53-1003168-01
27 June 2014

Flow Vision

Administrators Guide

Supporting Fabric OS v7.3.0

BROCADE

© 2014, Brocade Communications Systems, Inc. All Rights Reserved.

Brocade, the B-wing symbol, Brocade Assurance, ADX, AnyIO, DCX, Fabric OS, FastIron, HyperEdge, ICX, MLX, MyBrocade, NetIron, OpenScript, VCS, VDX, and Vyatta are registered trademarks, and The Effortless Network and the On-Demand Data Center are trademarks of Brocade Communications Systems, Inc., in the United States and in other countries. Other brands and product names mentioned may be trademarks of others.

Notice: This document is for informational purposes only and does not set forth any warranty, expressed or implied, concerning any equipment, equipment feature, or service offered or to be offered by Brocade. Brocade reserves the right to make changes to this document at any time, without notice, and assumes no responsibility for its use. This informational document describes features that may not be currently available. Contact a Brocade sales office for information on feature and product availability. Export of technical data contained in this document may require an export license from the United States government.

The authors and Brocade Communications Systems, Inc. assume no liability or responsibility to any person or entity with respect to the accuracy of this document or any loss, cost, liability, or damages arising from the information contained herein or the computer programs that accompany it.

The product described by this document may contain open source software covered by the GNU General Public License or other open source license agreements. To find out which open source software is included in Brocade products, view the licensing terms applicable to the open source software, and obtain a copy of the programming source code, please visit http://www.brocade.com/support/oscd.

Contents

Preface

Document conventions

The document conventions describe text formatting conventions, command syntax conventions, and important notice formats used in Brocade technical documentation.

Text formatting conventions

Text formatting conventions such as boldface, italic, or Courier font may be used in the flow of the text to highlight specific words or phrases.

Format	Description
bold text	Identifies command names
	Identifies keywords and operands
	Identifies the names of user-manipulated GUI elements
	Identifies text to enter at the GUI
italic text	Identifies emphasis
	Identifies variables and modifiers
	Identifies paths and Internet addresses
	Identifies document titles
`Courier font`	Identifies CLI output
	Identifies command syntax examples

Command syntax conventions

Bold and italic text identify command syntax components. Delimiters and operators define groupings of parameters and their logical relationships.

Convention	Description
bold text	Identifies command names, keywords, and command options.
italic text	Identifies a variable.

Convention	Description
value	In Fibre Channel products, a fixed value provided as input to a command option is printed in plain text, for example, **--show** WWN.
[ ]	Syntax components displayed within square brackets are optional. Default responses to system prompts are enclosed in square brackets.
{ **x** | **y** | **z** }	A choice of required parameters is enclosed in curly brackets separated by vertical bars. You must select one of the options. In Fibre Channel products, square brackets may be used instead for this purpose.
x | **y**	A vertical bar separates mutually exclusive elements.
< >	Nonprinting characters, for example, passwords, are enclosed in angle brackets.
...	Repeat the previous element, for example, *member*[*member*...].
\	Indicates a “soft” line break in command examples. If a backslash separates two lines of a command input, enter the entire command at the prompt without the backslash.

Notes, cautions, and warnings

Notes, cautions, and warning statements may be used in this document. They are listed in the order of increasing severity of potential hazards.

NOTE
A Note provides a tip, guidance, or advice, emphasizes important information, or provides a reference to related information.

ATTENTION
An Attention statement indicates a stronger note, for example, to alert you when traffic might be interrupted or the device might reboot.

CAUTION

A Caution statement alerts you to situations that can be potentially hazardous to you or cause damage to hardware, firmware, software, or data.

DANGER

A Danger statement indicates conditions or situations that can be potentially lethal or extremely hazardous to you. Safety labels are also attached directly to products to warn of these conditions or situations.

Brocade resources

Visit the Brocade website to locate related documentation for your product and additional Brocade resources.

You can download additional publications supporting your product at www.brocade.com. Select the Brocade Products tab to locate your product, then click the Brocade product name or image to open the individual product page. The user manuals are available in the resources module at the bottom of the page under the Documentation category.

To get up-to-the-minute information on Brocade products and resources, go to MyBrocade. You can register at no cost to obtain a user ID and password.

Release notes are available on MyBrocade under Product Downloads.

White papers, online demonstrations, and data sheets are available through the Brocade website.

Contacting Brocade Technical Support

As a Brocade customer, you can contact Brocade Technical Support 24x7 online, by telephone, or by e-mail. Brocade OEM customers contact their OEM/Solutions provider.

Brocade customers

For product support information and the latest information on contacting the Technical Assistance Center, go to http://www.brocade.com/services-support/index.html.

If you have purchased Brocade product support directly from Brocade, use one of the following methods to contact the Brocade Technical Assistance Center 24x7.

Online	Telephone	E-mail
Preferred method of contact for non-urgent issues: • My Cases through MyBrocade • Software downloads and licensing tools • Knowledge Base	Required for Sev 1-Critical and Sev 2-High issues: • Continental US: 1-800-752-8061 • Europe, Middle East, Africa, and Asia Pacific: +800-AT FIBREE (+800 28 34 27 33) • For areas unable to access toll free number: +1-408-333-6061 • Toll-free numbers are available in many countries.	support@brocade.com Please include: • Problem summary • Serial number • Installation details • Environment description

Brocade OEM customers

If you have purchased Brocade product support from a Brocade OEM/Solution Provider, contact your OEM/Solution Provider for all of your product support needs.

- OEM/Solution Providers are trained and certified by Brocade to support Brocade® products.
- Brocade provides backline support for issues that cannot be resolved by the OEM/Solution Provider.

- Brocade Supplemental Support augments your existing OEM support contract, providing direct access to Brocade expertise. For more information, contact Brocade or your OEM.
- For questions regarding service levels and response times, contact your OEM/Solution Provider.

Document feedback

To send feedback and report errors in the documentation you can use the feedback form posted with the document or you can e-mail the documentation team.

Quality is our first concern at Brocade and we have made every effort to ensure the accuracy and completeness of this document. However, if you find an error or an omission, or you think that a topic needs further development, we want to hear from you. You can provide feedback in two ways:

- Through the online feedback form in the HTML documents posted on www.brocade.com.
- By sending your feedback to documentation@brocade.com.

Provide the publication title, part number, and as much detail as possible, including the topic heading and page number if applicable, as well as your suggestions for improvement.

About This Document

Supported hardware and software

In those instances in which procedures or parts of procedures documented here apply to some switches but not to others, this list identifies exactly which switches are supported and which are not.

Although many different software and hardware configurations are tested and supported by Brocade Communications Systems, Inc. for Fabric OS 7.3.0, documenting all possible configurations and scenarios is beyond the scope of this document.

The following hardware platforms are supported by this release of Fabric OS:

TABLE 1 Brocade Fixed-port switches

Gen 4 platform (8-Gpbs)	Gen 5 platform (16-Gbps)
Brocade 300 switch	Brocade 6505 switch
Brocade 5100 switch	Brocade M6505 embedded switch
Brocade 5300 switch	Brocade 6510 switch
Brocade 5410 embedded switch	Brocade 6520 switch
Brocade 5424 embedded switch	Brocade 6547 embedded switch
Brocade 5430 embedded switch	Brocade 6548 embedded switch
Brocade 5431 embedded switch	Brocade 7840 extension switch
Brocade 5432 embedded switch	
Brocade 5450 embedded switch	
Brocade 5460 embedded switch	
Brocade 5470 embedded switch	
Brocade 5480 embedded switch	
Brocade NC-5480 embedded switch	
Brocade 7800 extension switch	
Brocade VA-40FC	
Brocade Encryption Switch	

TABLE 2 Brocade DCX Backbone family

Gen 4 platform (8-Gpbs)	Gen 5 platform (16-Gbps)
Brocade DCX	Brocade DCX 8510-4
Brocade DCX-4S	Brocade DCX 8510-8

What's new in this document

The following items are new or revised in this version of the *Flow Vision Administrator's Guide*:

- Supported hardware and software on page 11
- Firmware upgrade and downgrade restrictions
- Predefined flow creation and monitoring
- Increase in total number of concurrent flows supported
- Increase in the number of Virtual Channels supported
- Support for the Brocade 7840 extension switch
- Support for deactivated duplicate flow definitions.

In Fabric OS 7.3.0, the separate Flow Vision features have the following changes which are reflected in the documentation.

Flow Monitor updates:

- Flow performance monitor learning support on E_Ports and EX_Ports.
- Static and learning flow support for both inter- and intra-fabric traffic passing through XISL_Ports.
- Added support for duplicate flow definitions, but note that only one can be active at a time.
- Described chip duplicate flow enhancements.

Flow Generator updates:

- Information on a default predefined flow that automatically generates traffic between all configured SIM ports in a switch.

Flow Mirror updates:

- Support for combining the following keywords in Flow Mirror commands:
  - **-frametype** and **-ingrport**
  - **-frametype** and **-bidir**
- Support for Gen 5 (16 Gbps) F_Ports and F_Port trunks as either ingress or egress ports on the following devices:
  - Switches: Brocade 6505, 6510, 6520, and DCX 8510-4 and DCX 8510-8
  - Blades: CR16-4, CR16-8, FC8-32E, FC8-48E, FC16-32, FC16-48, FC16-64

  With this support, Flow Mirror can mirror frames from both Access Gateways and 16 Gbps Host Bus Adapters.
- Mirroring traffic to a physical port on the local switch.
- Mirroring traffic to a specific port (physical or virtual) on the local switch.
- Mirroring traffic originating from the CPU to an egress port.

Brocade Flow Vision terminology

The following terms are used in this document.

Term	Description
Defined flow	User-created flow; it can be active or inactive.
Local flow	Flow defined on the switch on which the **flow** command is being run.
Root flow	Instance of a static flow used to create learned flows.
Static flow	Flow created when learning is not used.
Sub-flow	System auto-created flow based on a root flow. There can be more than one sub-flow.
Remote flow	Flow defined on a different switch from the one on which you are viewing it.
Learned flow	Flow created by using an asterisk (*) as part of the flow definition.
Local switch	Switch on which the **flow** command is being run.
Remote switch	Switch other than the switch on which the **flow** command is being run.
ISL	An Inter-Switch Link (ISL) is a protocol that maintains VLAN information in Ethernet frames as traffic flows between switches and routers, or switches and switches.
DISL	A Dedicated ISL (DISL) is a physically-connected link between two logical switches that belong to the same Fabric ID (FID). A DISL is dedicated to carry frames only related to the FIDs of connected logical switches.
LISL	A LISL (Logical ISL) is a logical link between two logical switches that is used for control frames. Depending on the fabric topology, a LISL may or may not map directly to a single physical ISL.
XISL	An XISL (eXtended ISL) is a logical link connecting base switches together to form the base fabric. It carries frames from the base fabric and other logical fabrics using the encapsulation and inter-fabric link (IFL) header as identifiers.
Backbone E_Port	This is the E_Port on a Fibre Channel Routing (FCR)-enabled switch.

Flow Vision

Overview of Flow Vision

Flow Vision is a Fibre Channel SAN network diagnostic tool supported on all platforms supported by Fabric OS 7.2.0 and later, that provides you with a comprehensive vision of and deep insight into fabric traffic flows, along with the ability to non-disruptively create and capture copies of traffic flows for analysis of traffic flows, bottlenecks, bandwidth utilization and similar fabric connectivity functionality. Flow Vision also provides a test flow generation capability that you can use to pre-test a SAN infrastructure for robustness. This test flow generation capability is also useful for testing the internal connections on a switch before deploying the switch into a production environment. In addition, Flow Vision allows you to test for fabric connectivity issues, such as slow drain, bandwidth utilization, and similar issues.

Flow Vision features

Flow Vision has three features: Flow Monitor, Flow Generator, and Flow Mirror.

Flow Monitor

Flow Monitor provides flow monitoring and the gathering of frame statistics for fabric application flows, including the ability to learn (discover) flows automatically that are flowing through a specified port. Refer to Flow Monitor on page 33 for a complete description and sample use cases.

Flow Generator

Flow Generator simulates and generates test-load traffic in specific flows; this allows you to validate hardware components, connectivity, and verify performance. Refer to Flow Generator on page 59 for a complete description and sample use cases.

Flow Mirror

Flow Mirror provides the ability to non-disruptively create copies of application flow frames that can be captured for deeper analysis of their contents. Refer to Flow Mirror on page 75 for a a complete description and sample use cases.

Flow Vision limitations and considerations

Beyond the individual feature-specific restrictions, the following restrictions and limitations apply to Flow Vision as a whole:

- You cannot run Flow Vision and either Advanced Performance Monitor (APM) or Port Mirroring at the same time on a chassis (even across logical switches), as Flow Vision and Port Mirror connections are mutually exclusive. This means that legacy Port Mirroring-related operations are not allowed if any Flow Vision flow (active or defined) is present on a switch, and no Flow Vision flows can be created or run if legacy Port Mirroring is enabled.
- Port swap functionality is not supported.

Roles and access in Flow Vision

Flow Vision can be accessed by users with the following roles: Admin, Switch Admin, or Fabric Admin.

Flow Vision flows

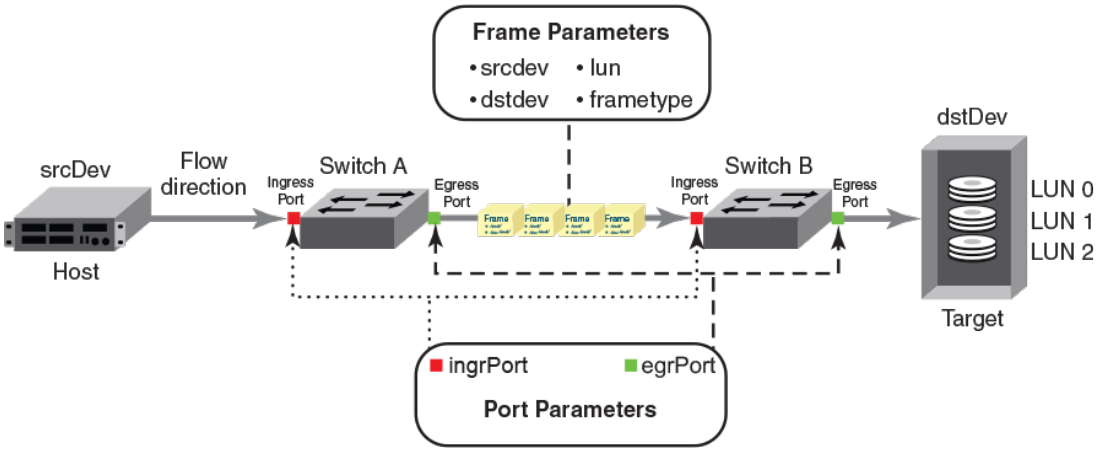
A flow is a set of Fibre Channel (FC) frames or packets that share similar traits, such as an ingress port or egress port identifier or any other data that can be used to differentiate one set of related frames or packets from a different set.

These parameters are specified as part of the **flow** command, and include:

- **Port parameters:** (Also called the “Point of Interest”, or where the data you want to examine is from.) This consists of an ingress port (ingrport) or an egress port (egrport). Only one can be specified when defining a flow.
- **Frame parameters:** These are the following parameters: Source Device Identification (SID or WWN), Destination Device Identification (DID or WWN), LUN, or frame type. At least one frame parameter must be present to define a flow. Refer to Flow frametype parameters on page 19 for details on frame types.
- **Direction:** A direction is implicitly defined from an ingress port to an egress port, or a source device (srcdev) to a destination device (dstdev). For example, srcdev=x, dstdev=y indicates traffic flowing from x to y. The **-bidir** option causes the flow definition to be monitored in both directions. This makes the following true:
  - Entering **srcdev=x dstdev=y** specifies that only traffic flowing from x to y is the desired flow.
  - Entering **srcdev=x dstdev=y -bidir** specifies that traffic traveling from x to y and traffic traveling from y to x are both desired flows.

The following figure illustrates how the frame and port parameters apply to a flow.

FIGURE 1 Frame and port parameters



Flow definitions

To define a flow and configure Flow Vision to monitor that flow, you must provide a unique flow name and specify the flow parameters. These parameters identify the sets of related frames that compose the flow; these can either be explicitly defined or Flow Vision can learn them through observation.

NOTE
These flow definitions are stored on the switch on which the flow is created, and are not distributed across the fabric. This means that each switch (logical or physical) knows only its own unique flows and does not know what flows exist on other switches.

When creating or viewing a flow, you can specify any combination of the three features (monitor, mirror, generator) in the **flow** command.

Flow definition parameters and rules

The rules listed in the following table identify the parameters that can be used to define a flow.

TABLE 3 Flow definition rules

Parameters	Field names	Rules
Port	ingrport egrport	• One field only must be specified • Values must be explicit

TABLE 3 Flow definition rules (Continued)

Parameters	Field names	Rules
Frame	srcdev dstdev lun frametype **NOTE** Refer to Table 5 on page 19 for more information on frame types.	• At least one field must be specified. • Values for srcdev and dstdev can be explicit or "*" ("*" indicates learned flows). • Values for lun and frametype must be explicit. • On XISL monitors, the SFID and DFID values are mandatory but srcdev & dstdev are not.

Notes

- On 8 Gbps-capable Fibre Channel platforms, possible frame monitoring flow classifiers include: egrport, ingrport, srcdev, dstdev, and lun.
- On Gen 5 Fibre Channel platforms and the Brocade FC8-32E and FC8-48E blades, possible frame monitoring flow classifiers include: ingrport, egrport, dstdev, srcdev, and lun.

Duplicate flow definition support

Flow Vision allows duplicate flow definitions to be created as long as the flows are not active. Duplicate flow definitions are detected during flow activation. If a flow is a duplicate of an active flow, the duplicate will not be activated.

Any flow that is considered to be a duplicate will remain deactivated as long as there is an existing matching flow definition active irrespective of the defined application. A warning message is displayed when you try to create (which implicitly activates) or activate a flow if there is an existing matching flow definition active. You must manually deactivate the active flow to activate the new flow definition.

A flow definition must be active to be considered a duplicate. For example, the following user-defined flow definitions are considered to be duplicates, as the "*" value for dstdev in the second example would include the 0xa20c81 value specified in the first.

- `flow --create flow1 -feature monitor -ingrport 9/46 -srcdev 0xb2c680 -dstdev 0xa20c81`
- `flow --create flow2 -feature monitor -ingrport 9/46 -srcdev 0xb2c680 -dstdev *`

However, these user-defined flow definitions will not be considered to be duplicates:

- `flow --create flow1 -feature monitor -ingrport 9/46 -srcdev 0xb2c680 -dstdev 0xa20c81`
- `flow --create flow2 -feature monitor -ingrport 9/46 -srcdev 0xb2c680 -dstdev 0xa20c81 -noactivate`
- `flow --create flow3 -feature generator -ingrport 9/46 -srcdev 0xb2c680 -dstdev 0xa20c81 -noactivate`

Predefined flows are considered when checking for duplicate flows. When a predefined flow is active for any feature, all user-defined flows for that feature are considered to be duplicate flows, but user-defined flows for different features are not considered to be duplicate flows. Duplicate predefined flow definitions can be active for different applications. Duplicate predefined flow definitions cannot be active simultaneously for the *same* application.

Supported port configurations for each application

The following table lists the supported configurations for each Flow Vision feature that can be made using only the basic flow identification parameters (ingrport and srcdev, egrport and dstdev).

TABLE 4 Port configurations supported in Flow Vision

	Platforms		Switch Configuration Mode	
Feature	**16 Gbps-capable Fibre Channel (Gen 5)**	**8 Gbps-capable Fibre Channel**	**Access Gateway**	**Virtual Fabric**
Flow Generator	Supported (SIM ports only)	Supported (Destination SIM ports only)	Not Supported	Supported
Flow Mirror	Supported (F_Ports and F_Port trunks)	Not Supported	Not Supported	Supported
Flow Monitor	Supported (E_Ports, EX_Ports, F_Ports, SIM ports, and XISL_Ports)	Supported (E_Ports, EX_Ports, F_Ports, and XISL_Ports)	Supported (F_Ports only)	Supported

Notes on supported configurations

- Neither ranges nor lists are supported for any parameter.
- If you are using at least one advanced parameter (lun, frametype, or bidir), then feature-specific rules apply. Refer to the individual Flow Vision features for specific details.
- Support for Gen 5 F_Ports and F_Port trunks is provided on the following devices:
  - Switches: Brocade 6505, 6510, 6520, DCX 8510-4 and DCX 8510-8
  - Blades: CR16-4, CR16-8, FC8-32E, FC8-48E, FC16-32, FC16-48, and FC16-64
  - Disabling a SIM port that is receiving traffic may produce class 3 discards for the simulated traffic; however, this will have no effect on other traffic flows.

Flow frametype parameters

Frame monitoring can be done for a variety of frames using predefined frametype parameters.

The following table lists these parameters and the type of frames counted for each.

TABLE 5 Supported frametype parameters

Frametype parameter	Frames counted
abts	Abort Sequence
baacc	All frames accepted
barjt	All frames rejected
scsi	All SCSI frames (including both command and data frames)
scsiread	Only SCSI read command frames

TABLE 5 Supported frametype parameters (Continued)

Frametype parameter	Frames counted
scsiwrite	Only SCSI write command frames
scsirw	Both SCSI read and write command frames
scsi2reserve	Only SCSI 2 reserve command frames
scsi3reserve	Only SCSI 3 reserve command frames
scsi2release	Only SCSI 2 release command frames
scsi3release	Only SCSI 3 release command frames
scsi2reserverelease	Only SCSI 2 reserve-release command frames
scsi3reserverelease	Only SCSI 3 reserve-release command frames
scsitur	Only SCSI test unit ready frames
scsistatus	Only SCSI status frames
scsicmdsts	Only SCSI command status frames **NOTE** This parameter is valid only for Flow Mirror. It implicitly assumes “-bidir” and looks for both SCSI command and status frames.
scsigoodstatus	Only SCSI status frames with status marked as good (all 0s [zeros] in the status byte)
scsicheckstatus	Only SCSI status frames with check status (Check Condition, Busy, Reservation Conflict, Task Full Set)
scsiinquiry	Only SCSI inquiry frames
scsiresvconflict	Only SCSI status frames with reservation conflict set
scsixferrdy	Only SCSI FCP XFER_RDY (transfer ready) frames

Numbers of flows supported

On chassis-based platforms, Flow Vision supports a maximum of 512 user-defined flows plus an additional 512 learned flows and predefined flows. On fixed-port platforms, Flow Vision supports a maximum of 128 user-defined flows plus an additional 128 learned flows and predefined flows. However, there is a combined limit for all features of 64 static flows and learning flows (whether active or inactive) for any one port, and a maximum of 64 learned flows per feature per port. This means (as an example) that two different learning flows on a given port can each have 64 learned flows.

Beyond these limits, there are limits for each individual feature, as described in the following table. In addition, refer to the individual features for other feature-specific restrictions.

NOTE
A verification is done for each flow when it is created or activated to ensure that there is no identical flow active. Duplicate flows will not be created or activated when there is a identical flow already active. To create a new flow that duplicates an active flow, you must use the **-noactivate** keyword as part of the **flow --create** command. Refer to the “Creating an inactive flow” section of each feature for instructions on creating an inactive flow for that feature.

