p> <p>If the local interface is set to no-auto-negotiation (autonegotiation is disabled), the local advertisement portion of the output is not shown.</p>
Enable	<p>(DCBX Version 1.01 only)</p> <p>State that the local interface advertises to the peer:</p> <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
Willing	<p>(DCBX Version 1.01 only)</p> <p>Willingness of the local interface to learn the FCoE interface state from the peer using DCBX:</p> <ul style="list-style-type: none"> • Yes—The local interface is willing to learn the FCoE interface state from the peer. • No—The local interface is not willing to learn the FCoE interface state from the peer.
Error	<p>(DCBX Version 1.01 only)</p> <p>Configuration compatibility error status:</p> <ul style="list-style-type: none"> • No—No error detected. The local and peer configuration are compatible. • Yes—Error detected. The local and peer configuration are not compatible.
Appl-Name	Name of the application:

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Ethernet-Type	<p>(DCBX Version 1.01 only)</p> <p>Ethernet type (EtherType) of the application. For example, 0x8906 indicates the EtherType for the FCoE application. Either the EtherType (for Layer 2 applications) or the Socket Number (for Layer 4 applications) of the application is displayed in the output.</p>
Socket-Number	<p>Destination port socket number of the application, if applicable. Either the EtherType (for Layer 2 applications) or the Socket Number (for Layer 4 applications) of the application is displayed in the output.</p>
Priority-Field or Priority-Map	<p>Priority assigned to the application.</p> <p>For EX Series switches, the priority of the FCoE application is determined by the PFC congestion notification profile that has been configured and associated with the FCoE interface. For other applications, the priority is based on the application map.</p>
Status	<p>(DCBX Version 1.01 only)</p> <p>Local status when autonegotiation is enabled:</p> <ul style="list-style-type: none"> • Enabled—The application feature is enabled on both the local interface and the peer interface. (The local configuration and the peer configuration match.) • Disabled—The local configuration and the peer configuration do not match. <p>NOTE: If there is a configuration mismatch in one application between the switch and the peer, all the other applications including FCoE are disabled.</p>
Peer-Advertisement	<p>Status of advertisements that the peer sends to the local interface.</p>
Enable	<p>(DCBX Version 1.01 only)</p> <p>State that the peer advertises to the local interface:</p> <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
Willing	<p>(DCBX Version 1.01 only)</p> <p>Willingness of the peer to learn the FCoE interface state from the local interface using DCBX:</p> <ul style="list-style-type: none"> • Yes—The peer is willing to learn the FCoE interface state from the local interface. • No—The peer is not willing to learn the FCoE interface state from the local interface.

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Error	(DCBX Version 1.01 only) Configuration compatibility error status: <ul style="list-style-type: none"> • No—No error detected. Local and peer configuration are compatible. • Yes—Error detected. Local and peer configuration are not compatible.
Appl-Name	Name of the application: <ul style="list-style-type: none"> • FCoE—Fibre Channel over Ethernet
Ethernet-Type	Ethernet type (EtherType) of the application. For example, 0x8906 indicates the EtherType for the FCoE application. Either the EtherType (for Layer 2 applications) or the Socket-Number (for Layer 4 applications) of the application is displayed in the output.
Socket-Number	Destination port socket number of the application, if applicable. Either the EtherType (for Layer 2 applications) or the Socket Number (for Layer 4 applications) of the application is displayed in the output.
Priority-Field or Priority-Map	Priority assigned to the application.
Status	(DCBX Version 1.01 only) Peer interface status: <ul style="list-style-type: none"> • Enabled—The application feature is enabled on both the local interface and the peer interface. (The local configuration and the peer configuration match.) • Disabled—The local configuration and the peer configuration do not match.

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Feature: ETS	Enhanced Transmission Selection (ETS) DCBX state information.
Protocol-State	(DCBX Version 1.01 only) ETS protocol state synchronization status: <ul style="list-style-type: none"> • in-sync—The local interface received an acknowledge message from the peer to indicate that the peer received an ETS state change message sent by the local interface. • ack-pending—The local interface has not yet received an acknowledge message from the peer to indicate that the peer received an ETS state change message sent by the local interface.
Operational State	(DCBX Version 1.01 only) Operational state of the feature, enabled or disabled .
Local-Advertisement	Status of advertisements that the local interface sends to the peer.
Enable	(DCBX Version 1.01 only) State that the local interface advertises to the peer: <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
TLV Type	(IEEE DCBX only) Type of ETS TLV: <ul style="list-style-type: none"> • Configuration—Advertises the Configuration TLV, which communicates the local ETS configuration to the peer but does not ask the peer to use the configuration. • Recommendation—Advertises the Recommendation TLV, which communicates the local ETS configuration to the peer, and if the peer is “willing,” configures the peer interface to match the local ETS configuration. • Recommendation-or-Configuration—Advertises both TLVs.
Willing	Willingness of the local interface to learn the ETS state from the peer using DCBX (EX Series switches always advertise No for this field): <ul style="list-style-type: none"> • Yes—Local interface is willing to learn the ETS state from the peer. • No—Local interface is not willing to learn the ETS state from the peer.
Credit Based Shaper	