TABLE 6 Feature-specific flow count restrictions in Flow Vision

Feature	Limit to number of flows
Flow Monitor	Up to 64 active flows per port, including static flows, learning flows, and learned flows.
Flow Generator	Up to 39 active flows per port for ingress ports and 64 active flows per port for egress ports.
Flow Mirror	One active flow per port.

Flow learning

Flow Vision can create a learned flow by using an asterisk (*) for the source device, the destination device, or both devices. This allows you to discover what flows are active on a port without having to explicitly identify all the devices.

The following items should be kept in mind when constructing learning flows:

- Learning is enabled on a port if the flow definition has an asterisk as the value for any of the flow parameters. The learning flow is expanded to learned flows based on the parameters indicated by the asterisk. Cumulative data is presented for parameters for which learning is not requested.
- When you enter an asterisk as part of the command to indicate a learned flow, you must enclose it in double quotes, like this: ("*").
- Learning source device (srcdev) or destination device (dstdev) values are only supported on Gen 5 Fibre Channel ports.
- Each Flow Vision feature uses learning as follows:
  - Flow Monitor can learn all the source device and destination device pairs passing through the ingress or egress port defined in a flow. Learning is not supported for Flow Monitor flows defined using the lun, frametype, or bidir parameters. Refer to Learning in Flow Monitor flows on page 37 for additional information.
  - Flow Generator can generate traffic to or from every source or destination device that shares the zone with the ingress or egress port defined in a flow. Refer to Learning in Flow Generator flows on page 65 for additional information.
  - Flow Mirror can capture all the source device and destination device pairs passing through the ingress or egress port defined in a flow. Learning is supported for Flow Mirror flows defined using the lun, frametype, or bidir parameters. Refer to Learning in Flow Mirror flows on page 83 for additional information.

Viewing flows

Flow Vision allows you to view the configuration parameters for each flow on a switch.

- To display all Flow Vision flows, enter **flow --show**.
- To display all flows for a specific feature, enter **flow --show -feature** *feature_name*.
- To display the definition for a specific flow, enter **flow --show** *flow_name* **-feature** *feature_name*. When you enter **flow --show** with a flow name, only the flow definition for the specified flow is displayed. If the feature is also specified, feature-specific data is displayed for the specified flow name. For root and static flows, this command shows the Source ID-Destination ID pairs and the cumulative frame count for the ingress or egress port specified in the flow definition.

The following example displays all the existing flows on the switch.

```
switch:admin> flow --show
-------------------------------------------------------------------------------------------------------
Flow Name           |  Feature  |SrcDev | DstDev |IngrPt|EgrPt |BiDir|LUN  |FrameType|SFID|DFID|MirPt |
-------------------------------------------------------------------------------------------------------
local               |gen        |-      |019200  |13    |-     |no   |-    |-        |-   |-   |-     |
flow2               |gen+,mon+  |010900 |01c100  |1/9   |-     |no   |-    |-        |-   |-   |-     |
flow1               |gen+,mon+  |01c100 |-       |8/1   |-     |no   |-    |-        |-   |-   |-     |
sys_gen_all_simports|gen        |*      |*       |*     |*     |no   |-    |-        |-   |-   |-     |
-------------------------------------------------------------------------------------------------------
  + Denotes feature is currently activated for the flow
  The flow name with prefix sys_ denotes a predefined flow
```

Refer to the individual features to see feature-specific output.

Repeating flow output

You can configure the Flow Vision features to repeat their flow output. The purpose of repeating a flow is so that you can view sample frames or output over time to look for differences. This allows you to continuously monitor a changing situation.

To specify the number of times the flow output should be repeated, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Use the **flow --show** *flow_name* **-feature** *feature_name* **-count** *num* command. The *num* value can range from 1 through 10. The default value is 1.

Repeating a Flow Monitor flow

The following example creates a Flow Monitor flow named “ag159_flow_2”, and then repeats the output two times:

```
switch:admin> flow --create ag159_flow_2 -feature monitor -srcdev 10:05:00:11:0d:78:45:02 -dstdev
10:00:8c:7c:ff:43:c0:01 -ingrport 3/2 -bidir

switch:admin> flow --show ag159_flow_2 -feature monitor -count 2
=============================================================================================================
Name      : ag159_flow_2        Features: mon(Activated)        noConfig: Off
Definition: IngrPort(3/2),SrcDev(10:05:00:11:0d:78:45:02),DstDev(10:00:8c:7c:ff:43:c0:01),BiDir


Flow Monitor (Activated):
Monitor time:  | Mon Jun 16 19:04:42 UTC 2014 |
-------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
|      Frame Count      |  Frames Per Sec.    |    Byte Count      |   Throughput(Bps)   |FrmSize(B) |
|   Tx  /   Rx  / Total | Tx    / Rx  /Total | Tx    /Rx   /Total  | Tx   / Rx   /Total  | Tx / Rx   |
-------------------------------------------------------------------------------------------------------------
|382.91M/394.17M/777.08M|46.93k/48.16k/95.10k|703.75G/701.23G/1.37T|88.34M/87.72M/176.07M|1976/1912  |
-------------------------------------------------------------------------------------------------------------

-----------------------------------------------------------------------------------------------
|      I/O Count        |   I/O Per Sec.(IOPS)  | I/O bytes Transferred |   I/O bytes Per Sec.  |
| Reads / Writes/ Total | Reads / Writes/ Total | Reads / Writes/ Total | Reads / Writes/ Total |
-----------------------------------------------------------------------------------------------
| 11.26M/ 11.26M/ 22.52M|  1.40k/  1.39k/  2.80k|687.43G/687.43G/  1.34T| 87.85M/ 87.46M/175.31M|
-----------------------------------------------------------------------------------------------
=============================================================================================================
=============================================================================================================
Name      : ag159_flow_2        Features: mon(Activated)        noConfig: Off
Definition: IngrPort(3/2),SrcDev(10:05:00:11:0d:78:45:02),DstDev(10:00:8c:7c:ff:43:c0:01),BiDir


Flow Monitor (Activated):
Monitor time:  | Mon Jun 16 19:04:48 UTC 2014 |
-------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
|      Frame Count      |  Frames Per Sec.    |    Byte Count       |   Throughput(Bps)     |FrmSize(B)
|   Tx  /   Rx  / Total | Tx   / Rx   /Total  | Tx    /Rx   /Total  | Tx    / Rx    /Total  |Tx  / Rx |
-------------------------------------------------------------------------------------------------------------
|383.23M/394.50M/777.74M|53.69k/55.40k/109.09k|704.34G/701.82G/1.37T|101.04M/100.94M/201.98M|1976/1912|
-------------------------------------------------------------------------------------------------------------

-----------------------------------------------------------------------------------------------
|      I/O Count        |   I/O Per Sec.(IOPS)  | I/O bytes Transferred |   I/O bytes Per Sec.  |
| Reads / Writes/ Total | Reads / Writes/ Total | Reads / Writes/ Total | Reads / Writes/ Total |
-----------------------------------------------------------------------------------------------
| 11.27M/ 11.27M/ 22.54M|  1.53k/  1.54k/  3.08k|   688G/688.00G/  1.34T| 96.20M/ 96.69M/192.89M|
-----------------------------------------------------------------------------------------------
=============================================================================================================
```

Repeating a Flow Generator flow

The following example creates a Flow Generator flow named “simflow_1”, and then repeats the output three times:

```
switch:admin> flow --create simflow_1 -feature generator -srcdev 07f000 -dstdev 371400 -ingrport 12/16

switch:admin> flow --show simflow_1 -feature generator -count 3
==========================================================================================================
Name      : simflow_1   Features: gen(Activated),mon(Activated) noConfig: Off
Definition: IngrPort(12/16),SrcDev(0x07f000),DstDev(0x371400)
Flow Generator (Activated):
-----------------------
|  SrcDev  |  DstDev  |
-----------------------
| 0x07f000 | 0x371400 |
-----------------------
Number of frames generated from IngrPort :   2.57G
==========================================================================================================
==========================================================================================================
Name      : simflow_1   Features: gen(Activated),mon(Activated) noConfig: Off
Definition: IngrPort(12/16),SrcDev(0x07f000),DstDev(0x371400)
Flow Generator (Activated):
-----------------------
|  SrcDev  |  DstDev  |
-----------------------
| 0x07f000 | 0x371400 |
-----------------------
Number of frames generated from IngrPort :   2.57G
==========================================================================================================
==========================================================================================================
Name      : simflow_1   Features: gen(Activated),mon(Activated) noConfig: Off
Definition: IngrPort(12/16),SrcDev(0x07f000),DstDev(0x371400)
Flow Generator (Activated):
-----------------------
|  SrcDev  |  DstDev  |
-----------------------
| 0x07f000 | 0x371400 |
-----------------------
Number of frames generated from IngrPort :   2.58G
==========================================================================================================
```

Repeating a Flow Mirror flow

The following example creates a bidirectional Flow Mirror flow named "fmcount_cfm" that is mirrored to the CPU, and repeats the output three times:

```
switch:admin> flow --create fmcount_cfm -feature mirror -ingrport 10 -srcdev 010403 -dstdev 020504 -
bidir

switch:admin> flow --show fmcount_cfm -fea mir -count 3
==============================================================================================================
Name      : fmcount_cfm    Features: mir(Activated)    noConfig: Off
Definition: IngrPort(14),SrcDev(0x010e00),DstDev(0x010f00),BiDir

Flow Mirror (Activated):
------------------------------------------------------------------------------------------
| OXID | RXID | SOF    | EOF      | Frame_type  | LUN(*) | Dir | Time-Stamp          |
------------------------------------------------------------------------------------------
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 07:54:27:100 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 07:54:27:100 |
(output truncated)
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 07:54:31:109 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 07:54:31:109 |
------------------------------------------------------------------------------------------
 No of Mirrored Frames : 1280, No of RX Mirrored Frames : 640, No of TX Mirrored Frames : 640
------------------------------------------------------------------------------------------
==============================================================================================================
==============================================================================================================
Name      : fmcount_cfm    Features: mir(Activated)    noConfig: Off
Definition: IngrPort(14),SrcDev(0x010e00),DstDev(0x010f00),BiDir

Flow Mirror (Activated):
------------------------------------------------------------------------------------------
| OXID | RXID | SOF    | EOF      | Frame_type  | LUN(*) | Dir | Time-Stamp          |
------------------------------------------------------------------------------------------
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 07:54:34:100 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 07:54:34:100 |
(output truncated)
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 07:54:38:109 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 07:54:38:109 |
------------------------------------------------------------------------------------------
 No of Mirrored Frames : 1280, No of RX Mirrored Frames : 640, No of TX Mirrored Frames : 640
------------------------------------------------------------------------------------------
==============================================================================================================
==============================================================================================================
Name      : fmcount_cfm    Features: mir(Activated)    noConfig: Off
Definition: IngrPort(14),SrcDev(0x010e00),DstDev(0x010f00),BiDir

Flow Mirror (Activated):
------------------------------------------------------------------------------------------
| OXID | RXID | SOF    | EOF      | Frame_type  | LUN(*) | Dir | Time-Stamp          |
------------------------------------------------------------------------------------------
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 07:54:40:100 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 07:54:40:100 |
(output truncated)
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 07:54:44:109 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 07:54:44:109 |
------------------------------------------------------------------------------------------
 No of Mirrored Frames : 1280, No of RX Mirrored Frames : 640, No of TX Mirrored Frames : 640
------------------------------------------------------------------------------------------
==============================================================================================================
```

The following example creates a Flow Mirror flow named "fmcount_lfm" that is mirrored to local port 16, and repeats the output five times:

```
switch:admin> flow --create fmcount_lfm -feature mirror -ingrport 14 -srcdev 010403 -dstdev 020504 -
mirrorport 16

switch:admin> flow --show fmcount_lfm -feature mirror -count 5
==============================================================================================================
Name      : fmcount_lfm      Features: mir(Activated)        noConfig: Off
Definition: IngrPort(14),SrcDev(0x010e00),DstDev(0x010f00),MirPort(16)

Flow Mirror (Activated):
------------------------------------------------------------------------------------------
 No of Mirrored Frames : 1032316, No of RX Mirrored Frames : 1032316, No of TX Mirrored Frames : 0
------------------------------------------------------------------------------------------
==============================================================================================================
```

```
================================================================================================================
Name      : fmcount_lfm      Features: mir(Activated)        noConfig: Off
Definition: IngrPort(14),SrcDev(0x010e00),DstDev(0x010f00),MirPort(16)

Flow Mirror (Activated):
----------------------------------------------------------------------------------------------------------------
 No of Mirrored Frames : 1267119, No of RX Mirrored Frames : 1267119, No of TX Mirrored Frames : 0
----------------------------------------------------------------------------------------------------------------
================================================================================================================
================================================================================================================
Name      : fmcount_lfm      Features: mir(Activated)        noConfig: Off
Definition: IngrPort(14),SrcDev(0x010e00),DstDev(0x010f00),MirPort(16)

Flow Mirror (Activated):
----------------------------------------------------------------------------------------------------------------
 No of Mirrored Frames : 1501921, No of RX Mirrored Frames : 1501921, No of TX Mirrored Frames : 0
----------------------------------------------------------------------------------------------------------------
================================================================================================================
================================================================================================================
Name      : fmcount_lfm      Features: mir(Activated)        noConfig: Off
Definition: IngrPort(14),SrcDev(0x010e00),DstDev(0x010f00),MirPort(16)

Flow Mirror (Activated):
----------------------------------------------------------------------------------------------------------------
 No of Mirrored Frames : 1736723, No of RX Mirrored Frames : 1736723, No of TX Mirrored Frames : 0
----------------------------------------------------------------------------------------------------------------
================================================================================================================
================================================================================================================
Name      : fmcount_lfm      Features: mir(Activated)        noConfig: Off
Definition: IngrPort(14),SrcDev(0x010e00),DstDev(0x010f00),MirPort(16)

Flow Mirror (Activated):
----------------------------------------------------------------------------------------------------------------
 No of Mirrored Frames : 1971525, No of RX Mirrored Frames : 1971525, No of TX Mirrored Frames : 0
----------------------------------------------------------------------------------------------------------------
================================================================================================================
```

Sorting flow output

In Flow Vision, frames can be sorted whether or not sub-flows are present. Sorting the output allows you to highlight a selected aspect of the flow data.

To sort the flow output, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Use the **flow --show** *flow_name* **-feature** *feature_name* **-sortby column***column_num* command. The **column***column_num* value is the number of the output column on which the data is to be sorted. There is no space between “column” and the column number.

NOTE
The **-sortby** parameter can only be applied when there is only one feature (monitor, mirror, or generator) specified in the **flow --show** *flow_name* command.

Sorting a Flow Monitor flow

Flow Monitor flows only would nee d sorting if they are a learned flow, as sorting with the dstdev and srcdev explicitly defined would not make sense because there would be only one line of data in the output. The table headings have been edited so that they will display more clearly in this document.

The following example creates the Flow Monitor flow “neutrons”, and then shows the output sorted by column 4, the Destination ID.

```
switch:admin> flow --create neutrons -feature monitor -egrport 1212 -dstdev "*" -srcdev "*"

switch:admin> flow --show neutrons -feature monitor -sortby column4

Monitor time:  | Mon Jun 16 21:46:52 UTC 2014 |
-------------------------------------------------------
=============================================================================================================
Name      : neutrons    Features: mon(Activated)        noConfig: Off
Definition: EgrPort(1212),SrcDev(*),DstDev(*),SFID(*),DFID(*)

Flow Monitor (Activated):
-------------------------------------------------------------------------------------------------------------
|SFID(*)|DFID(*)|SID(*)|DID(*)|Tx Frm Cnt|Tx Frm/Sec.|Tx Bytes Cnt|Tx Throughput(Bps)|Avg Tx Frm Sz(B)|
-------------------------------------------------------------------------------------------------------------
|     25|     25|0ffe80|01cd40|  50.59k  |   8.38k   |     1.28G  |       16.97M     |    2124        |
|     25|     25|0fffc0|01cec0| 752.38k  |   9.65k   |     1.48G  |       19.55M     |    2124        |
|     25|     25|0fff40|01e800| 634.85k  |   8.17k   |     1.25G  |       16.55M     |    2124        |
|     25|     25|0ffe00|01efc0| 742.98k  |   9.53k   |     1.46G  |       19.30M     |    2124        |
|     45|     45|3c8340|5ac9c0| 303.27k  |   3.92k   |   614.30M  |        7.94M     |    2120        |
|     45|     45|3cf140|5ac9c0| 174.55k  |   2.22k   |   353.58M  |        4.49M     |    2124        |
|     45|     45|3cfc00|5ac9c0| 562.38k  |   7.27k   |     1.11G  |       14.73M     |    2120        |
|     45|     45|3cfd00|5aca00| 981.76k  |  12.61k   |     1.94G  |       25.54M     |    2120        |
|     45|     45|3cb000|5aca00|   1.02M  |  12.99k   |     2.03G  |       26.31M     |    2120        |
|     45|     45|3c8340|5aca00| 301.74k  |   3.90k   |   611.20M  |        7.90M     |    2124        |
|     45|     45|3cdcc0|5aca00| 653.07k  |   8.48k   |     1.29G  |       17.17M     |    2120        |
|     45|     45|3cfd00|5aca40| 960.02k  |  12.33k   |     1.89G  |       24.97M     |    2120        |
|     45|     45|3cbe00|5aca40| 418.35k  |   5.33k   |   847.41M  |       10.81M     |    2120        |
|     45|     45|3c8340|5aca80| 262.76k  |   3.41k   |   532.25M  |        6.91M     |    2120        |
|     45|     45|3cdcc0|5aca80| 630.51k  |   8.16k   |     1.24G  |       16.54M     |    2124        |
|     45|     45|3cfd00|5aca80| 946.89k  |  12.17k   |     1.87G  |       24.65M     |    2120        |
|     45|     45|3cf140|5aca80| 175.48k  |   2.22k   |   355.45M  |        4.51M     |    2124        |
|     45|     45|3cbd00|5aca80|  52.19k  |    661    |   105.72M  |        1.33M     |    2124        |
|     45|     45|3cbd00|5acac0|  64.22k  |    807    |   130.09M  |        1.63M     |    2124        |
|     45|     45|3c82c0|5acac0| 209.24k  |   2.75k   |   423.85M  |        5.58M     |    2124        |
|     45|     45|3cfc00|5acac0| 570.87k  |   7.36k   |     1.12G  |       14.92M     |    2124        |
|     45|     45|3c8340|5acac0| 404.76k  |   5.23k   |   819.88M  |       10.61M     |    2124        |
|     45|     45|3cf140|5acac0| 168.94k  |   2.14k   |   342.21M  |        4.34M     |    2124        |
|     45|     45|3cf040|5acac0| 108.99k  |   1.40k   |   220.78M  |        2.84M     |    2124        |
|     45|     45|3cdd40|5acac0| 412.87k  |   5.34k   |   836.30M  |       10.81M     |    2120        |
|     45|     45|3cbe00|5acac0| 396.50k  |   5.05k   |   803.16M  |       10.23M     |    2124        |
|     45|     45|3c8300|5ace00| 970.02k  |  12.43k   |     1.91G  |       25.19M     |    2124        |
|     45|     45|3cbcc0|5ace00|  42.39k  |    538    |    85.87M  |        1.09M     |    2124        |
|     45|     45|3cdd00|5ace00| 952.45k  |  12.37k   |     1.88G  |       25.07M     |    2120        |
|     45|     45|3cbf40|5ace00| 448.57k  |   5.67k   |   908.62M  |       11.49M     |    2124        |
```

Sorting a Flow Generator flow

The following example creates a Flow Generator flow, and then shows the output sorted by column 2:

```
switch:admin> flow --create fSort -feature generator -egrport 4/8 -dstdev 022a00 -
srcdev 01d8c0

switch:admin> flow --show fSort -feature generator -sortby column2
```

Sorting a Flow Mirror flow

The following example creates a Flow Mirror flow, and then shows the output sorted by column 3, the OXID.

```
switch:admin> flow --create sortMirror -feature mirror -egrport 15 -srcdev "*" -bidir

switch:admin> flow --show sortMirror -feature mirror -sortby column3

==========================================================================================================
Name      : sortMirror    Features: mir(Activated)    noConfig: Off
Definition: EgrPort(15),SrcDev(*),BiDir

Flow Mirror (Activated):
----------------------------------------------------------------------------------------------------------
| SID(*)  | DID(*)  | OXID | RXID | SOF   | EOF     | Frame_type | LUN(*) | Dir | Time-Stamp          |
----------------------------------------------------------------------------------------------------------
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:100 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:101 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:102 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:103 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:104 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:105 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:106 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:107 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:108 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:109 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:50:110 |
| 010e00  | 010f00  | 0001 | ffff | SOFn3 | EOFn    | Data       | ----   | Tx  | Jun 05 10:16:51:104 |
| 010f00  | 010e00  | 0044 | ffff | SOFn3 | EOFn    | Data       | ----   | Rx  | Jun 05 10:16:51:111 |
| 010f00  | 010e00  | 0044 | ffff | SOFn3 | EOFn    | Data       | ----   | Rx  | Jun 05 10:16:52:104 |
| 010f00  | 010e00  | 0044 | ffff | SOFn3 | EOFn    | Data       | ----   | Rx  | Jun 05 10:16:52:104 |
| 010f00  | 010e00  | 0044 | ffff | SOFn3 | EOFn    | Data       | ----   | Rx  | Jun 05 10:16:53:106 |
| 010f00  | 010e00  | 0044 | ffff | SOFn3 | EOFn    | Data       | ----   | Rx  | Jun 05 10:16:54:109 |
  (output truncated)
----------------------------------------------------------------------------------------------
 No of Mirrored Frames : 1280, No of RX Mirrored Frames : 640, No of TX Mirrored Frames : 640
----------------------------------------------------------------------------------------------
==============================================================================================
```

Flow deletion

Flow Vision allows you to delete either individual flows or all flows at one time.

When you delete a flow, the following actions occur:

- The specified flow is automatically deactivated before it is deleted.
- All instances of the specified flow are removed.
- Any sub-flows associated with the specified flow are removed.
- If the specified flow is a Flow Monitor or Flow Mirror flow, all flow statistics for it are automatically cleared. If the specified flow is a Flow Generator flow, the statistics are retained.
- You are not asked to confirm the deletion, unless you use **all** as the flow name and do not use the **-force** keyword. For example: **flow --delete all**.

For more information on the **flow --delete** command, refer to the *Fabric OS Command Reference*.

Deleting flows

Flow Vision allows you to delete either a single flow or all flows.

Deleting a single flow

To delete any Flow Vision flow, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Enter **flow --delete** *flow_name*.
   The named flow is immediately deleted and cannot be recovered.

The following example deletes a Flow Monitor flow named “Flow1”.

```
switch:admin> flow --delete Flow1
```

Deleting all flows at one time

To delete all Flow Vision flows at one time, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Enter **flow --delete all**.
   You are then prompted to confirm this action.
3. Enter **y**.
   All user-defined Flow Vision flows will be deleted and cannot be recovered. Predefined flows will not be deleted, but they will be deactivated.

NOTE
You can compel the deletion of flows by adding the **-force** keyword to the command. Using this keyword causes Flow Vision to not issue a confirmation prompt.

The following example deletes all flows without prompting you for confirmation.

```
switch:admin> flow --delete all -force
```

Resetting flow statistics

Flow Vision allows you to clear (reset) the flow statistics record for each feature individually or as a group.

NOTE
Clearing the Flow Mirror statistics for a flow also clears the mirrored frames.

Clearing the statistics for all flow features

To clear all the statistics for a flow, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Enter **flow --reset** *flow_name* **-feature all**.
   You will not be asked to confirm this action.

The following example clears only the Flow Monitor statistics for the flow named “Flow4”.

```
switch:admin> flow --reset Flow4 -feature monitor
```

Clearing the statistics for a specific flow feature

To clear the statistics for specified features of a flow, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Enter **flow --reset** *flow_name* **-feature** *feature_list*. Replace *feature_list* with either an individual feature or a comma-separated list of features (for example, “generator,monitor” or “mir,mon”). You will not be asked to confirm this action.

The following example clears only the Flow Monitor statistics for the flow named “Flow4”.

```
switch:admin> flow --reset Flow4 -feature monitor
```

Flow Vision licensing

To run Flow Vision, you need either the Fabric Vision (FV) license, or *both* the Fabric Watch (FW) and the Advanced Performance Monitor (APM) licenses. If you have both of these licenses, you do not need a separate Flow Vision license.

Refer to the *Fabric OS Software Licensing Guide* for more specific information about licensing and how to obtain the needed license keys.

Flow Vision configuration setup

When a switch goes offline or comes online, Flow Vision reads the configuration files and then deletes flows, creates flows, and activates flows. After a switch goes offline, any flows that were active at the time it went offline will be reactivated when it comes back online and new traffic will be generated as soon as the source and destination devices defined in the flow are online. This includes predefined flows.

Use the following commands to upload, download, and delete configurations:

- To download a Flow Vision configuration to the switch, use the **configDownload** command.
- To save the Flow Vision configuration to the host FTP site, use the **configUpload** command.
- To delete all flows and simulation ports (SIM ports) from a switch, use the **configDefault** command.

NOTE
Statistical data for flows is not saved in the configuration database.

System event handling

Flow Vision handles the following system events:

- When an E_Port or F_Port comes online (PORT_ONLINE), if the resources are available, any flows specifying that port will be installed in the ASIC and made active. If the resources are not available, the flow will stay deactivated.
- When an E_Port is changed (EPORT_CHANGE), if the resources are available, any flows specifying that port will be installed in the ASIC and made active. If the resources are not available (for example, if there is already a flow using that port), the flow will stay deactivated.
- When an F_Port is changed (FPORT_CHANGE), if the resources are available, any flows specifying that port will be installed in the ASIC and made active. If the resources are not available (for example, if there is already a flow using that port), the flow will stay deactivated.

  An F_Port trunk has same trunk index for both the master and slave ports (as displayed in the output for **switchshow**, below). In order to create the same flow definition on the master and slave ports when portIdMode is set to “index”, the domain/Index can be obtained by using the **porttrunkarea –show all** command (as shown below). If you create a flow using the trunk index, then depending upon whether the trunk index maps to the master or the slave port the flow may or may not be installed. If the slave port becomes the master, it will be installed.

```
switch:admin> switchshow
…
Index Port Address  Media Speed  State   Proto
================================================
…
4     4    010400   id    N8     Online  FC  F-Port (Trunk master)
4     5    010400   id    N8     Online  FC  F-Port (Trunk port, master is Port 4)
…

switch:admin> porttrunkarea --show all
Port  Type   State   Master   TI  DI
-------------------------------------
  0    --               --    --   0
  1    --               --    --   1
  2    --               --    --   2
  3    --               --    --   3
  4   F-port  Master     4     4   4
  5   F-port  Slave      4     4   5
```

- If a PID is changed for a WWN flow and the new PID does not match the PID in the flow definition, the active flow will be uninstalled and then reinstalled with the updated PID in the flow definition.

Firmware upgrade and downgrade considerations

There are no restrictions on upgrading the firmware of a switch that has Flow Vision installed. However, downgrading the firmware on a switch with Flow Vision installed will fail if any Flow Vision-related configurations are present on the switch being downgraded. Both user-defined and system-defined flows support the configuration upload and download procedures.

Flow Vision functionality will not be affected if a switch running Fabric OS 7.3.0 is connected to a switch running Fabric OS 7.2.x. Connecting to a switch running any version of Fabric OS earlier than 7.2.0 will disable Flow Vision.

Upgrade considerations

The following items should be taken into consideration when upgrading to Fabric OS 7.3.0:

- When moving a configuration from a switch running Fabric OS 7.2.x to one running 7.3.0, predefined flows will be included automatically when the older configuration is downloaded to a switch running Fabric OS 7.3.0, but they will remain deactivated after download.
- If the in-flight encryption and compression functionality is enabled, then any Flow Mirror flow active before the upgrade will be deactivated after the upgrade and a RASlog entry displayed on the console.

Downgrade considerations

The following items should be taken into consideration when downgrading to a version of Fabric OS earlier than 7.3.0:

- All Flow Vision-related flows or simulation ports must be deleted prior to performing a downgrade to any version of Fabric OS prior to version 7.2.0; if they are not, the downgrade will be blocked and a warning message displayed.
- Flow counts that exceed the supported scalability limits will not be replayed when downgraded or failed over to a version of Fabric OS earlier than 7.3.0.
- Predefined flows will not be replayed, and flow definitions for newly introduced features will not be replayed from the flow configuration.
- Downgrading from Fabric OS 7.3.0 is not allowed if a Flow Mirror flow is active for local flow mirroring (LFM). You must first deactivate any active flow that is using a local mirror port.
- Flows that were created with the following keyword combinations are automatically deactivated.
  - **-bidir** and **-frametype**
  - **-ingrport** and **-frametype**
- Flows created using learning on E_Ports and EX_Ports will not be replayed after the downgrade.
- Flows created using monitor support on XISL ports will not be replayed after the downgrade.
- Flows will be deleted from memory configuration when firmware is downgraded.

High Availability and Flow Vision

High Availability (HA) preserves only the Flow Vision configuration settings through an HA failover, HA reboot, or a power cycle and reboot. It does not save feature-related data (for example, statistics). User-defined or system-defined (predefined) flows will not be restored if failed over to an earlier version of Fabric OS.

If a standby command processor (CP) with a downgrade revision code comes online and any flows (active or non-active) are configured, the HA will be out of sync. If a standby CP with a downgrade revision code comes online and no flows (active or non-active) are configured, HA will be in sync but flow creation will fail.

Refer to the following sections for information on how each feature is treated under HA:

- Flow Monitor and High Availability on page 57
- Flow Generator and High Availability on page 73
- Flow Mirror and High Availability on page 90

Flow Vision integration with MAPS

Statistics generated using Flow Vision can be monitored with the Monitoring and Alerting Policy Suite (MAPS) threshold service.

Refer to the individual features for information on how that feature interacts with MAPS, and the *Monitoring and Alerting Policy Suite Administrator's Guide* for more details on MAPS in general.

Flow Monitor

Overview of Flow Monitor

Flow Monitor enables you to monitor all the traffic passing through E_Ports, EX_Ports, F_Ports, and XISL_Ports using any hardware-supported flow parameters. It also lets you define your own monitoring flows using combinations of ingress and egress ports, source and destination devices, logical unit numbers (LUNs), and frame types to create a flow definition for a specific use case.

Flow Monitor provides support for monitoring the following flows and traffic:

- Learning and static flows for traffic passing through E_Ports and F_Ports
- Learning and static flows monitoring edge-to-edge traffic, edge-to-backbone traffic, and backbone-to-edge traffic passing through EX_Ports
- Learning and static flows monitoring traffic inside logical fabrics and inter-fabric (routed) traffic passing through XISL_Ports
- Learning and static flows monitoring inter-fabric traffic and backbone traffic passing through backbone E_Ports

In Fabric OS 7.1.x and earlier, the Advanced Performance Monitor (APM) provided the following monitors: End-to-End, Frame-based, ISL, and Top Talker. In Fabric OS 7.3.0, Flow Monitor provides you with the following abilities in addition to those provided by the APM monitors:

- Monitoring of application flows (for example, a flow within a fabric from a Host to a Target/LUN) at a given port.
- Comprehensive visibility into application flows in a fabric, including the ability to learn (discover) flows automatically.
- When N_Port ID Virtualization (NPIV) is used on the host, you can monitor VM (Virtual Machine)-to-LUN level performance.
- Capturing statistics for specified flows, which provides insights into application performance. These statistics include transmitted and received frame counts, transmitted and received frame throughput rates, SCSI Read and SCSI Write frame counts, the number of SCSI Reads and Writes per second (IOPS), as well as others.

A sample use case would be to monitor throughput statistics for inbound traffic between a source device and a destination device. Monitoring LUN level statistics on page 52 provides an example of the command and the results for this use case.

- Monitoring of various frame types at a switch port to provide deeper insights into storage I/O access patterns at a LUN, reservation conflicts, and I/O errors. Examples of the frame types that can be monitored include SCSI Aborts, SCSI Read, SCSI Write, SCSI Reserve, all rejected frames, and many others. Refer to Flow frametype parameters on page 19 for a list and description of the frame types that can be monitored.
- The SCSI Read/Write Frame Count and SCSI Read/Write Data statistics are supported only for F_Ports for any flow configuration where either srcdev or dstdev exists on the switch, and the flow is defined using a combination of srcdev, dstdev, ingrport, or egrport (with or without bidir), or a combination of srcdev, dstdev, lun, ingrport, or egrport.
- Integration with the Monitoring and Alerting Policy Suite (MAPS) service to enable threshold-based monitoring and alerting based on flows. Refer to the *Monitoring and Alerting Policy Suite Administrator's Guide* for more information on integration with MAPS.

Replicating APM monitors using Flow Monitor

It is possible to replicate standard Advanced Performance Monitor (APM) functionality using Flow Monitor.

For information on replicating standard APM functionality using Flow Monitor, refer to the following links:

- Creating an end-to-end monitor equivalent on page 55
- Creating a frame monitor equivalent on page 55
- Creating an ingress or egress Top Talker monitor equivalent on page 56
- Creating an end-to-end monitor equivalent on page 55

Creating Flow Monitor flows

To create a Flow Monitor flow, enter the **flow --create** *flowname* **-feature monitor** *parameters* command using the parameters listed in the following table. The figure Frame and port parameters on page 17 illustrates how the frame and port parameters apply to a flow.

TABLE 7 Flow Monitor flow parameter combinations

Parameters	Field names	Description
Port	ingrport egrport	• One field only must be specified • Values must be explicit • Can be an F_Port, E_Port, or EX_Port on a local switch
Frame	srcdev dstdev lun frametype	• At least one field must be specified • Values for srcdev and dstdev can be explicit or "*" ("*" indicates learned flows) • Values for lun and frametype must be explicit
Optional keyword parameters		

TABLE 7 Flow Monitor flow parameter combinations (Continued)

Parameters	Field names	Description
	-bidir	Adding this keyword makes the application monitor traffic in both directions.
	-noactivate	Adding this keyword creates the flow without activating it.
	-noconfig	Adding this keyword creates the flow without saving the flow to the configuration.

Parameter usage exceptions

The following restrictions apply to parameter usage in Flow Monitor flow definitions:

- The **-lun** and **-bidir** parameters cannot be used together in a flow definition.
- Flow Monitor does not support learning flows using the **-frametype**, **-lun**, or **-bidir** parameters.

The following example creates a Flow Monitor flow named “Flow1” that monitors all traffic flowing from device 010403 to device 020504 ingressing through port 10 on the switch on which this command was run.

```
switch:admin> flow --create Flow1 -feature monitor -ingrport 10 -srcdev 010403 -
dstdev 020504
```

When you create a flow, it is automatically activated unless you use the **-noactivate** keyword as part of the **flow --create** command. Refer to Creating an inactive flow in Flow Monitor on page 35 for an example of this option.

ATTENTION
Flow creation is not allowed if Advanced Performance Monitor (APM) or Port Mirroring is enabled. Similarly, APM and Port Mirroring-related operations will not be allowed if any flow (active or defined) is present on the switch.

Creating an inactive flow in Flow Monitor

The reason to create an inactive flow is to have it ready for future use. To create an inactive Flow Monitor flow, enter **flow --create** *flowname* **-feature** *feature_list flow_parameters* **-noactivate**.

The following example creates an inactive Flow Monitor flow named “sflow128” from device 020a00 to device 01c000 ingressing through port 10.

```
switch:admin> flow --create sflow128 -feature mirror -ingrport 10 -srcdev 0x020a00 -
dstdev 0x01c000 -noactivate
```

For information on activating an inactive Flow Monitor flow, refer to Activating Flow Monitor flows on page 36.

Activating Flow Monitor flows

To activate an inactive Flow Monitor flow, enter **flow --activate** *flowname* **-feature monitor**. Activating a flow automatically clears all the flow statistics for that flow.

The following example activates the Flow Monitor flow named “Flow1”:

```
switch:admin> flow --activate Flow1 -feature monitor
```

Automatic activation of a Flow Monitor flow

Flow Monitor automatically activates monitoring flows under the following conditions:

- On flow creation, unless the flow is created using the **-noactivate** keyword.
- On slot power-on, if any of the ports or devices defined in the flow are on the slots being powered on. This assumes that the flow was active when the slots were powered off.
- On a High Availability (HA) failover, HA reboot, or a power cycle, if the flow was active when the event occurred.

Deactivating Flow Monitor flows

You can deactivate Flow Monitor flows without deleting them. This allows you to create and store a “library” of flows that you can activate when needed without having to recreate them every time they are needed.

To deactivate a Flow Monitor flow, enter **flow --deactivate** *flow_name* **-feature monitor**.

NOTE
You can deactivate a single feature even though the flow is defined for multiple features. For example, if a flow had been defined using “-feature monitor,generator”, you can deactivate only the monitoring feature, while leaving the generator feature active.

The following example deactivates the Flow Monitor flow named “Flow1”.

```
switch:admin> flow --deactivate Flow1 -feature monitor
```

Automatic deactivation of a Flow Monitor flow

Flow Vision automatically deactivates Flow Monitor flows and stops monitoring if any of these conditions occur:

- Slot is powered off for the ingress or egress ports defined in the flow.
- Slot is powered off for the source or destination devices defined in the flow.
- The ingress or egress port type changes to anything other than an E_Port, EX_Port, XISL_Port, F_Port, or SIM port for a learned flow ("*"). The flow will not automatically reactivate if the port type is changed back. You must manually reactivate such a flow.
- The ingress or egress port type changes to anything other than an E_Port, EX_Port, XISL_Port, F_Port, or SIM port for a flow that has the lun or frametype value specified. The flow will not automatically reactivate if the port type is changed back. You must manually reactivate such a flow.

Viewing Flow Monitor flows

To display Flow Monitor flows, enter **flow --show** *flowname* **-feature monitor**.

The displayed information includes:

- Frame Statistics: Frame count and rate for the flow-defined frame type
- Throughput Statistics: Word count and throughput (bytes per second)
- I/O Statistics: I/O count, I/O per second, and I/O data transferred on a read/write basis
- Learn Statistics: All learned ("*") flows on a given port and the throughput and frame statistics for each learned flow on 16 GBps-capable Fibre Channel platforms

You can also repeat and sort the output of a Flow Monitor flow. For information on these tasks, refer to Repeating flow output on page 22 and Sorting flow output on page 26.

For illustrations of **flow --show** command output, refer to Flow Monitor examples on page 52.

Learning in Flow Monitor flows

You can apply learning in Flow Monitor flows in order to discover flow traffic. To apply learning to a Flow Monitor flow, you enter an asterisk inside quotation marks ("*") as the parameter value for the parameter to be learned.

The following list outlines the support for learning on various port types:

- F_Ports. Learning and static monitoring is supported.
- E_Ports. Learning and static monitoring is supported.
- EX_Ports. Learning and static monitoring is supported.
- XISL_Ports. Fabric wide learning and static monitoring is supported.
- Backbone E_Ports. Learning and static monitoring is supported.
- Trunked ports. Learning is supported, although statistics will be gathered only on the flow associated with the master port. These statistics are the cumulative total of all the ports on the trunk.

Notes on learning in Flow Monitor flows

The following items apply to learning in Flow Monitor flows:

- Only Gen 5 (16 Gbps-capable) Fibre Channel platforms and 8 Gbps Enhanced blades have the capability to learn flows on a specified port.
- Only one active flow per ASIC can be a learning flow.
- Using two flows to monitor traffic ingressing and egressing on the same ASIC is only supported if both flows are static. If one flow is a learning flow, only the static flow will count frames.
- You can use either a WWN or a PID for the srcdev and dstdev values when creating learning flows for Flow Monitor.

Creating Flow Monitor learning flows

Using learning flows in Flow Monitor allows you to discover flow traffic without having to identify specific devices or ports.

Refer to Monitoring flows using the learning functionality on page 53 to view how to display the data captured using a learning flow.

To create a leaning flow in Flow Monitor, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Enter **flow --create** *flow_name* **-feature monitor** *port_values* , using an asterisk in quotes ("*") for those port and device values you want to be learned.

The following example creates a Flow Monitor learning flow named “ingressTT” ingressing through port 30 (an E_Port).

```
switch:admin> flow --create ingressTT -feature monitor -ingrport 30 -srcdev "*" -
dstdev "*"
```

The following example creates a Flow Monitor learning flow named “ex_lrn_ingr” which captures traffic ingressing through port 219 headed for device 20:13:00:05:33:88:a3:90.

```
switch:admin> flow --create ex_lrn_ingr  -feature monitor -ingrport 219 -srcdev "*" -
dstdev 20:13:00:05:33:88:a3:90
```

Learning Flow creation on offline or slave ports

Flows can be created that specify either an inactive or slave port in their definitions, but activation is controlled not only by the port status, but by available resources and flow count limits.

- When a flow is created on an offline port, the flow is considered inactive until the port comes online. However, the flow would only be installed in the ASIC and made active if the resources are available. If the resources are not available the flow would remain deactivated.
- When a flow is created on a slave port, the flow is considered inactive until the port becomes the master port. However, the flow would only be installed in the ASIC and made active if the resources are available. If the resources are not available, the flow would remain deactivated.

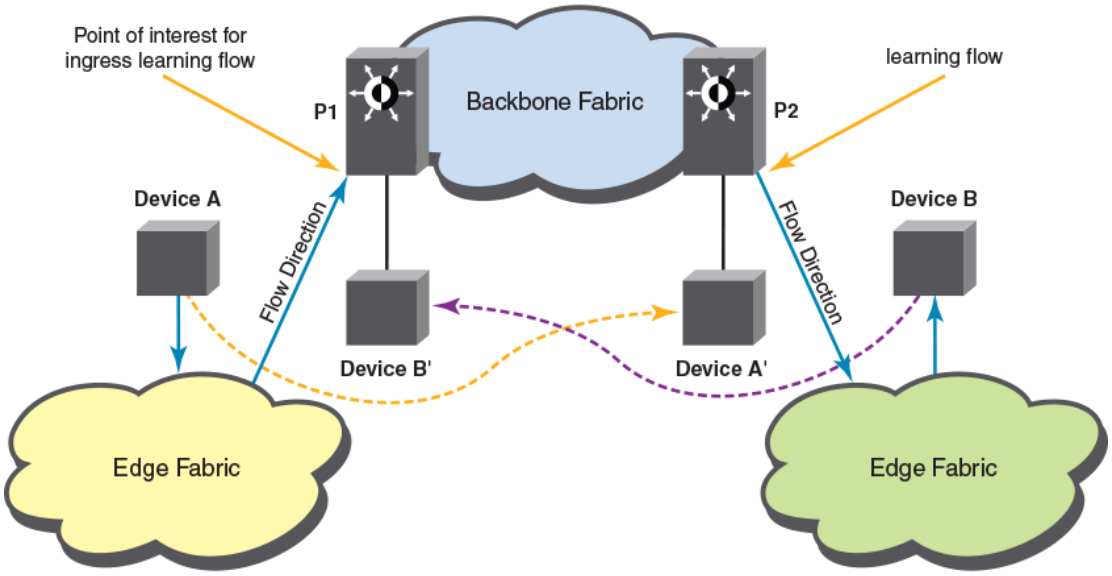
Flow Monitor learning on E_Ports and EX_Ports

Flow Monitor supports learning and monitoring all the traffic passing through both E_Ports and EX_Ports. The captured statistics are similar to the existing learning support provided for F_Ports.

As it is for F_Ports, learning is supported on trunked E_Ports and EX_Ports, and statistics are gathered only on the flow associated with the master port. These statistics are the cumulative total from all of the trunked ports. For this reason, you should create and use the same flow definition for each of the ports in the trunk. You can use either a WWN or a PID value for the srcdev and dstdev identifiers when creating learning flows.

While the source fabric ID to destination fabric ID option is allowed on any E_Port, it is needed only for Backbone E_Ports and the XISL_Ports. If the source fabric ID to destination fabric ID combination is configured on an edge E_Port learning flow, it will display the same source fabric ID to destination fabric ID combination for all learned flows.

FIGURE 2 Learning support in a Fibre Channel Routing fabric



The fixed parameters of a learning flow on an E_Port or an EX_Port should use the following combinations when defining flows using specific ingress or egress ports:

- For flows using an ingress port (ingrport), the real source ID of the source device and the proxy ID of the destination device.
- For flows using an egress port (egrport), the proxy ID of the source device and the real destination ID of the destination device.

The **flow --show** output for an E_Port or an EX_Port will use the flow definition; in this output the proxy ID of the destination device will be reported for flows defined using the ingress port, and the proxy ID of the source device will be reported for flows defined using the egress port.

Monitoring flows using the learning functionality on page 53 provides examples of both the flow command and the flow output.

Configuring Flow Monitor for a trunk group

Flow Monitor supports monitoring trunk ports subject to the following conditions:

- You must create the same flow on all trunk member ports.
- If you create a flow on a slave port without using the **-noactivate** keyword with the **flow** command, this flow is then automatically activated when the slave port becomes the master port.
- After a switch initialization or a recovery (cold or warm), existing flows are re-created on both master and slave ports, but only those flows associated with the master port are activated.

To configure Flow Monitor on a trunk group, use the following steps.

1. Identify your trunk group members using the **switchshow** command.
2. Create individual flow monitors for each member of the trunk group using the **flow -create** command.

NOTE
You cannot create a learned flow in a trunk group.

3. Enter **flow --show** *flow_name* **-feature monitor** to view the Flow Monitor statistical data for the entire trunk group.

NOTE
The accumulated Flow Monitor statistical data for the entire trunk group is stored on the master port. If the master port changes, the data is transferred to the new master port. To view this data, you must run the **flow --show** command on a flow that is defined using the master port. Flow statistics are not displayed for slave trunk ports.