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
	(IEEE DCBX only) Alternative method of flow control to buffer-to-buffer credit. The QFX Series does not support a credit-based shaper, so the value of this field is always No .
Error	(DCBX Version 1.01 only) Configuration error status: <ul style="list-style-type: none"> • No—No error. This should always be the switch ETS error state. • Yes—Error detected.
Maximum Traffic Classes capable to support PFC	(DCBX Version 1.01 only) Largest number of traffic classes the local interface supports for PFC.
Maximum Traffic Classes supported	(IEEE DCBX only) Largest number of traffic classes the local interface supports for ETS. (EX Series switches support only one traffic class for ETS. However, a different value might be shown for this field.)
Code Point	PFC code point, which is specified in the 3-bit class-of-service field in the VLAN header.
Priority-Group	Class-of-service (CoS) priority group (forwarding class set) identification number.
Percentage B/W	Configured minimum percentage of link bandwidth allocated to the priority group. Only explicitly configured values appear in this output column. If the link bandwidth is the default percentage, it is not shown. (EX Series switches allocate 100% of link bandwidth to the default priority group, group 7.)
Transmission Selection Algorithm	(IEEE DCBX only) The transmission selection algorithm used by the interface. The QFX Series supports ETS but does not support using the credit-based shaper algorithm, so the only value shown in this field is ETS .
Peer-Advertisement	Status of advertisements that the peer sends to the local interface.
Enable	

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
	(DCBX Version 1.01 only) State that the peer advertises to the local interface: <ul style="list-style-type: none"> • Yes—The feature is enabled. • No—The feature is disabled.
TLV Type	(IEEE DCBX only) Type of ETS TLV: <ul style="list-style-type: none"> • Configuration—Advertises the Configuration TLV, which communicates the local ETS configuration to the peer but does not ask the peer to use the configuration. • Recommendation—Advertises the Recommendation TLV, which communicates the local ETS configuration to the peer, and if the peer is "willing," configures the peer interface to match the local ETS configuration. • Configuration/Recommendation—Advertises both TLVs.
Willing	Willingness of the peer to learn the ETS state from the local interface using DCBX: <ul style="list-style-type: none"> • Yes—Peer is willing to learn the ETS state from the local interface. • No—Peer is not willing to learn the ETS state from the local interface.
Credit Based Shaper	(IEEE DCBX only) Alternative method of flow control to buffer-to-buffer credit. The QFX Series does not support a credit-based shaper, so the value of this field is always No .
Error	(DCBX Version 1.01 only) Configuration error status of the peer: <ul style="list-style-type: none"> • No—No error in peer ETS TLV. • Yes—Error in peer ETS TLV.
Maximum Traffic Classes capable to support PFC	(DCBX Version 1.01 only) Largest number of traffic classes the local interface supports for PFC.
Maximum Traffic Classes supported	(IEEE DCBX only) Largest number of traffic classes the local interface supports for ETS. (EX Series switches support only one traffic class for ETS. However, a different value might be shown for this field.)
Code Point	

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
	PFC code point, which is specified in the 3-bit class-of-service field in the VLAN header.
Priority-Group	CoS priority group (forwarding class set) identification number.
Percentage B/W	Configured minimum percentage of link bandwidth allocated to the priority group. (EX Series switches allocate 100% of link bandwidth to the default priority group, group 7.)
Transmission Selection Algorithm	(IEEE DCBX only) Transmission selection algorithm used by the interface. The QFX Series supports ETS but does not support using the credit-based shaper algorithm, so the only value shown in this field is ETS .
PFC	(QFX Series, terse option only) DCBX TLV advertisement state for PFC: <ul style="list-style-type: none"> • Disabled—PFC configuration matches the configuration on the connected peer and PFC is disabled • Enabled—PFC configuration matches the configuration on the connected peer and PFC is enabled • Not Advt—Interface does not advertise PFC to the connected peer
ETS	(terse option only) Local DCBX TLV advertisement state for ETS: <ul style="list-style-type: none"> • Advt—Interface advertises ETS TLVs • Disabled—ETS is disabled on the interface (interface does not advertise ETS)
ETS Rec	(terse option only) DCBX TLV peer advertisement state for ETS (state received from the connected DCBX peer): <ul style="list-style-type: none"> • Advt—Peer interface advertises ETS TLVs • Not Advt—Peer interface does not advertise ETS <p>NOTE: When the DCBX mode is DCBX version 1.01, no peer information is displayed.</p>