The following example displays the trunked ports and then creates four flows, one for each member of the trunk group identified by the **switchshow** command.

```
switch:admin> switchshow

24  24  021800  id  N16  Online  FC E-Port 10:00:00:05:33:e5:3c:d4 "Odin" (downstream)(Trunk master)
25 25 021900 id  N16  Online FC E-Port (Trunk port, master is Port 24)
26 26 021a00 id  N16  Online FC E-Port (Trunk port, master is Port 24)
27 27 021b00 id  N16  Online FC E-Port (Trunk port, master is Port 24)

switch:admin> flow -create f1 -feature monitor -egrport 24 -srcdev 022b00 -dstdev 033a00
switch:admin> flow -create f2 -feature monitor -egrport 25 -srcdev 022b00 -dstdev 033a00
switch:admin> flow -create f3 -feature monitor -egrport 26 -srcdev 022b00 -dstdev 033a00
switch:admin> flow -create f4 -feature monitor -egrport 27 -srcdev 022b00 -dstdev 033a00
```

Monitoring Fibre Channel routed fabrics

When you are monitoring Fibre Channel-routed fabrics, you should keep the following points in mind:

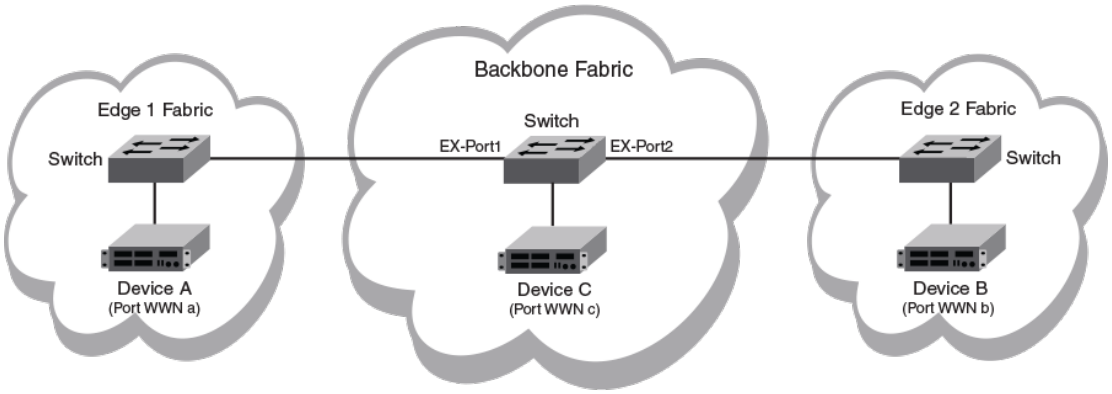
- When monitoring a FC-routed fabric, you may find it simpler to use port WWNs rather than proxy IDs in your flow definitions. This is because you do not need to locate and map the proxy IDs for the actual source and destination devices.
- When creating flow monitors on EX_Ports, you can use either a WWN or a Fibre Channel ID (FCID) for the source device (srcdev) and destination device (dstdev).
- Inter-Fabric Link (IFL) flows can be monitored only on 16 Gbps-capable EX_Ports in a Fibre Channel router.
- IFL flows are not supported on E_Ports or F_Ports.
- Even though a flow definition is always created in the backbone fabric, the perspective of the flow is from the edge fabric.

Monitoring FC router fabrics using port WWNs

The following figures and their descriptions illustrate how port IDs are assigned in Fibre Channel router fabrics using World Wide Names (WWNs). Use the **flow --control -deviceidmode wwn** command to set the mode to WWN.

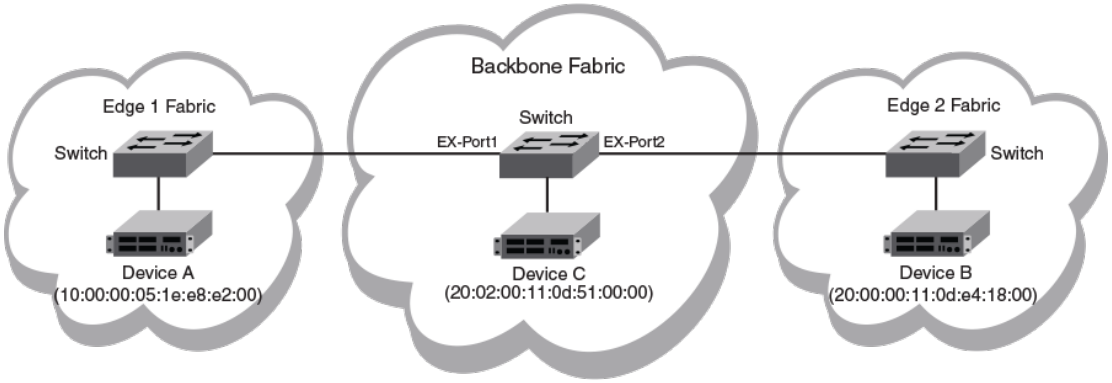
The following figure identifies the physical devices as A, B, and C, and shows that they have the port WWNs a, b, and c, respectively.

FIGURE 3 A Fibre Channel router fabric



The following figure provides the port WWN values for the physical devices and port WWNs.

FIGURE 4 A Fibre Channel router fabric annotated with port WWN values



Monitoring an edge-to-edge flow through an ingress port identified by a WWN

In a network set up as shown in Figure 4 on page 41, for a flow passing from Device A to Device B that is ingressing through EX_Port1, the source device (srcdev) is port “WWN a”, the destination device (dstdev) is port “WWN b”, and the ingress port (ingrport) is EX_Port1. (Traffic is running from right to left, and the flow definitions are based on the Edge 1 Fabric’s perspective.)

The following example creates a flow that filters frames passing from one edge fabric to another edge fabric using a specific ingress port on the backbone. The first command shows the available ports and the available Fibre Channel routers. The second command creates a Flow Monitor flow named “e2e_src_dcx_wwn” between device 10:00:00:05:1e:e8:e2:00 and device 20:00:00:11:0d:e4:18:00 ingressing through port 219, and the last command displays the results of the flow.

NOTE
The slash character (\) in the example indicates a break inserted because the output is too long to display here as a single line.

```
DCX_Backbone128:admin> switchshow |grep Port

Index Slot  Port Address Media  Speed  State  Proto
  37    3     5   012500   id   N16    Online FC EX-Port 10:00:00:05:33:ef:f1:1c \
  47    3    15   012f00   id   N8     Online FC F-Port  20:02:00:11:0d:51:00:00 \
```

```
 219   10   27   01db00   id   N16    Online FC EX-Port 10:00:00:05:33:ee:d0:a5 \
                                            E-Port  50:00:51:e4:91:9e:0f:28 \
\ "Wasp_e2" (fabric id=50)(Trunk master)
\
\ "Gnat_e1" (fabric id=100)(Trunk master)
\ "fcr_xd_2_100"

DCX_Backbone128:admin> flow --create e2e_src_dcx_wwn -feature monitor -ingrport 219
-srcdev 10:00:00:05:1e:e8:e2:00 -dstdev 20:00:00:11:0d:e4:18:00

DCX_Backbone128:admin>flow --show
------------------------------------------------------------------------------------------ \
      Flow Name     |    Feature    |         SrcDev          |          DstDev        | \
------------------------------------------------------------------------------------------ \
e2e_src_dcx_wwn     |mon+           |10:00:00:05:1e:e8:e2:00  |20:00:00:11:0d:e4:18:00 | \
------------------------------------------------------------------------------------------ \

\ ------------------------------------
\ IngrPt|EgrPt |BiDir| LUN  |FrameType|
\ ------------------------------------
\ 219   |-     |no   |-     |-        |
\ ------------------------------------
\   + Denotes feature is currently activated for the flow

DCX_Backbone128:admin> flow --show e2e_src_dcx_wwn -feature monitor
================================================================
Name      : e2e_src_dcx_wwn   Features: mon(Active) noConfig: Off
Definition: IngrPort(219),SrcDev(10:00:00:05:1e:e8:e2:00),
DstDev(20:00:00:11:0d:e4:18:00)

Flow Monitor (Activated):
Monitor time:  | Mon Jun 17 14:59:58 UTC 2013 |
----------------------------------------------------------------

-------------------------------------------------------------------------------------------------------
| Rx Frames Count | Rx Frames per Sec. |  Rx Bytes Count | Rx Throughput(Bps) | Avg Rx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------------
|       2.85G     |         8.44M      |     387.88G     |         1.12G      |         132         |
-------------------------------------------------------------------------------------------------------
```

Monitoring an edge-to-edge flow through an egress port identified by a WWN

In a network set up as shown in Figure 4 on page 41, for a flow passing from Device B to Device A that is egressing through EX_Port1, the source device (srcdev) is port “WWN b”, the destination device (dstdev) is port “WWN a”, and the egress port (egrport) is EX_Port1. (Traffic is running from right to left, and the flow definitions are based on the Edge 1 Fabric’s perspective.)

The following example creates a flow that filters out frames passing from one edge fabric to another edge fabric using a specific egress port on the backbone. The first command shows the available ports and the available Fibre Channel routers. The second command creates a Flow Monitor flow named “e2e_dst_dcx” between device 20:00:00:11:0d:e4:18:00 and device 10:00:00:05:1e:e8:e2:00 egressing through port 219, and the last command displays the results of the flow.

NOTE
The slash character (\) in the example indicates a break inserted because the output is too long to display here as a single line.

```
DCX_Backbone128:admin> switchshow |grep Port
Index Slot Port Address Media  Speed      State      Proto
37    3    5    012500   id     N16       Online     FC EX-Port 10:00:00:05:33:ef:f1:1c \
47    3   15    012f00   id     N8        Online     FC F-Port  20:02:00:11:0d:51:00:00 \
219   10  27    01db00   id     N16       Online     FC EX-Port 10:00:00:05:33:ee:d0:a5 \
                                                       E-Port  50:00:51:e4:91:9e:0f:28 \

\ "Wasp_e2" (fabric id=50)(Trunk master)
\
\ "Gnat_e1" (fabric id=100)(Trunk master)
\ "fcr_xd_2_100"

DCX_Backbone128:admin> flow --create e2e_dst_dcx -feature monitor -egrport 219
```

```
-srcdev 20:00:00:11:0d:e4:18:00 -dstdev 10:00:00:05:1e:e8:e2:00

DCX_Backbone128:admin> flow --show
------------------------------------------------------------------------------- \
   Flow Name  |  Feature  |       SrcDev          |        DstDev          | \
------------------------------------------------------------------------------- \
e2e_dst_dcx   |mon+       |20:00:00:11:0d:e4:18:00 |10:00:00:05:1e:e8:e2:00 | \
------------------------------------------------------------------------------- \
\ ---------------------------------------
\ |IngrPt|EgrPt |BiDir|LUN    |FrameType|
\ ---------------------------------------
\ |-     |219   |no   |-      |-        |
\ ---------------------------------------
\   + Denotes feature is currently activated for the flow

DCX_Backbone128:admin> flow --show e2e_dst_dcx -feature monitor
================================================================================
Name      : e2e_dst_dcx   Features: mon(Active) noConfig: Off
Definition: EgrPort(219),SrcDev(20:00:00:11:0d:e4:18:00),
DstDev(10:00:00:05:1e:e8:e2:00)

Flow Monitor (Activated):
Monitor time:  | Mon Jun 17 14:59:58 UTC 2013 |
-------------------------------------------------------
-------------------------------------------------------------------------------------------------
| Tx Frames Count| Tx Frames per Sec.| Tx Bytes Count| Tx Throughput(Bps)| Avg Tx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------
|       2.85G    |         8.44M     |    387.88G    |         1.12G     |          132        |
-------------------------------------------------------------------------------------------------
```

Monitoring a backbone-to-edge flow identified by WWNs

In a network set up as shown in Figure 4 on page 41, for a flow passing from Device C to Device A that is egressing through EX_Port1, the source device (srcdev) is port “WWN c”, the destination device (dstdev) is port “WWN a”, and the egress port (egrport) is EX_Port1. (Traffic is running from right to left, and the flow definitions are based on the Edge 1 Fabric’s perspective.)

The following example creates a flow that filters out frames passing from the backbone fabric to an edge fabric using a specific egress port. The first command shows the available ports and the available Fibre Channel routers. The second command creates a Flow Monitor flow named “b2e_dst_dcx” between device 20:02:00:11:0d:51:00:00 and device 10:00:00:05:1e:e8:e2:00 egressing through port 219, and the last command displays the results of the flow.

NOTE
The slash character (\) in the example indicates a break inserted because the output is too long to display here as a single line.

```
DCX_Backbone128:admin> switchshow |grep Port
Index Slot Port Address Media  Speed      State      Proto
37    3    5    012500   id     N16       Online     FC EX-Port 10:00:00:05:33:ef:f1:1c \
47    3   15    012f00   id     N8        Online     FC F-Port  20:02:00:11:0d:51:00:00 \
219   10  27    01db00   id     N16       Online     FC EX-Port 10:00:00:05:33:ee:d0:a5 \
                                                       E-Port  50:00:51:e4:91:9e:0f:28 \

\ "Wasp_e2" (fabric id=50)(Trunk master)
\
\ "Gnat_e1" (fabric id=100)(Trunk master)
\ "fcr_xd_2_100"

DCX_Backbone128:admin> flow --create b2e_dst_dcx -feature monitor -egrport 219
-srcdev 20:02:00:11:0d:51:00:00 -dstdev 10:00:00:05:1e:e8:e2:00

DCX_Backbone128:admin> flow --show
------------------------------------------------------------------------------- \
  Flow Name  |  Feature  |     SrcDev             |      DstDev            | \
------------------------------------------------------------------------------- \
b2e_dst_dcx  |mon+       |20:02:00:11:0d:51:00:00 |10:00:00:05:1e:e8:e2:00 | \
------------------------------------------------------------------------------- \
\ ---------------------------------------
\ |IngrPt|EgrPt|BiDir| LUN   | FrameType|
```

```
\ ------------------------------------
\ |-     |219  |no   |-     |-         |
\ ------------------------------------
  + Denotes feature is currently activated for the flow

DCX_Backbone128:admin> flow --show b2e_dst_dcx -feature monitor
================================================================================
Name      : b2e_dst_dcx   Features: mon(Active) noConfig: Off
Definition: EgrPort(219),SrcDev(20:02:00:11:0d:51:00:00),
DstDev(10:00:00:05:1e:e8:e2:00)

Flow Monitor (Activated):
Monitor time:  | Mon Jul 17 15:59:58 UTC 2013 |
-----------------------------------------------------
-------------------------------------------------------------------------------------------------
| Tx Frames Count| Tx Frames per Sec.| Tx Bytes Count| Tx Throughput(Bps)| Avg Tx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------
|     142.93M    |    3.74M          |    26.97G     |       724.78M     |          204        |
-------------------------------------------------------------------------------------------------
```

Monitoring an edge-to-backbone flow identified by WWNs

In a network set up as shown in Figure 4 on page 41, for a flow passing from Device A to Device C that is ingressing through EX_Port1, the source device (srcdev) is port “WWN a”, the destination device (dstdev) is port “WWN c”, and the ingress port (ingrport) is EX_Port1. (Traffic is running from right to left, and the flow definitions are based on the Edge 1 Fabric’s perspective.)

The following example creates a flow that filters out frames passing from an edge fabric to the backbone fabric using a specific ingress port. The first command shows the available ports and the available Fibre Channel routers. The second command creates a Flow Monitor flow named “e2b_src_dcx” between device 10:00:00:05:1e:e8:e2:00 and device 20:02:00:11:0d:51:00:00 egressing through port 219, and the last command displays the results of the flow.

NOTE
The slash character (\) in the example indicates a break inserted because the output is too long to display here as a single line.

```
DCX_Backbone128:admin> switchshow |grep Port
Index Slot Port Address Media  Speed     State       Proto                          \
37    3    5    012500  id     N16       Online      FC EX-Port 10:00:00:05:33:ef:f1:1c \
47    3   15    012f00  id     N8        Online      FC F-Port  20:02:00:11:0d:51:00:00 \
219   10  27    01db00  id     N16       Online      FC EX-Port 10:00:00:05:33:ee:d0:a5 \
                                                       E-Port  50:00:51:e4:91:9e:0f:28 \
\
\ "Wasp_e2" (fabric id=50)(Trunk master)
\
\ "Gnat_e1" (fabric id=100)(Trunk master)
\ "fcr_xd_2_100"

DCX_Backbone128:admin> flow --create e2b_src_dcx -feature monitor -ingrport 219
-srcdev 10:00:00:05:1e:e8:e2:00 -dstdev 20:02:00:11:0d:51:00:00

DCX_Backbone128:admin>flow --show
------------------------------------------------------------------------------ \
  Flow Name   | Feature  |     SrcDev             |      DstDev             | \
------------------------------------------------------------------------------ \
e2b_src_dcx   |mon+      |10:00:00:05:1e:e8:e2:00 |20:02:00:11:0d:51:00:00 | \
------------------------------------------------------------------------------ \
\ ------------------------------------
\ |IngrPt|EgrPt|BiDir| LUN  |FrameType |
\ ------------------------------------
\ |219   |-    |no   |-     |-         |
\ ------------------------------------
     + Denotes feature is currently activated for the flow

DCX_Backbone128:admin> flow --show e2b_src_dcx -feature monitor
================================================================================
Name: e2b_src_dcx  Features: mon(Active) noConfig: Off
Definition: IngrPort(219),SrcDev(10:00:00:05:1e:e8:e2:00),
DstDev(20:02:00:11:0d:51:00:00)
```

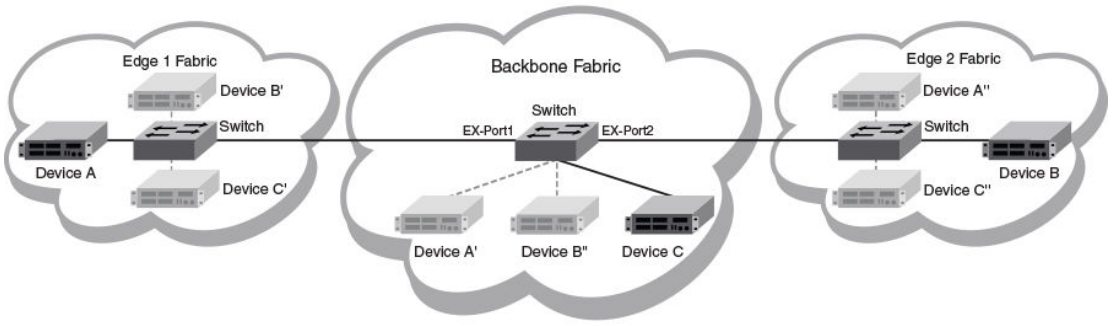
```
Flow Monitor (Activated):
Monitor time:  | Mon Jul 17 15:59:58 UTC 2013 |
-------------------------------------------------------
-------------------------------------------------------------------------------------------------
| Rx Frames Count| Rx Frames per Sec.| Rx Bytes Count| Rx Throughput(Bps)| Avg Rx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------
|     142.93M    |        3.74M      |    26.97G     |    724.78M        |          204        |
-------------------------------------------------------------------------------------------------
```

Monitoring Fibre Channel router fabrics using proxy IDs

The following figures and their descriptions illustrate how port IDs (PIDs) are assigned in Fibre Channel router fabrics using proxy IDs. Use the **flow --control -deviceidmode pid** command to set the mode to PID mode.

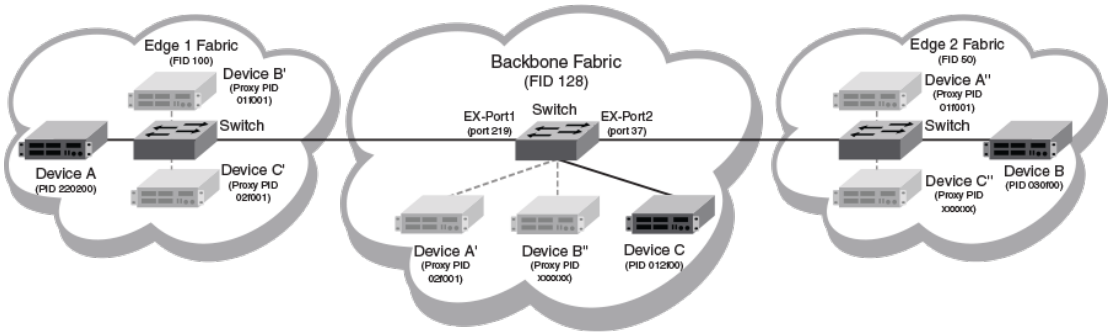
In the following figure, the physical devices are labeled A, B, and C. The proxy devices are the devices labeled A′, B′, C′, A″, B″, and C″, representing the physical devices A, B, and C, respectively.

FIGURE 5 An FC router fabric



The following figure provides the port ID, fabric ID, and proxy port ID values for the following examples.

FIGURE 6 An FC router fabric annotated with PID, FID, and proxy PID values



NOTE
The proxy port ID values for devices B″ and C″ were not generated for the examples, and so are marked “xxxxxx” in this figure.

Monitoring an edge-to-edge flow through an ingress port identified by a proxy ID

In a network set up as shown in Figure 6 on page 45, for a flow passing from Device A to Device B that is ingressing through EX_Port1, the source device (srcdev) is Device A, the destination device (dstdev) is Device B′, and the ingress port (ingrport) is EX_Port1. (Traffic is running from left to right, and the flow definitions are based on the Edge 1 Fabric's perspective.)

The following example creates a flow that filters frames passing from one edge fabric to another edge fabric using a specific ingress port on the backbone. Notice that this is running in port WWN (portwwn) mode rather than device ID (deviceid) mode. The first two commands show the available ports and the available Fibre Channel routers. The third command creates a Flow Monitor flow named "e2e_src_dcx_wwn" between device 220200 and device 01f001 ingressing through port 219, and the last command displays the results of the flow.