Table 60: show dcbx neighbors Output Fields (continued)

Field Name	Field Description
Version	<p>(terse option only) The DCBX version used on the interface and whether the DCBX version was autonegotiated or explicitly configured:</p> <ul style="list-style-type: none"> • IEEE—The interface uses IEEE DCBX. • 1.01—The interface uses DCBX version 1.01. <p>When the DCBX version used is the result of autonegotiation, the term (Auto) appears next to the version. For example, IEEE (Auto) indicates that the interface autonegotiated with the connected peer to use IEEE DCBX. Autonegotiation is enabled by default.</p>

Sample Output

show dcbx neighbors interface (Junos Fusion Data Center, DCBX Version 1.01 Mode)

```
user@aggregation-device> show dcbx neighbors interface xe-0/0/0
```

```
Interface : xe-103/0/10.0 - Parent Interface: ae2.0
Active-application-map: iscsi-map
Protocol Mode: DCBX Version 1.01
Protocol-State: in-sync

Local-Advertisement:
  Operational version: 0
  sequence-number: 1, acknowledge-id: 6
  satellite sequence-number: 2

Peer-Advertisement:
  Operational version: 0
  sequence-number: 6, acknowledge-id: 1

Feature: PFC, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:
  Enable: Yes, Willing: No, Error: No
  Maximum Traffic Classes capable to support PFC: 8

Code Point      Admin Mode
000             Disabled
001             Disabled
010             Disabled
011             Enabled
100             Enabled
101             Disabled
110             Disabled
111             Disabled

Peer-Advertisement:
  Enable: Yes, Willing: No, Error: No
  Maximum Traffic Classes capable to support PFC: 8
```


Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

App1-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iSCSI		3260	00010000	Enabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

App1-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iSCSI		3260	00010000	Enabled

Feature: ETS, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	0
001	6
010	6
011	1
100	2
101	6
110	6
111	6

Priority-Group	Percentage B/W
0	35%
1	40%
2	25%
6	0%

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	0

001	6
010	6
011	1
100	2
101	6
110	6
111	6

Priority-Group	Percentage B/W
0	35%
1	40%
2	25%
6	0%

Interface : xe-103/0/3.0 - Parent Interface: ae2.0

Active-application-map: iscsi-map

Protocol Mode: DCBX Version 1.01

Protocol-State: in-sync

Local-Advertisement:

Operational version: 0

sequence-number: 1, acknowledge-id: 5

satellite sequence-number: 2

Peer-Advertisement:

Operational version: 0

sequence-number: 5, acknowledge-id: 1

Feature: PFC, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iSCSI		3260	00010000	Enabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iSCSI		3260	00010000	Enabled

Feature: ETS, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	0
001	6
010	6
011	1
100	2
101	6
110	6
111	6

Priority-Group	Percentage B/W
0	35%
1	40%
2	25%
6	0%

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	0
001	6
010	6
011	1
100	2
101	6
110	6
111	6

Priority-Group	Percentage B/W
0	35%

1	40%
2	25%
6	0%

show dcbx neighbors interface (QFX Series, DCBX Version 1.01 Mode)

```
user@switch> show dcbx neighbors interface xe-0/0/0
```

```
Interface : xe-0/0/0.0 - Parent Interface: ae0.0
```

```
Active-application-map: app-map-1
```

```
Protocol-State: in-sync
```

```
Protocol-Mode: DCBX Version 1.01
```

```
Local-Advertisement:
```

```
Operational version: 1
```

```
sequence-number: 130, acknowledge-id: 102
```

```
Peer-Advertisement:
```

```
Operational version: 1
```

```
sequence-number: 102, acknowledge-id: 130
```

```
Feature: PFC, Protocol-State: in-sync
```

```
Operational State: Enabled
```

```
Local-Advertisement:
```

```
Enable: Yes, Willing: No, Error: No
```

```
Maximum Traffic Classes capable to support PFC: 8
```