NOTE
The slash character (\) in the example indicates a break inserted because the output is too long to display here as a single line.

```
DCX_Backbone128:admin> switchshow |grep Port
 Index Slot Port Address Media  Speed     State    Proto                          \
  37    3    5   012500   id    N16       Online   FC EX-Port 10:00:00:05:33:ef:f1:1c \
  47    3   15   012f00   id    N8        Online   FC F-Port  20:02:00:11:0d:51:00:00 \
 219   10   27   01db00   id    N16       Online   FC EX-Port 10:00:00:05:33:ee:d0:a5 \
                                                     E-Port  50:00:51:e4:91:9e:0f:28 \
\
\"Wasp_e2" (fabric id=50)(Trunk master)
\
\"Gnat_e1" (fabric id=100)(Trunk master)
\"fcr_xd_2_100"

DCX_Backbone128:admin> fcrproxydevshow

  Proxy           WWN             Proxy      Device   Physical    State
 Created                           PID       Exists     PID
in Fabric                                   in Fabric
-------------------------------------------------------------------------
    50   10:00:00:05:1e:e8:e2:00  01f001      100      220200   Imported
   100   20:00:00:11:0d:e4:18:00  01f001       50      030f00   Imported
   100   20:02:00:11:0d:51:00:00  02f001      128      012f00   Imported
   128   10:00:00:05:1e:e8:e2:00  02f001      100      220200   Imported
Total devices displayed: 4

DCX_Backbone128:admin> flow --create e2e_src_dcx_wwn -feature monitor -ingrport 219
-srcdev 220200 -dstdev 01f001

DCX_Backbone128:admin> flow --show
------------------------------------------------------------------------ \
      Flow Name   |   Feature   |       SrcDev      |        DstDev       \
------------------------------------------------------------------------ \
e2e_src_dcx_wwn   |mon+         |220200             |01f001               \
------------------------------------------------------------------------ \

\ --------------------------------------
\ |IngrPt|EgrPt|BiDir| LUN  | FrameType|
\ --------------------------------------
\ |219   |-    |no   |-     |-         |
\ --------------------------------------
    + Denotes feature is currently activated for the flow

DCX_Backbone128:admin> flow --show e2e_src_dcx_wwn -feature monitor

========================================================================
Name      : e2e_src_dcx_wwn   Features: mon(Active) noConfig: Off
Definition: IngrPort(219),SrcDev(220200),DstDev(01f001)

Flow Monitor (Activated):
Monitor time:  | Mon Jun 17 14:59:58 UTC 2013 |
-----------------------------------------------------
-------------------------------------------------------------------------------------------------
| Rx Frames Count| Rx Frames per Sec.|  Rx Bytes Count| Rx Throughput(Bps)| Avg Rx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------
```

```
|       2.85G    |          8.44M    |     387.88G    |         1.12G     |              132    |
-------------------------------------------------------------------------------------------
```

Monitoring an edge-to-edge flow through an egress port identified by a proxy ID

In a network set up as shown in Figure 6 on page 45, for a flow passing from Device B to Device A that is egressing through EX_Port1, the source device (srcdev) is Device B′, the destination device (dstdev) is Device A, and the egress port (egrport) is EX_Port1. (Traffic is running from left to right.)

The following example creates a flow that filters out frames passing from one edge fabric to another edge fabric using a specific egress port on the backbone. The first two commands show the available ports and the available Fibre Channel routers. The third command creates a Flow Monitor flow named “e2e_dst_dcx” between device 01f001 and device 220200 egressing through port 219, and the last command displays the results of the flow.

NOTE
The slash character (\) in the example indicates a break inserted because the output is too long to display here as a single line.

```
DCX_Backbone128:admin> switchshow |grep Port
Index Slot Port Address Media  Speed     State     Proto                              \
37    3    5    012500   id    N16       Online    FC EX-Port 10:00:00:05:33:ef:f1:1c \
47    3   15    012f00   id    N8        Online    FC F-Port  20:02:00:11:0d:51:00:00 \
219   10  27    01db00   id    N16       Online    FC EX-Port 10:00:00:05:33:ee:d0:a5 \
                                                      E-Port  50:00:51:e4:91:9e:0f:28 \
\
\ "Wasp_e2" (fabric id=50)(Trunk master)
\
\ "Gnat_e1" (fabric id=100)(Trunk master)
\ "fcr_xd_2_100"

DCX_Backbone128:admin> fcrproxydevshow

  Proxy           WWN             Proxy      Device   Physical    State
 Created                           PID       Exists     PID
in Fabric                                   in Fabric
-------------------------------------------------------------------------
    50   10:00:00:05:1e:e8:e2:00  01f001      100      220200   Imported
   100   20:00:00:11:0d:e4:18:00  01f001       50      030f00   Imported
   100   20:02:00:11:0d:51:00:00  02f001      128      012f00   Imported
   128   10:00:00:05:1e:e8:e2:00  02f001      100      220200   Imported
Total devices displayed: 4

DCX_Backbone128:admin> flow --create e2e_dst_dcx -feature monitor -egrport 219
-srcdev 01f001 -dstdev 220200

DCX_Backbone128:admin>flow --show
------------------------------------------------------------------------ \
   Flow Name      |  Feature  |       SrcDev      |        DstDev         \
------------------------------------------------------------------------ \
e2e_dst_dcx       |mon+       |01f001             |220200                 \
------------------------------------------------------------------------ \

\ ---------------------------------------
\ |IngrPt|EgrPt|BiDir| LUN  | FrameType|
\ ---------------------------------------
\ |-     |219  |no   |-     |-         |
\ ---------------------------------------
     + Denotes feature is currently activated for the flow

DCX_Backbone128:admin> flow --show e2e_dst_dcx -feature monitor

========================================================================
Name      : e2e_dst_dcx   Features: mon(Active) noConfig: Off
Definition: EgrPort(219),SrcDev(0x01f001),DstDev(0x220200)

Flow Monitor (Activated):
Monitor time:  | Mon Jun 17 14:59:58 UTC 2013 |
-------------------------------------------------------
-------------------------------------------------------------------------------------------
```

```
| Tx Frames Count| Tx Frames per Sec.| Tx Bytes Count| Tx Throughput(Bps)| Avg Tx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------
|       2.85G     |         8.44M      |     387.88G     |         1.12G |          132        |
-------------------------------------------------------------------------------------------
```

Monitoring a backbone-to-edge flow identified by proxy IDs

In a network set up as shown in Figure 6 on page 45, for a flow passing from Device C to Device A that is egressing through EX_Port1, the source device (srcdev) is Device C′, the destination device (dstdev) is Device A, and the egress port (egrport) is EX_Port1. (Traffic is running from left to right, and the flow definitions are based on the Edge 1 Fabric's perspective.)

The following example creates a flow that filters out frames passing from the backbone fabric to an edge fabric using a specific egress port. The first two commands show the available ports and the available Fibre Channel routers. The third command creates a Flow Monitor flow named "b2e_dst_dcx" between device 02f001 and device 220200 egressing through port 219, and the last command displays the results of the flow.

NOTE
The slash character (\) in the example indicates a break inserted because the output is too long to display here as a single line.

```
DCX_Backbone128:admin> switchshow |grep Port
Index Slot Port Address Media  Speed      State       Proto                              \
37    3    5    012500   id     N16       Online      FC EX-Port 10:00:00:05:33:ef:f1:1c \
47    3   15    012f00   id     N8        Online      FC EX-Port 10:00:00:05:33:ef:f1:1c \
219   10  27    01db00   id     N16       Online      FC F-Port  20:02:00:11:0d:51:00:00 \
                                                     FC EX-Port 10:00:00:05:33:ee:d0:a5 \
                                                     E-Port  50:00:51:e4:91:9e:0f:28    \
\
\ "Wasp_e2" (fabric id=50)(Trunk master)
\ "Wasp_e2" (fabric id=50)(Trunk master)
\ "Gnat_e1" (fabric id=100)(Trunk master)
\ "fcr_xd_2_100"

DCX_Backbone128:admin> fcrproxydevshow
  Proxy           WWN             Proxy      Device   Physical    State
 Created                           PID       Exists     PID
in Fabric                                   in Fabric
-------------------------------------------------------------------------
    50   10:00:00:05:1e:e8:e2:00  01f001      100      220200   Imported
   100   20:00:00:11:0d:e4:18:00  01f001       50      030f00   Imported
   100   20:02:00:11:0d:51:00:00  02f001      128      012f00   Imported
   128   10:00:00:05:1e:e8:e2:00  02f001      100      220200   Imported
Total devices displayed: 4

DCX_Backbone128:admin> flow --create b2e_dst_dcx -feature monitor
-egrport 219 -srcdev 02f001 -dstdev 220200

DCX_Backbone128:admin> flow --show
------------------------------------------------------------------------ \
  Flow Name       |  Feature     |     SrcDev        |      DstDev        \
------------------------------------------------------------------------ \
b2e_dst_dcx       |mon+          |02f001             |220200              \
------------------------------------------------------------------------ \
\ ---------------------------------------
\ |IngrPt|EgrPt|BiDir| LUN  | FrameType|
\ ---------------------------------------
\ |-     |219  |no   |-     |-         |
\ ---------------------------------------
    + Denotes feature is currently activated for the flow

DCX_Backbone128:admin> flow --show b2e_dst_dcx -feature monitor
========================================================================
Name      : b2e_dst_dcx   Features: mon(Active) noConfig: Off
Definition: EgrPort(219),SrcDev(0x02f001),DstDev(0x220200)
Flow Monitor (Activated):
Monitor time:  | Mon Jul 17 15:59:58 UTC 2013 |
-----------------------------------------------------
-------------------------------------------------------------------------------------------
```

```
| Tx Frames Count| Tx Frames per Sec.| Tx Bytes Count| Tx Throughput(Bps)|Avg Tx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------
|    142.93M     |    3.74M          |     26.97G    |    724.78M        |       204          |
-------------------------------------------------------------------------------------------
```

Monitoring an edge-to-backbone flow identified by proxy IDs

In a network set up as shown in Figure 6 on page 45, for a flow passing from Device A to Device C that is ingressing through EX_Port1, the source device (srcdev) is Device A, the destination device (dstdev) is Device C′, and the ingress port (ingrport) is EX_Port1. (Traffic is running from left to right, and the flow definitions are based on the Edge 1 Fabric's perspective.)

The following example creates a flow that filters out frames passing from an edge fabric to the backbone fabric using a specific ingress port. The first two commands show the available ports and the available Fibre Channel routers. The third command creates a Flow Monitor flow named "e2b_src_dcx" between device 220200 and device 02f001 egressing through port 219, and the last command displays the results of the flow.

NOTE
The slash character (\) in the example indicates a break inserted because the output is too long to display here as a single line.

```
DCX_Backbone128:admin> switchshow |grep Port
Index Slot Port Address  Media  Speed     State      Proto                              \
37    3    5    012500   id     N16       Online     FC EX-Port 10:00:00:05:33:ef:f1:1c \
47    3   15    012f00   id     N8        Online     FC F-Port  20:02:00:11:0d:51:00:00 \
219   10  27    01db00   id     N16       Online     FC EX-Port 10:00:00:05:33:ee:d0:a5 \
                                                       E-Port  50:00:51:e4:91:9e:0f:28 \
\
\ "Wasp_e2" (fabric id=50)(Trunk master)
\
\ "Gnat_e1" (fabric id=100)(Trunk master)
\ "fcr_xd_2_100"

DCX_Backbone128:admin> fcrproxydevshow
  Proxy           WWN             Proxy      Device   Physical    State
 Created                           PID       Exists     PID
in Fabric                                   in Fabric
-------------------------------------------------------------------------
    50   10:00:00:05:1e:e8:e2:00  01f001      100      220200   Imported
   100   20:00:00:11:0d:e4:18:00  01f001       50      030f00   Imported
   100   20:02:00:11:0d:51:00:00  02f001      128      012f00   Imported
   128   10:00:00:05:1e:e8:e2:00  02f001      100      220200   Imported
Total devices displayed: 4

DCX_Backbone128:admin> flow --create e2b_src_dcx -feature monitor -ingrport 219
-srcdev 220200 -dstdev 02f001

DCX_Backbone128:admin> flow --show
------------------------------------------------------------------------ \
  Flow Name      |  Feature       |     SrcDev         |      DstDev      \
------------------------------------------------------------------------ \
e2b_src_dcx      |mon+            |220200              |02f001            \
------------------------------------------------------------------------ \

\ ----------------------------------------
\ |IngrPt|EgrPt|BiDir| LUN  | FrameType|
\ ----------------------------------------
\ |219   |-    |no   |-     |-         |
\ ----------------------------------------
    + Denotes feature is currently activated for the flow

DCX_Backbone128:admin> flow --show e2b_src_dcx -feature monitor

========================================================================
Name: e2b_src_dcx  Features: mon(Active) noConfig: Off
Definition: IngrPort(219),SrcDev(0x220200),DstDev(0x02f001)
Flow Monitor (Activated):
Monitor time:  | Mon Jul 17 15:59:58 UTC 2013 |
-----------------------------------------------------------
```

```
-------------------------------------------------------------------------------------------------
| Rx Frames Count| Rx Frames per Sec.| Rx Bytes Count| Rx Throughput(Bps)| Avg Rx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------
|     142.93M     |   3.74M          |    26.97G     |     724.78M       |          204         |
-------------------------------------------------------------------------------------------------
```

XISL and Backbone E_Port monitoring

Flow Monitor provides support for both learning and static monitoring of fabric-wide statistics on both XISL_Ports and Backbone E_Ports.

Output created using the **flow --show** command for a flow using an XISL_Port or a Backbone E_Port displays actual device PIDs and the edge fabric FIDs for Edge-to-Edge traffic, and PIDs with reference to the backbone fabric and backbone fabric FID for Edge to Backbone traffic. You can use this data to estimate the logical fabric or inter-fabric utilization of an XISL_Port or a Backbone E_Port, as shown in the following figures.

The following restrictions apply to XISL and Backbone E_Port monitoring:

- IFL flows cannot be monitored if the source fabric ID and destination fabric IDs are not specified. If these are not specified, the devices will not be known in the backbone fabric and the flow will be treated as a flow with end devices “offline”.
- Flows without the source fabric ID and destination fabric IDs specified will work only for flows on the same fabric. IFL traffic will not be monitored (except in the case of Backbone-to-Edge flows, where the flow is deemed to be in same fabric).
- Only the combinations specified in the following table can be configured.

TABLE 8 XISL and Backbone E_Port monitoring combinations

Srcdev	Dstdev	SFID	DFID	Port	Description
Not specified	Not specified	Fixed	Fixed	Ingress or Egress	This combination monitors frame statistics for traffic using the specified port from the specified SFID to the specified DFID.
Not specified	Not specified	*	*	Ingress or Egress	This combination monitors frame statistics on the specified port for traffic from all SFIDs to all DFIDs.
*	*	*	*	Ingress or Egress	This combination monitors frame statistics on the specified port for traffic from all SFIDs to all DFIDs, and records the device IDs associated with the traffic.

FIGURE 7 Monitoring fabric statistics on an XISL_Port

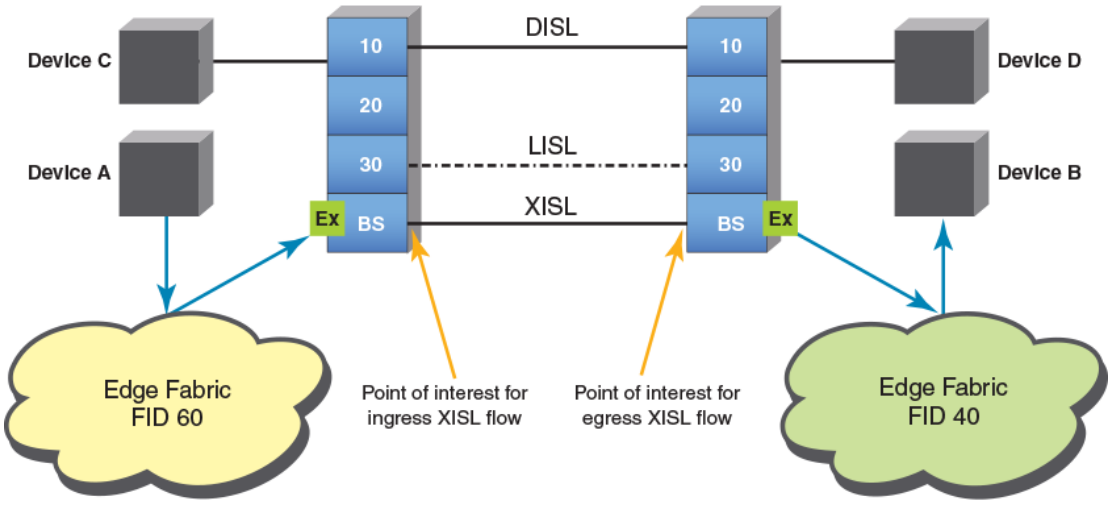
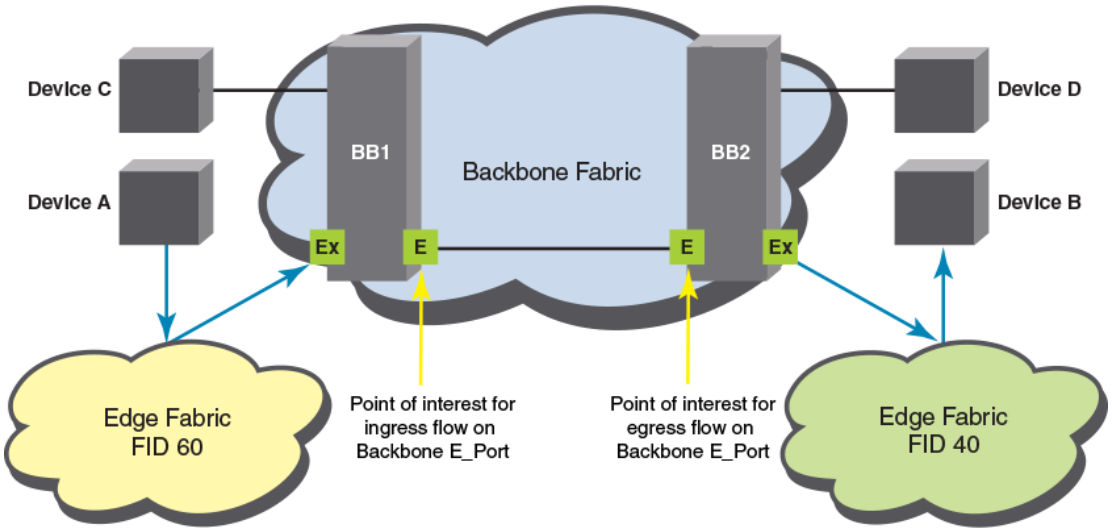


TABLE 9 Learning support for XISL_Ports and Backbone E_Ports

Learned traffic	Backbone E_Ports	XISL_Ports
Intra-fabric traffic	Only Backbone fabric traffic is learned.	Logical fabric traffic is learned.
Inter-fabric traffic	Edge-to-edge, Backbone-to-edge, and edge-to-Backbone traffic is learned.	Edge-to-edge traffic only is learned.

The following figure shows fabric-based monitoring on a Backbone E_Port between BB1 and BB2.

FIGURE 8 Fabric-based monitoring on a Backbone E_Port



Refer to XISL_Port or Backbone E_Port flow examples on page 54 to see examples of the flow creation and output for this type of flow.

Flow Monitor examples

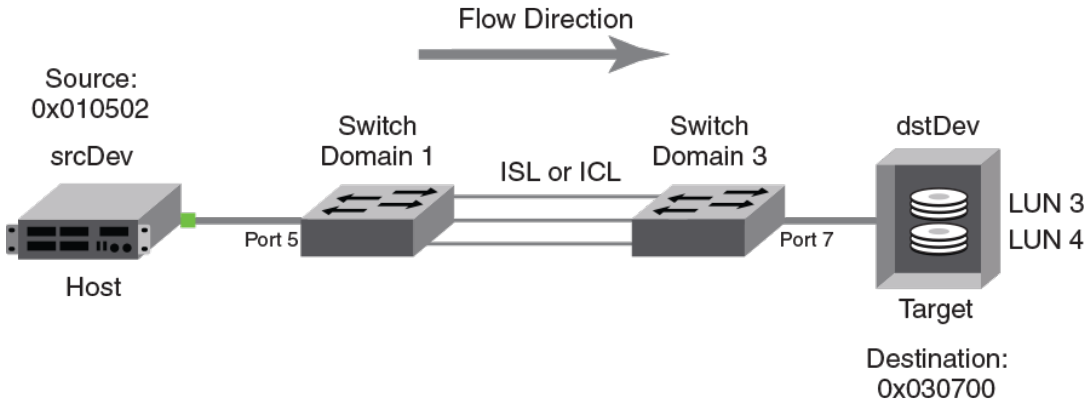
The following examples display how to use the Flow Monitor feature.

Monitoring LUN level statistics

A common use of flow monitors is to monitor traffic flowing from a particular ingress port to a specified LUN.

The following example creates a flow named “lunFlow11” that monitors traffic ingressing on port 5 between device 010502 and device 030700 using LUN 4, and then displays the results of that flow. The figure provides an illustration of what is happening in the example.

FIGURE 9 A LUN monitoring flow




```
switch128:admin> flow --create lunFlow11 -feature monitor -ingrport 5 -srcdev 0x010502 -dstdev
0x030700 -lun 4

switch128:admin> flow --show lunFlow11 -feature monitor

Name      : lunflow1  Features: mon(Activated) noConfig: off
Definition: IngrPort(5),SrcDev(010502),DstDev(030700),Lun(4)
Flow Monitor (Activated):
Monitor time:  | Thu Jun 06 15:15:39 UTC 2013 |
-------------------------------------------------------------------------------------------------
|      I/O Count        |   I/O Per Sec.(IOPS)  | I/O bytes Transferred |   I/O bytes Per Sec.  |
| Reads / Writes/ Total | Reads / Writes/ Total | Reads / Writes/ Total | Reads / Writes/ Total |
-------------------------------------------------------------------------------------------------
| 44.92k/ 44.94k/ 89.85k|  2.00k/  2.00k/  4.01k|  5.88M/  5.89M/ 11.77M|  2.62M/  2.62M/  5.25M|
-------------------------------------------------------------------------------------------------
```

Viewing summary flow data for a specific device pair

The following example creates a Flow Monitor flow gathering statistics for frames ingressing through port 30 between device 010000 and device 010100, and then displays the results. The point of interest in this example is port 30; it can be an E_Port, EX_Port, or F_Port.

```
switch:admin> flow --create sumflow1 -feature monitor -ingrport 30 -srcdev 010000 -dstdev 010100

switch:admin> flow --show
-------------------------------------------------------------------------------------------------
Flow Name     | Feature    | SrcDev        | DstDev        |IngrPt|EgrPt |BiDir| LUN  | FrameType|
-------------------------------------------------------------------------------------------------
 sumflow1     |mon+        |010000         |010100         |30    |-     |no   |-     |-         |
-------------------------------------------------------------------------------------------------
  + Denotes feature is currently activated for the flow
```

```
switch:admin> flow --show sumflow1 -feature monitor
=================================================================================================================
Name      : sumflow1 Features: mon(Active) noConfig: Off
Definition: IngrPort(30),SrcDev(0x010000),DstDev(0x010100)
Flow Monitor (Activated):
Monitor time:   | Tue Jul 16 22:06:32 CLT 2013 |
-----------------------------------------------------------
-----------------------------------------------------------------------------------------------------------------
| Rx Frames Count | Rx Frames per Sec. |  Rx Bytes Count | Rx Throughput(Bps) | Avg Rx Frm Sz(Bytes)|
-----------------------------------------------------------------------------------------------------------------
|       4.83G     |        10.62M      |     617.07G     |         1.34G      |          140        |
-----------------------------------------------------------------------------------------------------------------
-----------------------------------------------------------------------------------------------------------------
|      I/O Count         |   I/O Per Sec.(IOPS)   | I/O bytes Transferred  |   I/O bytes Per Sec.   |
| Reads / Writes/ Total  | Reads / Writes/ Total  | Reads / Writes/ Total  | Reads / Writes/ Total  |
-----------------------------------------------------------------------------------------------------------------
| 4.88G/     0 /  4.88G | 10.62M/     0 / 10.62M | 21.79T/     0 / 21.79T | 559.59M/    0 / 559.59M |
-----------------------------------------------------------------------------------------------------------------
=================================================================================================================
```

Monitoring flows using the learning functionality

The following example illustrates using the learning functionality for flow monitoring on an E_Port. The defined flow will monitor for frames ingressing on port 30 between all devices. The example then shows the flow output.

```
switch:admin> flow --create ingressTT -feature monitor -ingrport 30 -srcdev "*" -dstdev "*"

switch:admin> flow --show ingressTT
-------------------------------------------------------------------------------------------------
Flow Name     |Feature    |SrcDev        |DstDev        |IngrPt|EgrPt |BiDir| LUN  | FrameType|
-------------------------------------------------------------------------------------------------
ingressTT     |mon+       |*             |*             |30    |-     |no   |-     |-         |
-------------------------------------------------------------------------------------------------
   + Denotes feature is currently activated for the flow

switch:admin> flow --show ingressTT -feature monitor
=================================================================================================
Name      : ingresstt Features: mon(Active) noConfig: Off
Definition: IngrPort(30),SrcDev(*),DstDev(*)
Flow Monitor (Activated):
Monitor time:  | Tue Jul 16 06:12:12 CLT 2013 |
-----------------------------------------------------------
-------------------------------------------------------------------------------------------------
|SID(*)|DID(*)|Rx Frames Cnt|Rx Frames per Sec.|Rx Bytes Cnt |Rx Throughput(Bps)|Avg Rx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------
|010000|010100|   9.92G     |     201.22k      |  18.87T     |       399.93M    |        2092        |
|010000|010200|   9.92G     |     201.23k      |  18.87T     |       399.93M    |        2092        |
|010000|010300|   9.92G     |     201.23k      |  18.87T     |       399.93M    |        2092        |
|010000|010400|   9.92G     |     201.22k      |  18.87T     |       399.93M    |        2092        |
-------------------------------------------------------------------------------------------------
|  *   |  *   |  39.69G     |     804.91k      |  75.48T     |         1.56G    |        2092        |
-------------------------------------------------------------------------------------------------
=================================================================================================
```

The following example illustrates using the learning functionality for flow monitoring on an EX_Port. The defined flow will monitor for frames ingressing on port 219 headed for device 20:02:00:11:0d:51:00:00. The example then shows the flow output.

```
DCX_edge2:admin> flow --create ex_lrn_ingr -feature monitor -ingrport 219 -srcdev "*" -dstdev
20:02:00:11:0d:51:00:00

DCX_edge2:admin> flow --show ex_lrn_ingr
=================================================================================================
Name      : ex_lrn_ingr   Features: mon(Active)
Definition: IngrPort(219),SrcDev(*),DstDev(*)


Flow Stats (Active):
Stats time:  | Mon Jun 17 14:59:58 UTC 2013 |
-------------------------------------------------------------------------------------------------
|  SID | DID    |Rx Frames Cnt|Rx Frames per Sec.|Rx Bytes Cnt|Rx Throughput(Bps)|Avg Rx Frm Sz(Bytes)|
```

```
-------------------------------------------------------------------------------------------------------
|220200| 01f001 |  2.85G      |   8.45M          |   387.88G  |    1.12G         |    132             |
-------------------------------------------------------------------------------------------------------
|220200| 02f001 |  2.85G      |   6.00M          |   350.00G  |    1.00G         |    232             |
-------------------------------------------------------------------------------------------------------
|   *  |    *   |  5.60G      |  14.45M          |   737.88G  |    2.12G         |    152             |
=======================================================================================================
```

XISL_Port or Backbone E_Port flow examples

The following examples show the creation and typical results of flows for using XISL_Ports or Backbone E_Ports.

The following example creates three flows on one XISL_Port or Backbone E_Port.

```
switch10:FID128:admin> flow --create fm219 -ingrport 219 -sfid 10 -dfid 20 -feature
monitor

switch10:FID128:admin> flow --create fm219 -ingrport 219 -sfid "*" -dfid "*" -
feature monitor

switch10:FID128:admin> flow --create fm219 -ingrport219 -srcdev "*"  -dstdev "*" -
sfid "*" -dfid "*" -feature monitor
```

The following example shows the result of entering these commands.

```
switch10:FID128:admin> flow --show fm219 -feature monitor
=========================================================================
Name      : fm  Features: gen(Activated),mon(Activated) noConfig: Off
Definition: EgrPort(12),SFID(80),DFID(90)

Flow Monitor (Activated):
Monitor time:  | Thu Oct 31 23:48:30 UTC 2013 |
-------------------------------------------------------------------------------------------------------
|SFID|DFID|Tx Frames Count|Tx Frames per Sec.|Tx Bytes Count |Tx Throughput(Bps) |Avg Tx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------------
|80  |90  |    16.29M     |   402.46k        |   31.61G      |   799.88M         |      208           |

switch10:FID128:admin> flow --show fm -feature monitor
=========================================================================
Name      : fm  Features: gen(Activated),mon(Activated) noConfig: Off
Definition: EgrPort(11),SFID(70),DFID(70)

Flow Monitor (Activated):
Monitor time:  | Thu Oct 31 23:48:30 UTC 2013 |
-------------------------------------------------------------------------------------------------------
|SFID|DFID|Tx Frames Count|Tx Frames per Sec.|Tx Bytes Count |Tx Throughput(Bps) |Avg Tx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------------
|70  |70  |   16.29M      |     402.46k      |    31.61G     |     799.88M       |       2084         |


switch10:FID128:admin>  flow --show fm219 -feature monitor
=========================================================================
Name      : fm  Features: gen(Activated),mon(Activated) noConfig: Off
Definition: IngrPort(8),SID(*),DID(*), SFID(*),DFID(*)

Flow Monitor (Activated):
Monitor time:  | Thu Oct 31 23:48:30 UTC 2013 |
-------------------------------------------------------------------------------------------------------
|SFID|DFID|SID   |DID   |RxFramesCount|RxFrames perSec|RxBytesCount|RxThroughput(Bps)|AvG Rx Sz(Bytes)|
-------------------------------------------------------------------------------------------------------
|7   |11  |021200|031300|  16.29M     |     402.46k   |    31.61G  |    799.88M      |      2084      |
|7   |9   |021700|041200|  16.29M     |     402.46k   |    31.61G  |    799.88M      |      2084      |
|10  |10  |057200|057300|  18.00M     |     420.50k   |    36.11G  |    799.88M      |      2084      |
|20  |20  |061200|061300|  19.30M     |     450.50k   |    41.61G  |    799.88M      |      2084      |
-------------------------------------------------------------------------------------------------------
|*   |*   | *    | *    |  69.88M     |     1674.96k  |   126.46G  |      3.12G      |      2084      |
```

Legacy use case monitoring

You can create monitoring flows in Flow Vision that provide similar functionality to those available through Advanced Performance Monitor (APM). The following examples cover creating Flow Monitor equivalents for an end-to-end monitor, a frame monitor, and an ingress or egress Top Talker monitor.

Creating an end-to-end monitor equivalent

You can use the **-bidir** keyword with the **flow** command to create the equivalent to an end-to-end monitor.

The following example creates a bidirectional Flow Monitor flow between device 02d8c0 and device 023a00 egressing port 4/10 of the switch on which the command is running.

```
switch:admin> flow --create e2eflow -feature monitor -egrport 4/10 -dstdev 023a00 -srcdev 02d8c0 -bidir

switch:admin> flow --show e2eflow
==========================================================================
Name      : e2eflow      Features: mon(Activated)      noConfig: Off
Definition: EgrPort(4/10),SrcDev(0x02d8c0),DstDev(0x023a00),BiDir
Flow Monitor (Activated):
Monitor time:  | Fri Aug 30 22:52:35 UTC 2013 |
-------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------
|    Frame Count       | Frames Per Sec.     |    Byte count        | Throughput(Bps)     |Frame      |
                                                                                          Size(Bytes)|
|   Tx  /  Rx  / Total |  Tx  /   Rx / Total | Tx  /   Rx  / Total  |  Tx  /   Rx  / Total| Tx  / Rx  |
-------------------------------------------------------------------------------------------------------
|65.11M/129.63M/194.75M|962.52k/653.84k/1.61M|99.49G/185.44G/284.93G|958.32M/957.77M/1.87G|1632 /1528 |
-------------------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------
|      I/O Count         |   I/O Per Sec.(IOPS)    | I/O bytes Transferred   |   I/O bytes Per Sec.   |
| Reads / Writes/ Total  | Reads / Writes/ Total   | Reads / Writes/ Total   | Reads / Writes/ Total  |
-------------------------------------------------------------------------------------------------------
|  3.19M/ 24.14M/ 27.33M | 481.13k/481.13k/962.27k | 176.56G/  1.30T/ 1.47T  | 2.61G/ 2.61G/ 1.22G    |
-------------------------------------------------------------------------------------------------------
=======================================================================================================
```

Creating a frame monitor equivalent

You can use the **-frametype** parameter as part of the **flow** command to create the equivalent to an APM monitor created using the **fmmonitor** command.

The following example creates a Flow Monitor flow that counts SCSI Read-Write (scsirw) frames egressing port 2 of the switch on which the command is running.

```
switch:admin> flow --create scsirw -fe mon -egrport 2 -frametype scsirw
Monitor feature(s) have been activated.

switch:admin> flow --show
-------------------------------------------------------------------------------------------------------
Flow Name   |  Feature    |    SrcDev       |     DstDev       |IngrPt|EgrPt|BiDir| LUN  | FrameType |
-------------------------------------------------------------------------------------------------------
f1          |mon          |030300           |030400            |3     |-    |no   |0     |-          |
lrn0        |mon+         |*                |*                 |0     |-    |no   |-     |-          |
lrn89       |mon+         |*                |*                 |89    |-    |no   |-     |-          |
scsirw      |mon+         |-                |-                 |-     |2    |no   |-     |srdwr      |
-------------------------------------------------------------------------------------------------------

switch:admin> flow --show scsirw
==========================================================================
Name      : scsirw      Features: mon(Activated)        noConfig: Off
Definition: EgrPort(2),FrameType(srdwr)
Flow Monitor (Activated):
Monitor time:  | Fri Aug 30 23:31:04 UTC 2013 |
-----------------------------------------------------------
----------------------------------------
| Tx Frames Count | Tx Frames per Sec.  |
----------------------------------------
```

```
|      10.27M     |       327.55k       |
----------------------------------------
================================================================================
```

Creating an ingress or egress Top Talker monitor equivalent

You can use the learning flow ("*") parameter to create the equivalent to a legacy Top Talker monitor. A Top Talker monitor is used to identify high-volume flows passing a port.

The following example creates both an ingress and an egress Top Talker monitor. The first command creates a Flow Monitor learning flow named “ingresstt” for all frames between any devices ingressing through port 41 of the switch on which the command is running. The second command creates a Flow Monitor learning flow named “egresstt” for all frames between any devices egressing through port 30 of the switch on which the command is running.

```
switch:admin> flow --create ingresstt -feature monitor -ingrport 41 -srcdev "*" -dstdev "*"
Monitor feature(s) have been activated.

switch:admin> flow --create egresstt -feature monitor -egrport 30 -srcdev "*" -dstdev "*"
Monitor feature(s) have been activated.

switch:admin> flow --show
-------------------------------------------------------------------------------------
Flow Name     | Feature    | SrcDev   | DstDev   |IngrPt|EgrPt|BiDir| LUN  | FrameType|
-------------------------------------------------------------------------------------
ingresstt     |mon+        |*         |*         |41    |-    |no   |-     |-         |
egresstt      |mon+        |*         |*         |30    |-    |no   |-     |-         |
-------------------------------------------------------------------------------------
  + Denotes feature is currently activated for the flow
=====================================================================

switch:admin> flow --show ingresstt
=====================================================================
Name      : ingresstt   Features: mon(Activated)        noConfig: Off
Definition: IngrPort(41),SrcDev(*),DstDev(*)
Flow Monitor (Activated):
Monitor time:  | Fri Aug 30 23:44:58 UTC 2013 |
-----------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
|SID(*)|DID(*)|Rx Frames Cnt|Rx Frames per Sec.|Rx Bytes Cnt |Rx Throughput(Bps)| Avg Rx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------------------
|012900|051e00|   3.97M     |     112.68k      |   5.68G     |    165.06M       |         1536        |
|012900|020600|   7.95M     |     225.64k      |  15.09G     |    438.13M       |         2036        |
|012900|010700|   4.52M     |     128.62k      |   4.36G     |    127.08M       |         1036        |
|012900|020900|   7.90M     |     224.21k      |  11.31G     |    328.43M       |         1536        |
-------------------------------------------------------------------------------------------------------------
|  *   |  *   |  24.36M     |     691.16k      |  36.44G     |      1.03G       |         1606        |
-------------------------------------------------------------------------------------------------------------

switch:admin> flow --show egresstt
=====================================================================
Name      : egresstt    Features: mon(Activated)        noConfig: Off
Definition: EgrPort(0/30),SrcDev(*),DstDev(*)
Flow Monitor (Activated):
Monitor time:  | Fri Aug 30 23:25:35 UTC 2013 |
-----------------------------------------------------------------------
-------------------------------------------------------------------------------------------------------------
|SID(*)|DID(*)|Tx Frames Cnt|Tx Frames per Sec.|Tx Bytes Cnt|Tx Throughput(Bps)| Avg Tx Frm Sz(Bytes)|
-------------------------------------------------------------------------------------------------------------
|022900|051e00|   7.99M     |       1.86k      |    9.19G   |        2.19M     |         1236        |
|012c00|051e00|   4.50M     |       1.04k      |    4.35G   |        1.03M     |         1036        |
|022800|051e00|   7.99M     |       1.86k      |    7.71G   |        1.83M     |         1036        |
|012a00|051e00|   2.25M     |         524      |    3.22G   |      787.35k     |         1532        |
|022a00|051e00|   7.38M     |       1.71k      |      14G   |        3.33M     |         2032        |
|012b00|051e00|   4.50M     |       1.04k      |    4.35G   |        1.03M     |         1036        |
|012900|051e00|   2.25M     |         524      |    4.27G   |        1.01M     |         2032        |
-------------------------------------------------------------------------------------------------------------
|  *   |  *   |  36.89M     |       8.58k      | 47.11G     |        11.23M    |         1368        |
-------------------------------------------------------------------------------------------------------------

Note: Statistics are provided for the aggregate traffic generated to the specified SIM-port.
No traffic is actually transmitted out on the SIM-port.
=====================================================================
```

Flow Monitor and High Availability

When a High Availability (HA) failover, High Availability reboot, or a power cycle occurs, all flows are deactivated, and statistics for all Flow Monitor flows are not retained. Flow Monitor will begin to gather statistics again when the standby control processor becomes active. After the device is back online, only the first 64 Flow Monitor sub-flows that can be learned are reactivated. Flow Monitor always recreates these sub-flows based on the order in which the switch learns the flows.

Refer to High Availability and Flow Vision on page 32 for more information.

Flow monitors and MAPS

Flow Monitor statistics can be used by the Monitoring and Alerting Policy Suite (MAPS) service. This can help you identify critical administrative information such as traffic patterns, bottlenecks, and slow drains. Refer to the *Monitoring and Alerting Policy Suite Administrator's Guide* for more details.

Flow monitors on Access Gateways

Access Gateways support flow monitoring on ingress F_Ports only. The CLI and outputs are exactly the same as for a switch.

NOTE
Enabling WWN device ID mode is blocked on Access Gateways. This means that the **-deviceIdMode WWN** keyword is not permitted as part of the **flow** command, so the device ID mode always remains "PID" on Access Gateways.

Flow Monitor limitations

The following limitations apply to all Flow Monitor flows:

- Only one active learned flow is supported per ASIC.
- Learning is supported only on 16 Gbps-capable Fibre Channel platforms.
- The frame type parameters scsiread, scsiwrite, and scsirdwr monitor only SCSI 6-, 10-, 12-, and 16-bit Read and Write values. Read Long and Write Long values cannot be monitored.
- Flow Monitor is not supported on ports with Encryption or Compression enabled.
- IFL flows can be monitored only on EX_Ports in a Fibre Channel router.
- Flow Monitor cannot monitor Inter-Fabric Link (IFL) flows on E_Ports or F_Ports.
- Flow Monitor cannot monitor flows that are using frame redirection for encryption.
- Flow Monitor flows cannot be converted to Fabric OS 7.1.x flow performance monitors.

- The calculated Rx and Tx frame size values displayed in the output are accurate within a range of -4 through +8 bytes. For example, a frame size value of 256 bytes may actually be anywhere from 252 to 260 bytes in size.
- For Flow Monitor flows passing through the base switch in a VF-enabled fabric the source fabric ID (SFID) and destination fabric ID (DFID) values must be specified when the flow is defined.

The following limitations apply to 16 Gbps-capable Fibre Channel platforms, including the Brocade FC8-32E and FC8-48E blades:

- They support a maximum of 2 flows defined using a combination of ingress port and frame type parameters per ASIC chip.
- Each port supports a maximum of 12 flows defined using both egress port and frame type parameters.
- Flow Monitor can only monitor flows that are using EX_Ports.

The following limitations apply to 8 Gbps-capable Fibre Channel platforms and blades:

- They do not support monitoring flows using both ingress port and frame type parameters.
- Each port supports a maximum of 12 flows defined using both egress port and frame type parameters, except for the Brocade 300, 5300, 5410, 5424, 5450, 5460, 5470, 5480, 7800 and 7840 platforms, which support a maximum of 8 flows per port.
- They cannot show statistics for SIM ports.
- They do not support learning.

Flow Generator

Overview of Flow Generator

Flow Generator is a test traffic generator designed to allow you to pre-test a SAN infrastructure (including internal connections) for robustness before deploying it.

CAUTION

You should not use Flow Generator in an active production environment, as the Flow Generator traffic can saturate the links and will impact the production traffic sharing the same links.

Flow Generator provides you with the ability to:

- Configure a 16 Gbps Gen 5 Fibre Channel-capable port as a simulated device that can transmit frames at full 16 Gbps line rate.
- Emulate a 16 Gbps SAN without actually having any 16 Gbps hosts or targets or SAN-testers.
- Pre-test the entire SAN fabric at the full line rate, including optics and cables on ISLs as well as internal connections within a switch.

Flow Generator achieves this using simulation mode (SIM) ports. SIM ports behave like normal F_Ports, but are used only for testing. By using SIM ports, Flow Generator traffic is terminated at the destination port and does not leave the switch. Refer to SIM port attributes and configuration on page 71 for more information on SIM ports.

Flow Generator can generate standard frames or create custom frames with sizes and patterns you specify. A sample use case would be to create a traffic flow from a Source ID (SID) to a Destination ID (DID) to validate routing and throughput. Creating a flow from a specific source ID to a specific destination ID on page 68 provides an example of the command and the results for this use case.

Flow Generator supports predefined flows to generate traffic between all configured SIM ports. Fabric OS 7.3.0 supports 36 Virtual Channels (VCs), and balances the traffic generated from a SIM port to multiple destinations by transmitting traffic using the same number of VCs for each destination.

Once you activate a Flow Generator flow, the flow will stay active until you deactivate the flow. The flow stays active even though the SID and DID SIM-ports are offline. As soon as SID and DID SIM-ports are online, traffic will start.

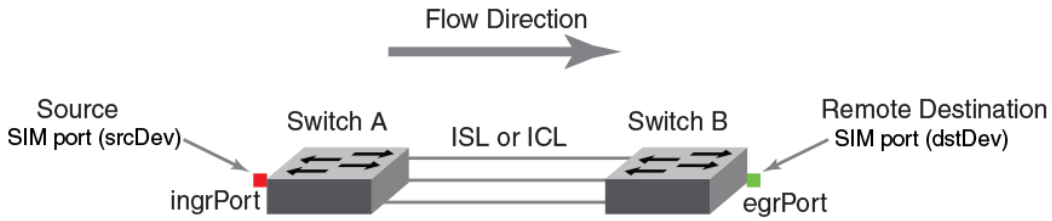
Flow Generator setup

Flow Generator offers several flow control options that you can configure, including the ability to specify both the frame size and the frame payload pattern. Header parameters and other control parameters can also be added as part of the definition. The 0XID value for frames cannot be user-specified.

Flow Generator generates and receives traffic only from simulated ingress and egress ports (SIM ports) which emulate device entries in the Name Server database, so that they are treated as real devices and can be used to evaluate various switch and fabric operations such as QoS and Traffic Isolation. For more information on working with SIM ports, refer to SIM port attributes and configuration on page 71.

Flow Generator flows are defined using a combination of the source device (srcdev), destination device (dstdev), ingress port (ingrport), and egress port (egrport) parameters. All of these must be SIM ports. The source device is the origination point of the test traffic. The destination device is the destination of the test traffic; for Flow Generator flows it may be remote from the switch. The port that transmits the simulation traffic must be a 16 Gbps-capable Fibre Channel port. The port that receives the simulated traffic can be either an 8 Gbps- or a 16 Gbps-capable Fibre Channel port. The following figure illustrates this concept.

FIGURE 10 A Flow Generator flow structure



Predefined Flow Generator flows

Predefined flows are system-defined flows that support most common testing scenarios. These flows are automatically created and defined based on your network structure as part of the upgrade to Fabric OS 7.3.0. These flows use the port ID and device ID modes and other control parameters configured for Flow Generator.

With the release of Fabric OS 7.3.0, there is one predefined flow. The name of this flow is sys_gen_all_simports. In this flow, traffic is generated from each SIM port on a switch to all the other SIM ports configured on that switch. This allows you to easily stress-test the hardware, ASIC path, backplanes, front-end, switch, and fabric operations. The stress-testing operation is handled in iterations. At each iteration, all SIM ports generate traffic to a set of destination ports, determined by their order in the physical chip interleave, so that all the chips are tested at the beginning of the test. Every SIM port will generate traffic to four destinations through 39 Virtual Channels, but it will not generate traffic to itself.

You can configure this flow to run on all the ports on the switch, or on a specific slot, port range, or list of ports.

- To run the test on all the ports on the local switch, set all the ports on the switch to SIM ports.
- To run the test on one slot only, set only the ports of the slot to SIM ports.
- To run the test on any other set of ports, set these specific ports to SIM ports.

The frame payload size and pattern control parameters apply to sys_gen_all_simports. The control parameters can be the default, user-defined default, or specific to the sys_gen_all_simports flow. Refer to Customizing Flow Generator flows on page 67 for more details.

To start this flow, you must first enable it (specifying the ports you want used), and then you must activate it. The following example enables SIM ports 10 through 20 and then activates the flow.

```
switch:admin> flow --control -simport 10-20 -enable

switch:admin> flow --activate -feature generator sys_gen_all_simports
```

NOTE
Once started, sys_gen_all_simports will run until you deactivate the flow.

To stop the flow, enter **flow --deactivate -feature generator sys_gen_all_simports**.

To reset the flow metrics, enter **flow --reset -feature generator sys_gen_all_simports**. This resets the ingress and egress counts for all the tested SIM ports.

The following restrictions apply specifically to this stress-test flow:

- You must configure the SIM ports you are going to test before activating the flow.
- There is a limit of 256 flows (64 flows at 4 flows per port) that can be generated per iteration.
- This flow bypasses all zoning, as SIM ports do not need to be zoned for the flows to be generated.
- Activating the predefined flow is mutually exclusive with all other active Flow Generator flows. If there are any static flows or sub-flows activated on the switch, you cannot activate the predefined flow. If the predefined flow is activated, no other Flow Generator flow can be activated.