Code Point	Admin Mode	Operational Mode
000	Disabled	Disable
001	Disabled	Disable
010	Disabled	Disable
011	Enabled	Enable
100	Enabled	Enable
101	Disabled	Disable
110	Disabled	Disable
111	Disabled	Disable

```
Peer-Advertisement:
```

```
Enable: Yes, Willing: No, Error: No
```

```
Maximum Traffic Classes capable to support PFC: 8
```

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

```
Feature: Application, Protocol-State: in-sync
```

```
Local-Advertisement:
```

```
Enable: Yes, Willing: No, Error: No
```

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001110	Enabled

```

iSCSI                                3260                10000000        Enabled

Peer-Advertisement:
  Enable: Yes, Willing: Yes, Error: No

  Appl-Name    Ethernet-Type    Socket-Number    Priority-Map    Status
  FCoE         0x8906                N/A              00001110        Enabled

Feature: ETS, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:
  Enable: Yes, Willing: No, Error: No
  Maximum Traffic Classes capable to support PFC: 8

  Code Point    Priority-Group
  000           0
  001           7
  010           7
  011           7
  100           0
  101           1
  110           1
  111           7

  Priority-Group    Percentage B/W
  0                 40%
  1                 5%

Peer-Advertisement:
  Enable: Yes, Willing: No, Error: No
  Maximum Traffic Classes capable to support PFC: 8

  Code Point    Priority-Group
  000           0
  001           7
  010           7
  011           7
  100           0
  101           1
  110           1
  111           7

  Priority-Group    Percentage B/W
  0                 40%
  1                 5%

```

show dcbx neighbors interface (QFX Series, IEEE DCBX Mode)

```

user@switch> show dcbx neighbors interface xe-0/0/0

Interface : xe-0/0/0.0 - Parent Interface: ae0.0
Active-application-map: app-map-1

```

Protocol-Mode: IEEE-DCBX Version

Feature: PFC

Local-Advertisement:

Willing: No
Mac auth Bypass Capability: No
Operational State: Enabled

Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Peer-Advertisement:

Willing: No
Mac auth Bypass Capability: No
Operational State: Enabled

Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Feature: Application

Local-Advertisement:

Appl-Name	Ethernet-Type	Socket-Number	Priority-field
FCoE	0x8906		00001110
iSCSI		3260	10000000

Peer-Advertisement:

Appl-Name	Ethernet-Type	Socket-Number	Priority-field
FCoE	0x8906	N/A	00001110

Feature: ETS

Local-Advertisement:

TLV Type: Configuration/Recommendation
Willing: No
Credit Based Shaper: No
Maximum Traffic Classes supported: 3

Code Point	Priority-Group
000	0

001	7
010	7
011	7
100	0
101	1
110	1
111	7

Priority-Group	Percentage B/W
0	40%
1	5%

Priority-Group	Transmission Selection Algorithm
0	Enhanced Transmission Selection
1	Enhanced Transmission Selection

Peer-Advertisement:

TLV Type: Configuration

Willing: No

Credit Based Shaper: No

Code Point	Priority-Group
000	0
001	7
010	7
011	7
100	0
101	1
110	1
111	7

Priority-Group	Percentage B/W
0	40%
1	5%

Priority-Group	Transmission Selection Algorithm
0	Enhanced Transmission Selection
1	Enhanced Transmission Selection

Peer-Advertisement:

TLV Type: Recommendation

Code Point	Priority-Group
000	0
001	7
010	7
011	7
100	0
101	1
110	1
111	7

Priority-Group	Percentage B/W
0	40%
1	5%

Priority-Group	Transmission Selection Algorithm
0	Enhanced Transmission Selection

1 Enhanced Transmission Selection

show dcbx neighbors terse (QFX Series)

```
user@switch> show dcbx neighbors terse
```

Interface	Parent Interface	PFC	ETS	ETS	Version Rec
xe-0/0/8.0	-	Enabled	Advt	Advt	IEEE (Auto)
xe-0/0/9.0	-	Disabled	Disabled		1.01
xe-0/0/11.0	ae0.0	Enabled	Advt	Advt	IEEE (Auto)
xe-0/0/12.0	ae0.0	Enabled	Advt	Advt	IEEE (Auto)
xe-0/0/32.0	-	Enabled	Advt	Not Advt	IEEE
xe-0/0/36.0	-	Not Advt	Advt	Advt	IEEE

show dcbx neighbors (EX4500 Switch: FCoE Interfaces on Both Local and Peer with PFC Configured Compatibly)

```
user@switch> show dcbx neighbors interface xe-0/0/14
```

```
Interface : xe-0/0/14.0 - Parent Interface: ae0.0
Protocol-State: in-sync
```