Entering **flow --show sys_gen_all_simports** displays:

- The SID-DID pairs tested
- The number of complete runs where all the SID-DID pairs have been tested
- The completion percentage of the current run
- The total number of frames generated from all the ingress ports

The following example shows the typical results of the **flow -- show** command when the sys_gen_all_simports flow is active:

```
switch10:FID128:admin> flow --show
-------------------------------------------------------------------------------------------------------
Flow Name            | Feature  |   SrcDev      |    DstDev     |IngrPt|EgrPt |BiDir| LUN  | FrameType|
-------------------------------------------------------------------------------------------------------
f1                   |gen+,mon+ |*              |-              |-     |5     |no   |-     |-         |
sys_gen_all_simports |gen+      |*              |*              |-     |*     |*    |-     |-         |
-------------------------------------------------------------------------------------------------------
  + Denotes feature is currently activated for the flow
  The flow name with prefix sys_ denotes predefined flow
```

The following example shows the results of **flow --show sys_gen_all_simports**.

```
switch10:FID128:admin> flow --show sys_gen_all_simports
================================================================================
Name      : sys_gen_all_simports     Features: gen(Activated)        noConfig: Off

Number of complete runs: 2
Percent complete of the current run: 33

Flow Generator (Activated):
-----------------------
|  SrcDev  |  DstDev  |
-----------------------
| 0x014000 | 0x014100 |
-----------------------
| 0x014000 | 0x014200 |
-----------------------
| 0x014000 | 0x014300 |
-----------------------
| 0x014000 | 0x014400 |
-----------------------
| 0x014100 | 0x014000 |
-----------------------
| 0x014100 | 0x014200 |
-----------------------
| 0x014100 | 0x014300 |
-----------------------
| 0x014100 | 0x014400 |

    (output truncated)

Number of frames generated from IngrPorts :   9.20G
```

Notes on predefined flows

The following items should be kept in mind when working with predefined flows:

- If the sys_gen_all_simports flow was active before a reboot, it will be replayed after the reboot.
- If the port, SIM device, slot, or switch goes offline, the subflows on the offline ports will be stopped. Traffic will continue to run on the online ports.
- If all SIM ports in the test go offline, the flow will stay active but traffic will not start, and entering **flow --show** will return “no sim devices”. In this case, the flow traffic will resume when any SIM ports in the flow come online.
- To prevent dropped frames when offline SIM ports come back on line, those ports included in the test flow are only added back to the test flow during the pause between iterations.
- The following restrictions apply to predefined flows:
  - Activation, deactivation, reset, show, and control operations are supported, but creation and deletion are not supported.
  - Predefined flows do not include learned flows (those created using an asterisk (*)) or sub-flows.

Refer to Notes on predefined flows for information on how sys_gen_all_simports behaves with HA and MAPS.

Determining how long one pass of sys_gen_all_simports should take

The following calculation can be used to estimate how long one full pass should take if all the possible pairings of Source ID and Destination ID are tested.

- Flows per port = 4
- Time per iteration = 1 minute
- Number of iterations for full run = Integer of ((number of SIM ports -1) / flows per port). This value should always be rounded up to the next integer.
- The number of iterations needed to complete one full pass = (number of iterations + 1)
- Time to run one full pass = (number of iterations for full run * time per iteration)

Based on the above formula, the time it takes to run a full pass of sys_gen_all_simports for 128 SIM ports is 32 * 1 min = 32 minutes.

In those cases where the device ID (DID) is equal to the source (SID), that DID will be skipped and the next DID (from the next iteration) will be selected to run. This way, every SID will send traffic to four destinations at a time for every iteration.

Creating Flow Generator flows

To create a Flow Generator flow, enter the **flow --create** *flow_name* **-feature generator** *parameters* command.

The following table lists the parameters available to Flow Generator.

TABLE 10 Flow Generator supported flow parameter combinations

Parameter	Field name	Description
Port	ingrport egrport	• One field only must be specified. • Values must be explicit. • Must be a SIM port local to the switch for a flow to generate traffic.
Frame	srcdev dstdev	• At least one field must be specified. • Values for srcdev and dstdev can be explicit or "*" ("*" indicates learned flows). • Must be a SIM port PID for a flow to generate traffic. • The parameters lun and frametype are not supported.
Optional keyword parameters		
	-bidir	Not supported directly. To emulate this function you must create two flows (one in each direction).
	-noactivate	Adding this keyword creates the flow without activating it.
	-noconfig	Adding this keyword creates the flow without saving the flow to the configuration.

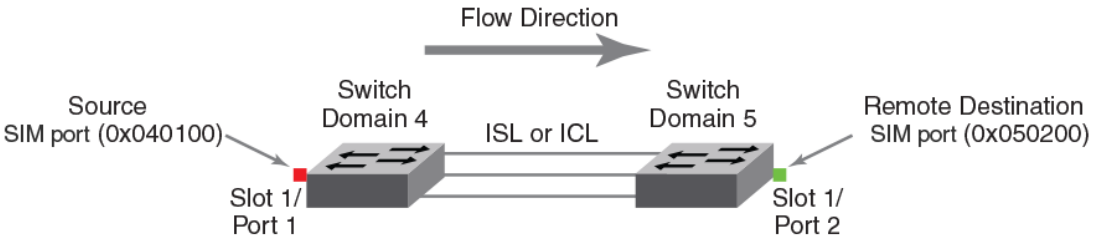
Refer to Customizing Flow Generator flows on page 67 for information on changing the flow frame size and contents.

Parameter usage exceptions

When you create a flow, it is automatically activated unless you use the **-noactivate** keyword for the **flow --create** command. Refer to Creating an inactive flow in Flow Generator on page 64 for an example.

The following illustrated example creates a Flow Generator flow named “Flow11” and generates traffic using the ingress SIM port 1/1 from device 040100 (Domain 4) to device 050200 (Domain 5).

FIGURE 11 A Flow Generator flow between two switches




```
switch123:admin> flow --create Flow11 -feature generator -ingrport 1/1 -srcdev
040100 -dstdev 050200
```

Restrictions

The following restrictions apply to Feature Generator parameter usage:

- If the srcdev and ingrport parameters are both defined, they must both be local to the switch and refer to the same source.
- If the dstdev and egrport parameters are both defined for the flow, they must both be local to the switch and represent the same destination.

ATTENTION
Flow creation is not allowed if Advanced Performance Monitor (APM) or Port Mirroring is enabled. Similarly, APM and Port Mirroring-related operations will not be allowed if any flow (active or defined) is present on the switch.

Creating an inactive flow in Flow Generator

To create an inactive Flow Generator flow, enter **flow --create** *flow_name* **-feature grenerator** *flow_parameters* **-noactivate**.

Refer to Activating Flow Generator flows on page 65 for information on activating a Flow Generator flow.

The following example creates an inactive Flow Generator flow named “superflow238” from device 020a00 to device 01c000 ingressing through SIM-Port 110.

```
switch:admin> flow --create superflow238 -feature generator -ingrport 110 -srcdev
0x020a00 -dstdev 0x01c000 -noactivate
```

Activating Flow Generator flows

When a flow is activated, traffic is generated by the ingress port or source device for that flow and any sub-flows associated with it as soon as all SIM ports and devices defined in the flow are online.

Activating a flow does not automatically clear the flow statistics for that flow; the existing statistic counters resume counting using the resumed flow data. If you are activating a learned flow, the sub-flows will be refreshed based on the first 39 Source ID-Destination ID pairs of SIM devices in the zone database that are registered in the Name Server. A flow can be activated that includes SIM ports that are either offline or that have not yet been created. If such a flow is activated, an alert message is displayed, noting that the activated flow is not enforced.

To activate an inactive Flow Generator flow, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Enter **flow --activate** *flow_name* **-feature generator**.

The following example activates the Flow Generator flow named “Flow1”.

```
switch:admin> flow --activate Flow1 -feature generator
```

Automatic activation of a Flow Generator flow

Flow Generator automatically activates a generated flow under the following conditions:

- On flow creation, unless the flow is being created using the **-noactivate** keyword as part of the **flow** command. Refer to Creating an inactive flow in Flow Generator on page 64 for information on this procedure.
- On slot power-on, if the specified port belongs to the slot being powered on and the flow was active when the slot was powered off.
- On a High Availability (HA) failover, or a HA reboot, if the flow was active when the HA event occurred.

Learning in Flow Generator flows

To apply learning to a Flow Generator flow, use an asterisk inside of quotation marks ("*") to specify the parameter to be learned.

When Flow Generator activates learned flows, it queries the Name Server database to identify source and destination devices that are zoned together. These pairings are not automatically changed if either member of the pair changes zones. If either member of the pair changes zones, you must deactivate the flow and then reactivate it to use the new zone values. Flow Generator allocates the first 39 flows per source ID to zoned destination IDs. The rest of the destination IDs are not tested. For learned flows, zone enforcement is applied to both the source and destination SIM-Ports.

In the following example, the only flows that will be activated are the ones where the destination devices share a zone with the source device (204000) and use ingress port 24. To view the data generated by this flow, refer to Viewing the output of a learned Flow Generator flow on page 66.

```
switch:admin> flow --create fgflow12 -feature generator -ingrport 24 -srcdev 0x204000
-dstdev "*"
```

Viewing Flow Generator flows

To display Flow Generator flows, enter **flow --show** *flowname* **-feature generator**. For root and static flows, this command shows the Source ID-Destination ID pairs and the cumulative frame count on the ingress or egress port specified in the flow definition.

Displaying the status of a single Flow Generator flow

The following example displays the status of the Flow Generator flow named “f2”.

```
switch:admin> flow --show f2 -feature generator
================================================================================
Name      : f2       Features: gen(Active) noConfig: Off
Definition: IngrPort(1/9),SrcDev(0x010900),DstDev(0x01c100)
Flow Generator (Activated):
-----------------------
|  SrcDev  |  DstDev  |
-----------------------
| 0x010900 | 0x01c100 |
-----------------------
Number of frames generated from IngrPort : 595.41M
Note: More than 1 flow active on this port.
================================================================================
```

Viewing the output of a learned Flow Generator flow

To view the output of a learned Flow Generator flow, enter **flow --show** *flow_name* **-feature generator**.

When you view the output of a learned flow, the Name line displays the flow name and flow features with their respective states. The Definition line displays the port of interest and the device. In the table under Flow Generator, each row is an individual sub-flow, and the column shows the individual device IDs. The last line displays the number of frames (in units of 1000 (K), 1,000,000 (M), or 1,000,000,000 (G)) that have passed through that port measured from the time the port became active.

The following example shows the output of the Flow Generator flow named "fgflow12":

```
switch:admin>flow --show fgflow12 -feature generator
Name : fgflow12 Features: gen(Active) noConfig: Off
Definition: IngrPort(4),DstDev(*)
Flow Generator (Activated):
-----------------------
| SrcDev   | DstDev   |
-----------------------
| 0x204000 | 0x040700 |
-----------------------
| 0x204000 | 0x040800 |
-----------------------
| 0x204000 | 0x050900 |
-----------------------
| 0x204000 | 0x051000 |
-----------------------
Number of frames generated from IngrPort : 82.21M
```

Notes on displaying the status of a Flow Generator flow

- If you want to see the per-flow frame count on a port with multiple flows, you must include the flow monitoring feature in the flow definition (**flow --create** *flow_name* **-feature generator**,**monitor**).
- Flow Generator will append a note at the bottom of the output if there is more than one static flow or a learned flow active on the port.

Deactivating Flow Generator flows

You can deactivate Flow Generator flows without deleting them. This allows you to have a “library” of flows that you can activate as needed without having to recreate them.

NOTE
When a flow is deactivated, traffic stops for that flow and any sub-flows associated with it. When a flow is deactivated, the definition remains but Flow Generator does not populate it with traffic.

To manually deactivate a Flow Generator flow, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Enter **flow --deactivate** *flow_name* **-feature generator**.

The following example deactivates the Flow Generator flow named “Flow1”.

```
switch:admin> flow --deactivate Flow1 -feature generator
```

Customizing Flow Generator flows

Flow Generator allows you to specify the frame payload size and pattern to be used for the Flow Generator flows by using the **flow --control** command.

Frame payload size

Flow Generator allows you to define the frame payload size in bytes. The frame payload size value must be either 0 (which produces frames of random size using a multiple of 4 between 64 and 2048 bytes) or a multiple of 4 in the range from 64 through 2048. (64, 68, 72, 120, 140, 320, 512, and so on). The default payload size value is 2048.

There are two ways to change the frame payload size; you can change the default payload size or you can change the payload size for a single flow.

To see the current generic payload size, enter **flow --show -ctrlcfg**; to see the payload size for a specific flow, enter **flow --show** *flow_name***-ctrlcfg**.

Changing the default frame payload size

Assigning a frame payload size without defining a flow creates a default that applies to all flows created afterward. The following example sets the payload size default for all new flows to 512 bytes.

```
switch:admin> flow --control -feature generator -size 512
```

Changing the frame payload size for a single flow

Assigning a frame payload size explicitly to a flow affects only that flow and overrides the existing payload size for that flow. Changing a flow’s payload size can only be done to an inactive flow. The following example changes the payload size for the flow “F1024” to 1024 bytes.

```
switch:admin> flow --control F1024 -feature generator -size 1024
```

Frame payload pattern

Flow Generator allows you to define the pattern to be used as the frame payload. The frame payload pattern must be an alphanumeric ASCII string between 1 and 32 characters in length. The default frame payload pattern value is 0, which produces a random pattern of alphanumeric ASCII characters with a variable string length between 1 and 32 characters.

There are two ways to change a frame payload pattern; you can change the default payload pattern, or you can change the payload pattern for a single flow.

To see the current generic payload pattern, enter **flow --show -ctrlcfg**; to see the payload pattern for a specific flow, enter **flow --show** *flow_name* **-ctrlcfg**.

Changing the default frame payload pattern

Assigning a frame payload pattern without defining a flow creates a default that applies to all subsequently-created flows. The following example sets the default payload pattern for all new flows to “TestFlow”.

```
switch:admin> flow --control -feature generator -pattern "TestFlow"
```

Changing the frame payload pattern for a specific flow

Explicitly assigning a frame payload pattern to a flow overrides the existing frame payload pattern for that flow, and affects only that flow. Changing a payload pattern can only be done to an inactive flow. The following example sets the default payload pattern for the flow F2 to “a5a5a5”.

```
switch:admin> flow --control F2 -feature generator -pattern "a5a5a5"
```

Flow Generator examples

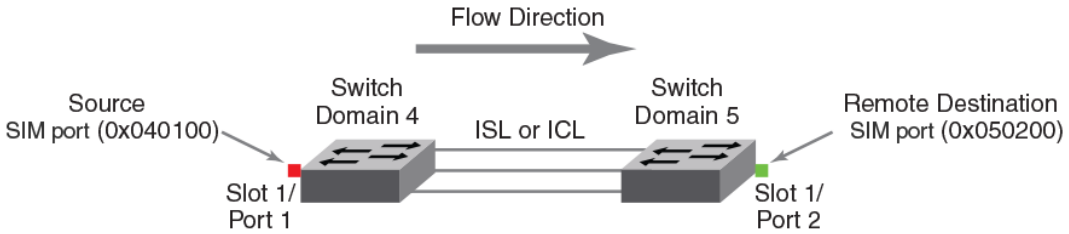
The following examples describe how to work with Flow Generator flows.

Creating a flow from a specific source ID to a specific destination ID

To create a flow between a specific source ID (SID) and a specific destination ID (DID), complete the following steps.

1. Create two SIM ports.
2. Create an active flow from the SID to the DID.

FIGURE 12 A flow from a specific source ID to a specific destination ID



The following example creates the flow as shown in the figure above. SIM port 1/1 is the source port and SIM port 1/2 is the destination device. The **flow --show flowCase1 -feature generator** command displays the SID frame count and then the DID frame count.

```
switch:admin> flow --control -simport 1/1 -enable

switch:admin> flow --control -simport 1/2 -enable

switch:admin> flow --create flowcase1 -feature generator -ingrport 1/1 -srcdev 0x040100 -dstdev
0x050200

switch:admin> flow --show flowCase1 -feature generator
Name: flowcase1 Features: gen(Activated) noConfig: Off
Definition: IngrPort(1/1),SrcDev(040100),DstDev(050200)
Flow Generator (Activated):
-----------------------
|  SrcDev  |  DstDev  |
-----------------------
| 0x040100 | 0x050200 |
-----------------------
Number of frames generated from ingrport:  19.46M

switch:admin> flow --show -ctrlcfg
SimPort Information
-------|------|--------|-------------------------|--------------------|------------------|
 Slot  | Port |  PID   |         PWWN            |   SID Frame Count  | DID Frame Count  |
-------|------|--------|-------------------------|--------------------|------------------
   1   |  2   | 050200 | 20:02:00:05:1e:e2:8e:00 |        0K          |      19480K      |
-------|------|--------|-------------------------|--------------------|------------------|
Addressing mode information
Port Addressing Mode: index
Device Addressing Mode: PID
Flow Generator Information
Size: 2048
Pattern: Random (Default)
Flow mirror Information
enable_wrap
```

Integrating Flow Generator with Flow Monitor

Flow Generator flows can be monitored using Flow Monitor. For example, you can use a combination of Flow Generator flows and Flow Monitor flows to verify per-flow throughput at an ingress or egress port. This can be useful when more than one Flow Generator flow shares the same ingress or egress port. To do this, you must create a flow using both the Flow Generator feature and the Flow Monitor feature that share the ingress or egress port.

The following example illustrates a flow that uses both the Flow Generator and Flow Monitor features. In this example, they share an ingress port.

```
switch:admin> flow --create flowCase3Source -feature generator,monitor -ingrPort 1/1 -srcDev 0x010100 -
dstDev "*"

switch:admin> flow --show flowCase3Source -feature generator,monitor
Name: flowCase3Source Features: gen(Activated),sts(Activated)
Definition: IngrPort(1/1),SrcDev(010100),DstDev(*)

Flow Generator (Activated):
-----------------------
| SrcDev   | DstDev   |
-----------------------
| 0x010100 | 0x010000 |
-----------------------
| 0x010100 | 0x015000 |
-----------------------
| 0x010100 | 0x015100 |
-----------------------

Number of frames generated from IngrPort : 1.63G

Flow Monitor (Activated):
-------------------------------------------------------------------------------------------------
|DID(*)| Rx Frames Count | Rx Frames per Sec. | Rx Bytes Count | Rx Throughput(Bps) | Avg Rx Frm Sz|
                                                                                  (Bytes)       |
```

```
-------------------------------------------------------------------------------------------------
| 10000| 75.84M          | 482.95k           | 1568G          | 14.47M           | 2080         |
| 15000| 37.42M          | 241.47k           | 784.4G         | 50.23M           | 2080         |
| 15100| 37.42M          | 241.47k           | 784.4G         | 50.23M           | 2080         |
-------------------------------------------------------------------------------------------------
| *    | 1.50G           | 965.90k           | 3137G          | 1.15G            | 2080         |
-------------------------------------------------------------------------------------------------
```

Commands related to Flow Generator

The following commands affect or are affected by Flow Generator. Refer to the *Fabric OS Command Reference* for more detailed information.

portcfgshow

Entering **portcfgshow** for a specified port shows the configuration of the SIM port. (Called out for illustration.)

```
switch:admin>portcfgshow 8/0
Area Number:              96
Octet Speed Combo:        1(16G|8G|4G|2G)
Speed Level:              AUTO(SW)
AL_PA Offset 13:          OFF
. . . . .
Mirror Port               OFF
SIM Port                  ON <-- SIM Port status
Credit Recovery           ON
F_Port Buffers            48
. . . . .
Compression:              OFF
Encryption:               OFF
FEC:                      ON
```

portperfshow

When you run the **portperfshow** command, an asterisk (*) represents traffic running on either an ingress port or an egress port from a Flow Generator flow. For the **portperfshow** command, the Transmit Throughput value represents the egress port, and the Receive Throughput value represents the ingress port.

portstatsclear

Entering **portstatsclear** for a port clears the Flow Generator frame count for all flows sharing this port. This is equivalent to the **flow --reset** command. Refer to Resetting flow statistics on page 29 for details.

portstatsshow

When you run the **portstatsshow** command, the Transmit Word Count value represents the egress port, and the Receive Word Count value represents the ingress port. The frame size used for **portstatsshow** is 2048 bytes, regardless of what value has been set for the flow.

slotstatsclear

Entering **slotstatsclear** for a slot clears the Flow Generator frame count for all flows sharing the ports on that slot.

switchshow

Entering **switchshow** generates output showing which ports are set as simulation mode ports (SIM ports) and displays the WWN for each emulated device.

```
switch:admin> switchshow | grep SIM
192   8   0   046000    id    16G    Online    FC  SIM-Port 20:c0:00:05:1e:99:61:00
193   8   1   046100    id    16G    Online    FC  SIM-Port 20:c1:00:05:1e:99:61:00
194   8   2   046200    id    16G    Online    FC  SIM-Port 20:c2:00:05:1e:99:61:00
195   8   3   046300    id    16G    Online    FC  SIM-Port 20:c3:00:05:1e:99:61:00
196   8   4   046400    id    16G    Online    FC  SIM-Port 20:c4:00:05:1e:99:61:00
```

SIM port attributes and configuration

Flow Vision requires that the source device and destination device ports be in simulation mode (SIM port mode) prior to activating the test flows, and checks for this before activating the test flows. Prior to creating and activating flows, you must enter **flow --control** on the local switch to set the source device (srcdev) and the destination device (dstdev) ports as SIM ports. This ensures that test flows are not unintentionally transmitted to real devices. After the source device and destination device ports are configured to be SIM ports, you can create and activate the flow.

The following restrictions will affect your use of SIM-Ports:

- Flow Generator supports up to 39 active flows per ingress SIM port, and takes 48 credits per SIM port from the ASIC.
- Zoning is bypassed on SIM ports. Traffic will reach its destination regardless of zoning configuration.
- Zones are used to gather the Source ID-Destination ID pairs for learning flows, zoning is bypassed for static and pre-defined flows.

SIM port criteria

Flow Generator simulation (SIM) ports must meet the following criteria to be valid:

- SIM ports are supported on ASICs that support either 8 Gbps- or 16 Gbps-capable Fibre Channel ports. Source devices or ingress ports can only be on 16 Gbps-capable Fibre Channel ports. Destination devices or egress ports can be on either 8 Gbps- or 16 Gbps-capable Fibre Channel ports.
- SIM ports cannot be in the base switch or Access Gateway.
- SIM ports cannot be configured on a port that is online and connected to a real device.

NOTE
If a port is connected to a real device, you can disable the port, configure the SIM port, and then re-enable the port. The port will be a SIM port; the real device will not join the fabric.