Local-Advertisement:

```
Operational version: 0
sequence-number: 6, acknowledge-id: 6
```

Peer-Advertisement:

```
Operational version: 0
sequence-number: 6, acknowledge-id: 6
```

```
Feature: PFC, Protocol-State: in-sync
```

```
Operational State: Enabled
```

Local-Advertisement:

```
Enable: Yes, Willing: No, Error: No
Maximum Traffic Classes capable to support PFC: 6
```

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Disabled
101	Disabled
110	Disabled
111	Disabled

Peer-Advertisement:

```
Enable: Yes, Willing: No, Error: No
Maximum Traffic Classes capable to support PFC: 6
```

Code Point	Admin Mode
------------	------------


```

000      Disabled
001      Disabled
010      Disabled
011      Enabled
100      Disabled
101      Disabled
110      Disabled
111      Disabled

```

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No <<< Error bit will not be set as there is no miss configuration between local and peer.

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Status	Appl-Name	Ethernet-Type	Socket-Number	Priority-Map
Enabled	FCoE	0x8906		00001000

show dcbx neighbors (EX4500 Switch: DCBX Interfaces on Local and Peer Are Configured Compatibly with iSCSI Application)

```
user@switch> show dcbx neighbors interface xe-0/0/14
```

Interface : xe-0/0/14.0 - Parent Interface: ae0.0

Protocol-State: in-sync

Active-application-map: iscsi-map

Local-Advertisement:

Operational version: 0
sequence-number: 9, acknowledge-id: 12

Peer-Advertisement:

Operational version: 0
sequence-number: 12, acknowledge-id: 9

Feature: PFC, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No
Maximum Traffic Classes capable to support PFC: 6

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Disabled
101	Disabled
110	Disabled
111	Disabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes capable to support PFC: 6

Code Point	Admin Mode
000	Disabled
001	Disabled
010	Disabled
011	Enabled
100	Disabled
101	Disabled
110	Disabled
111	Disabled

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iscsi		3260	00100000	Enabled

Peer-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iscsi		3260	00100000	Enabled

show dcbx neighbors (EX4500 Switch: Includes ETS)

user@switch> show dcbx neighbors interface xe-0/0/3

```

Interface : xe-0/0/3.0
Protocol-State: in-sync
Active-application-map: map_iscsi

Local-Advertisement:
  Operational version: 0
  sequence-number: 1, acknowledge-id: 5

```

Peer-Advertisement:

Operational version: 0
sequence-number: 5, acknowledge-id: 1

Feature: PFC, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No
Maximum Traffic Classes capable to support PFC: 6

Code Point	Admin Mode
000	Enabled
001	Enabled
010	Disabled
011	Disabled
100	Disabled
101	Disabled
110	Disabled
111	Disabled

Peer-Advertisement:

Enable: Yes, Willing: Yes, Error: No
Maximum Traffic Classes capable to support PFC: 8

Code Point	Admin Mode
000	Enabled
001	Disabled
010	Disabled
011	Disabled
100	Enabled
101	Disabled
110	Disabled
111	Disabled

Feature: Application, Protocol-State: in-sync

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00000001	Enabled
iscsi		3260	00000010	Enabled

Peer-Advertisement:

Enable: Yes, Willing: Yes, Error: No

Appl-Name	Ethernet-Type	Socket-Number	Priority-Map	Status
FCoE	0x8906		00001000	Enabled
iscsi		3260	00010000	Enabled

Feature: ETS, Protocol-State: in-sync

Operational State: Enabled

Local-Advertisement:

Enable: Yes, Willing: No, Error: No

Maximum Traffic Classes supported : 3

Code Point	Priority-Group
000	7
001	7
010	7
011	7
100	7
101	7
110	7
111	7

Priority-Group	Percentage B/W
7	100%

Peer-Advertisement:

Enable: Yes, Willing: Yes, Error: No

Maximum Traffic Classes supported : 8

Code Point	Priority-Group
000	0
001	1
010	0
011	0
100	2
101	0
110	0
111	0

Priority-Group	Percentage B/W
0	30%
1	40%
2	30%