- Existing SIM ports are added to Device Connection Control (DCC) policies when created with a wildcard (*) but are not adhered to. These SIM port entries must be deleted if a new WWN is connected.
- SIM ports cannot be configured as any of the following port types; these restrictions also apply at the time a SIM port is enabled:
  - Any port running Encryption or Compression
  - Any port configured with QoS on
  - Any F_Port connected to a real device (unless the port is disabled)
  - D_Port (Diagnostic Port)
  - E_Port

  - EX_Port
  - F_Port trunked
  - Fastwrite port
  - FCoE port
  - ICL port
  - L_Port
  - M_Port (Mirror Port)
  - VE port
- If a port is configured with CSCTL_mode enabled, you can configure it as a SIM port.
- If a port has an Ingress Rate Limit set, you can configure it as a SIM port.
- If a port is configured as a SIM port:
  - You cannot enable QoS.
  - You cannot enable CSCTL_mode.
  - You can set an Ingress Rate Limit.
- The following features of a SIM port are persistent across a reboot:
  - Each SIM port is assigned a PID and is displayed in a **switchShow** command.
  - Each SIM port's Port Worldwide Name by default is the switch Port Worldwide Name (PWWN), unless a user-defined Virtual Port Worldwide Name is assigned to it.
  - Each SIM port registers itself into the Name Server database.

Identifying SIM ports

In order to distinguish SIM ports from other devices, the Name Server commands show "Port Properties: SIM Port", as called out in the following example:

```
switch:admin> nscamshow
nscam show for remote switches:
Switch entry for 105
state  rev    owner  cap_available
known   v730  0xfffc6e 1
Device list: count 12
Type Pid     COS     PortName                NodeName
N    691000; 3;      10:00:00:00:00:0f:00:00;10:00:00:00:00:00:0f:00;
     Fabric Port Name: 20:10:00:05:1e:57:dc:b3
     Permanent Port Name: 10:00:00:00:00:0f:00:00
     Port Index: 16
     Share Area: No
     Device Shared in Other AD: No
     Redirect: No
     Partial: No   <— Port Properties is not shown for non-SIM ports
N    691400; 2,3;    20:14:00:05:1e:57:dc:b3;20:14:00:05:1e:57:dc:b3;
     Fabric Port Name: 20:14:00:05:1e:57:dc:b3
     Permanent Port Name: 20:14:00:05:1e:57:dc:b3
     Port Index: 20
     Share Area: No
     Device Shared in Other AD: No
     Redirect: No
     Partial: No
     Port Properties: SIM Port   <— Port Properties shows "SIM Port"
      (output truncated)

switch:admin> nsshow
Type Pid     COS    PortName                NodeName                TTL(sec)
N    691000; 3;     10:00:00:00:00:0f:00:00;10:00:00:00:00:00:0f:00; na
    Fabric Port Name: 20:10:00:05:1e:57:dc:b3
    Permanent Port Name: 10:00:00:00:00:0f:00:00
    Port Index: 16
    Share Area: No
    Device Shared in Other AD: No
    Redirect: No
    Partial: No
    LSAN: No   <— Port Properties is not shown for non-SIM ports
N   691400; 2,3;   20:14:00:05:1e:57:dc:b3;20:14:00:05:1e:57:dc:b3; na
    Fabric Port Name: 20:14:00:05:1e:57:dc:b3
```

```
Permanent Port Name: 20:14:00:05:1e:57:dc:b3
Port Index: 20
Share Area: No
Device Shared in Other AD: No
Redirect: No
Partial: No
LSAN: No
Port Properties: SIM Port   <— Port Properties shows "SIM Port"
 (output truncated)
```

Sending traffic using a Fabric Assigned WWN

If you want to use a Fabric Assigned WWN (FA-WWN), you need to set the FA-WWN on the SIM port using the Dynamic Fabric Provisioning command, **fapwwn -assign**. For details, refer to the "Dynamic Fabric Provisioning" section of the *Fabric OS Administrator's Guide*.

CAUTION

If the fapwwn command is used to assign a user-defined Port WWN to a SIM port, it is the person making the assignment's responsibility to not assign a Port WWN that duplicates one already in the fabric. If there is a duplicated WWN, both entries will be removed from the Name Sever database. This has a high probability of disrupting traffic.

Flow Generator and High Availability

On a High Availability (HA) failover, HA reboot, or a power cycle and reboot, both local and remote flows remain active. When SIM ports come back online from an HA failover or HA reboot event, local flows are re-created and reactivated, and local traffic is restarted. Inactive flows are re-created but not activated by an HA failover, HA reboot, or a power cycle and reboot.

ATTENTION

For the first 39 flows that can be learned for Flow Generator, a HA failover, HA reboot, or a power cycle and reboot event may cause different sub-flows to be re-created, as the flow order depends on the zone database.

If the sys_gen_all_simports flow was active prior to a HA failover, the flow will be replayed after the HA failover with all the SIM ports that are configured on the switch.

Refer to High Availability and Flow Vision on page 32 and Notes on predefined flows on page 62 for more information.

Flow Generator and MAPS

The Monitoring and Alerting Policy Suite (MAPS) can be used to monitor SIM port traffic thresholds while Flow Generator flows are running.

MAPS treats SIM ports as F_Ports, so MAPS can issue warnings on these ports if threshold values are triggered. If you do not want to see MAPS warnings for SIM ports, you must disable MAPS monitoring for those ports.

Flow Generator traffic will also impact E_Ports; this may cause MAPS warnings for E_Port throughput levels. Refer to the *Monitoring and Alerting Policy Suite Administrator's Guide* for more information about working with MAPS.

You can use the Monitoring and Alerting Policy Suite (MAPS) utility to monitor traffic in the sys_gen_all_simports flow using the same default and custom policies as used for F_Ports. However, there will not be a check in MAPS for maximum throughput for SIM ports, as Flow Generator always runs at maximum throughput.

Flow Generator limitations and considerations

The following limitations apply specifically to Flow Generator:

- If used on a live production system, Flow Generator traffic will compete with any existing traffic. Consequently, E_Ports and FCIP links can become congested when using Flow Generator, leading to throughput degradation. FCIP links are more prone to congestion than E_Ports.
- Only four active Flow Generator flows are allowed per ingress port.
- Flow Generator flows can only be mirrored at the ingress port; they cannot be mirrored at the egress port.
- Flow Generator is not supported on Access Gateways or for Fibre Channel routers.
- Frame redirection is not supported for SIM ports.
- Zoning is not enforced. Sources and destinations can be in different zones.
- Flow Generator gathers source and destination pairs from the zoning database for learning flows only at the time the flow is activated. Subsequent changes to this database will not be registered until a flow is reactivated.
- If a SIM port configuration is deleted while the port is online, Flow Vision automatically stops all Flow Generator flows, but the flows are not deactivated.

Flow Mirror

Overview of Flow Mirror

As storage networks get larger and more complicated, it is becoming increasingly important to have non-intrusive diagnostic tools which can help identify problems without the need of disturbing the existing fabric. Flow mirroring is a diagnostic feature within Flow Vision that addresses this need.

Flow Mirror provides you with the ability to:

- Non-disruptively create copies of application flows that can be captured for deeper analysis.
- Conduct in-depth analysis of flows of interest, such as SCSI Reservation frames, ABTS frames, flows going to a bottlenecked device, and others.
- Select the type of frames you want to be mirrored.
- Select a traffic pattern and create a real-time copy of this traffic, allowing you to debug a live system without disturbing existing connections. You can also use this feature as a way to view traffic passing through a port.

Flow Mirror duplicates the specified frames in a user-defined flow, and sends them to a sink. This sink could be either:

- The Local switch control processor unit (CPU); this form is called CPU flow mirroring or CFM, and has a limit of 256 frames per second.
- An external analyzer/packet sniffer connected through a port in the metaSAN. The limit for this is the bandwidth of the mirror destination port. This form is called Local flow mirroring (LFM), and mirrors the flow to a port on the same physical switch. This requires that a loopback SFP be plugged in at the other end of the analyzer, or on the port configured as a mirror port, which must be in the same domain.

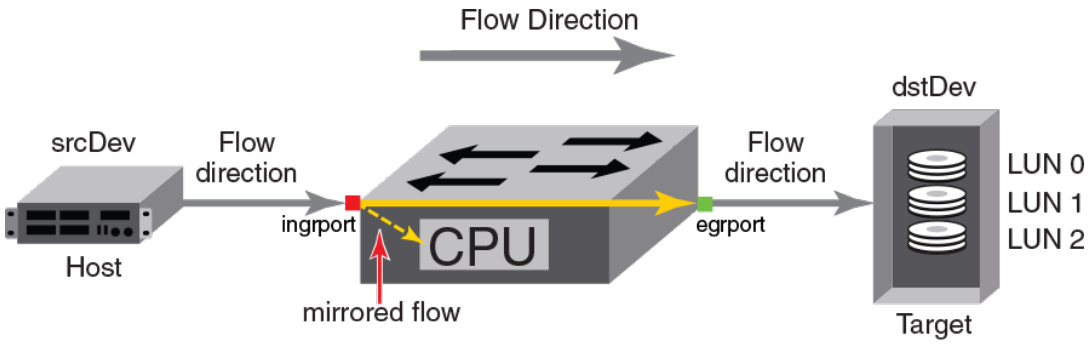
NOTE
Any mirroring possible in CFM is also possible in LFM, however LFM and CFM are mutually exclusive.

Flow Mirror flows can be in an active or inactive state. If the mirror flow is “active”, mirroring starts immediately; if the flow is “inactive”, the flow must be activated (by using the **flow --activate** command) for mirroring to start. Mirrored flows can be unidirectional or bidirectional.

A sample use case would be to mirror the traffic flow from a slow-draining F_Port to see what is causing this condition. Diagnosing a slow-draining F_Port on page 86 provides an example of this use case.

The following figure provides a diagram of a flow that mirrors to the CPU the traffic ingressing through the ingrport. Flow Mirror can similarly mirror the egrport, but only one port (ingrport or egrport) can be mirrored per flow. To mirror from one port in both flow directions (left to right and right to left in the figure), the **-bidir** keyword must be used in the flow definition.

FIGURE 13 A flow being mirrored to the CPU



Creating Flow Mirror flows

To create a Flow Mirror flow, use the **flow --create** *flow_name* **-feature mirror** *parameters* command.

When you create a flow, it is automatically activated unless you use the **-noactivate** keyword as part of the **flow --create** command. Refer to Creating an inactive flow in Flow Mirror on page 80 for an example.

Figure 1 on page 17 illustrates how the frame and port parameters apply to a flow. The following table shows the supported Flow Mirror flow parameter combinations.

TABLE 11 Flow Mirror-supported flow parameter combinations

Parameters	Field names	Description
Port	ingrport egrport	• One field only must be specified. • Values must be explicit. • Can only be an F_Port local to the switch, a Gen 5 (16 Gbps) F_Port, or a Gen 5 F_Port trunk on the local domain.
Frame	srcdev dstdev lun frametype	• Only one field can be specified. • Values for srcdev and dstdev can be explicit or "*" ("*" indicates learned flows). • Values for lun and frametype must be explicit.
Optional keyword parameters		
	-bidir	Adding this keyword makes the application mirror traffic in both directions.

TABLE 11 Flow Mirror-supported flow parameter combinations (Continued)

Parameters	Field names	Description
	-noactivate	Adding this keyword creates the flow without activating it.
	-noconfig	Adding this keyword creates the flow without saving the flow to the configuration.

The following example creates a Flow Mirror flow named “flowmirror14” that mirrors traffic flowing from device “080e00 “ to device “080f00” ingressing through the port 14 on the switch on which this command was run.

```
switch:admin> flow --create flowmirror14 -feature mirror -ingrport 14 -srcdev 080e00 -
dstdev 080f00
Mirror feature(s) have been activated.
```

Flow Mirror limitations and restrictions

The following limitations and restrictions apply specifically to Flow Mirror flows and flow mirroring:

- Flow Mirror is supported only on Gen 5 Fibre Channel platforms.
- Only one active Flow Mirror flow is supported per chassis or fixed-port switch.
- Active Flow Mirror flows are mutually exclusive with the In-Flight Encryption/Compression feature on a blade or fixed-port switch. However, if Flow Mirror flows can exist on one blade and In-Flight encryption/compression can be enabled on a different blade in the same chassis, then they can co-exist.
- You cannot simultaneously mirror to a local port (LFM) and to the CPU (CFM). These are mutually exclusive.
- A mirror port cannot be either an ingress or egress port of the flow definition.
- The **flow --create enable_wrap** and **flow --create disable_wrap _wrap** command are only applicable to CPU flow mirroring.
- The mirror port should always be in the local domain.
- For bidirectional traffic, if the combined traffic rate exceeds the limit of the mirror port traffic limit, then the Flow Mirror flow is not permitted. (For example, the combined rate of a bidirectional flow from a 16 Gbps port is 32 Gbps, and so cannot be mirrored to a 16 Gbps mirror port.)
- If a flow monitor flow defined using the “-frametype” keyword as part of the **flow** command is installed on an ingress port, and a matching Flow Mirror flow is installed on an egress port, then traffic egressing through the egress port is not mirrored.
- If a flow is created for both Flow Monitor and Flow Mirror that uses a combination of either the “-frametype” and “-ingrport” keywords, or a combination of “-frametype”, “-egrport”, and “bidir” keywords, frames matching these definitions will be monitored but will not be mirrored.
- If a Flow Monitor flow is created on a blade or fixed-port switch that uses a combination of either the “-frametype” and “-ingrport” keywords, or a combination of “-frametype”, “-egrport”, and “bidir” keywords, then Flow Mirror frames matching any flow definitions defined using the “-ingrport” keyword that use ports on the same blade or fixed-port switch are not mirrored.
- Flow Mirror is not supported in Access Gateway mode or on SIM ports that are specified as ingress or egress ports in the flow definition.
- Flow Mirror cannot mirror:
  - Frames belonging to device-switch communication (for example, a FLOGI or PLOGI action)
  - Link Primitives, discarded frames, frames from a remote Control Unit Port (CUP), Link Control Frames, or frames containing domain controller addresses used as source IDs
- For flows mirrored to a CPU, only the first 256 frames are mirrored. If a greater number of frames that match the flow definition within a second are identified, those later frames are not mirrored.

For example, on a fixed-port switch, if 500 frames meet the flow definition in the first second of the Flow Mirror operation, only the first 256 frames are mirrored. In the next second, frame mirroring will begin with the five-hundred-and-first frame that matches the flow definition. The intervening frames will not be mirrored, even though they match the flow definition.

The following table shows the maximum frame rate and mirroring capacity for each platform type.

TABLE 12 Flow Mirror CFM frame rates and frame capacity

Platform type	Maximum rate (frames per second)	Maximum capacity (frames)
Fixed-port switch	256	1280
Chassis-based systems	256	5120

Local flow mirroring

Local flow mirroring (LFM) allows you to mirror a flow to a port in the same domain that the flow has been defined in. This mirrored data can then be analyzed through an external analyzer/frame sniffer connected to the port.

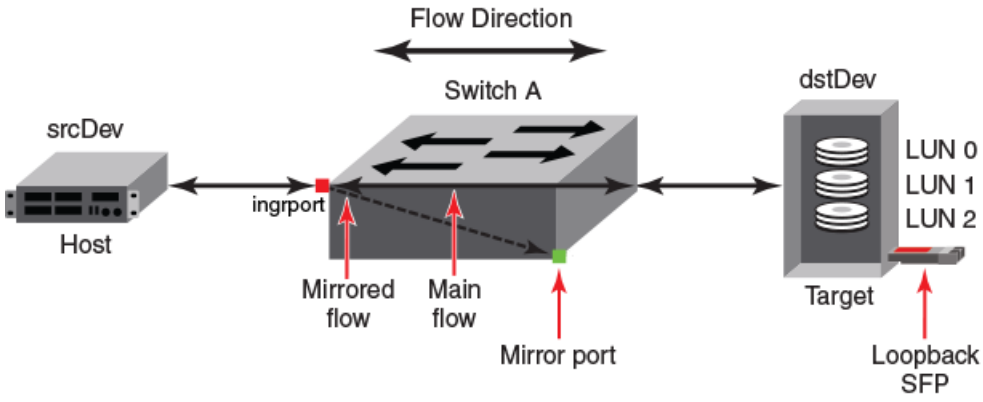
To mirror traffic to a local port, the port must be configured as a mirror port before it is used in the flow definition. A loopback SFP should be plugged in at the other end of the analyzer or on the port configured as a mirror port.

Here is the pattern for a command creating a flow definition to mirror a local flow:

- First: Use the **portcfg mirrorport** *port_num* **--enable** command to configure the mirror port.
- Next: Use the **flow --create** *flow_name* **–feature mirror –srcDev** *SrcDevID* **-dstDev** *DestDevID* **-ingrport** *portID* **-bidir –mirrorport** *port_num* to create the flow that is mirrored to that port.

A typical configuration for local flow mirroring is shown below.

FIGURE 14 Sample local flow mirroring configuration



The following example configures port 16 as a mirror port, then creates a flow for all traffic flowing from device 010e00 to device 010f00 ingressing through port 14 that sends the mirrored frames to the mirror port, and finally displays a list of the flows followed by the results of the flow.

```
switch:admin> portcfg mirrorport 16 --enable

switch:admin> flow --create fmtest -feature mirror -srcdev 010e00 -dstdev 010f00 -ingrport 14 -
mirrorport 16
Mirror feature(s) have been activated.
```

```
switch:admin> flow --show
-------------------------------------------------------------------------------------------------------
Flow Name           |Feature| SrcDev | DstDev |IngrPt|EgrPt|BiDir|LUN|FrameType|SFID|DFID|MirPt|
-------------------------------------------------------------------------------------------------------
sys_gen_all_simports|gen    |*       |*       |*     |*    |no   |-  |-        |-   |-   |-    |
fmtest              |mir+   |010e00  |010f00  |14    |-    |no   |-  |-        |-   |-   |16   |
-------------------------------------------------------------------------------------------------------
  + Denotes feature is currently activated for the flow
  The flow name with prefix sys_ denotes predefined flow

switch:admin> flow --show fmtest -feature mirror
=======================================================================================================
Name      : fmtest      Features: mir(Activated)        noConfig: Off
Definition: IngrPort(14),SrcDev(0x010e00),DstDev(0x010f00),MirPort(16)

Flow Mirror (Activated):
-------------------------------------------------------------------------------------------------------
No of Mirrored Frames : 91134, No of RX Mirrored Frames : 91134, No of TX Mirrored Frames : 0
-------------------------------------------------------------------------------------------------------
=======================================================================================================
```

After a port is configured as a mirror port, the **switchshow** command output looks similar to the following example:

```
switch:admin> switchshow|grep
Port
Index Port Address Media Speed       State    Proto
   3   3   010300   id    N16       Online      FC  G-Port
   4   4   010400   id    16G       Online      FC  SIM-Port 20:04:00:27:f8:93:6a:23
   5   5   010500   id    16G       Online      FC  SIM-Port 20:05:00:27:f8:93:6a:23
   6   6   010600   id    16G       Online      FC  SIM-Port 20:06:00:27:f8:93:6a:23
   7   7   010700   id    16G       Online      FC  SIM-Port 20:07:00:27:f8:93:6a:23
   8   8   010800   id    N8        Online      FC  G-Port
  14  14   010e00   id    N8        Online      FC  F-Port  50:08:01:60:09:15:7a:03
  15  15   010f00   id    N8        Online      FC  F-Port  50:08:01:60:09:15:7a:02
  16  16   011000   id    8G        Online      FC  Mirror Port<— Mirror port identification
```

After a port is configured as a mirror port, the **portcfgshow** command output looks similar to the following example:

```
switch:admin> portcfgshow 16
Area Number:              16
Speed Level:              AUTO(SW)
AL_PA Offset 13:          OFF
Trunk Port                ON
Long Distance             OFF
VC Link Init              OFF
Locked L_Port             OFF
Locked G_Port             OFF
Disabled E_Port           OFF
Locked E_Port             OFF
ISL R_RDY Mode            OFF
RSCN Suppressed           OFF
Persistent Disable        OFF
LOS TOV enable            OFF
NPIV capability           ON
QOS Port                  AE
Port Auto Disable:        OFF
Rate Limit                OFF
EX Port                   OFF
Mirror Port               ON <— Mirror port identification
SIM Port                  OFF
Credit Recovery           ON
F_Port Buffers            32
E_Port Credits            OFF
Fault Delay:              0(R_A_TOV)
NPIV PP Limit:            126
NPIV FLOGI Logout:        OFF
CSCTL mode:               OFF
D-Port mode:              OFF
D-Port over DWDM:         OFF
FEC:                      ON
FEC via TTS:              OFF
Non-DFE:                  OFF
```

Creating an inactive flow in Flow Mirror

To create an inactive Flow Mirror flow, enter the **flow --create** *flow_name* **-feature mirror** *flow_parameters* **-noactive** command.

The following example creates an inactive Flow Mirror flow named “mirroredflow120” from device 020a00 to device 01c000 ingressing through port 120.

```
switch:admin> flow --create mirroredflow120 -noactivate -feature mirror -ingrport
120 -srcdev 0x020a00 -dstdev 0x01c000
```

Refer to Activating Flow Mirror flows on page 80 for information on activating a Flow Mirror flow.

Activating Flow Mirror flows

To activate an inactive Flow Mirror flow, complete the following steps.

1. Connect to the switch and log in using an account with admin permissions.
2. Enter **flow --activate** *flow_name* **-feature mirror**.

The following example activates the Flow Mirror flow named “Flow1”.

```
switch:admin> flow --activate Flow1 -feature mirror
```

NOTE
Activating a Flow Mirror flow automatically clears all the flow statistics for that flow.

Automatic activation of a Flow Mirror flow

Flow Mirror automatically activates a mirroring flow under the following conditions:

- On flow creation, unless the flow is created using the **-noactivate** keyword as part of the **flow** command.
- On slot power-on, if the port specified is part of the slot being powered on and the flow was active when the slot was powered off.
- On a High Availability (HA) failover, HA reboot, or a power cycle, if the flow was active when the HA event occurred.

NOTE
Flow Mirror will not automatically re-activate a flow if the port types are other than Gen 5 (16 Gbps) F_Ports or F_Port trunks.

Viewing Flow Mirror flows

The following sections describe the different ways of viewing frames mirrored by Flow Mirror.

Summary information view of a Flow Mirror flow

To display the summary view of a Flow Mirror flow, enter **flow --show** *flow_name* **-feature mirror**.

In the summary information view, the first output line lists the flow name and the flow features; the second line lists the source and destination devices and ports, and the flow's directionality; the third line identifies the active features. The following section presents a table with a line for each mirrored frame listing the destination ID, the OXID (originator exchange identifier) of the flow, the RXID (responder exchange identifier) of the flow, the start of frame and end of frame values, the frame type, the LUN, the direction of the frame, and the time stamp of the frame. A learned field column (indicated by an asterisk (*) adjacent to the column name) is added to the output only if the flow definition does not contain the keyword associated with the field for this column. The last data line displays the total number of frames sent to the CPU, the total number of received frames and the total number of transmitted frames.

The following example displays the summary information recorded for the Flow Mirror flow named "fmshow". The LUN column is a learned field in this example.

```
switch:admin> flow --show fmshow -feature mirror
=================================================================================================
Name      : fmshow  Features: mir(Activated) noConfig: Off
Definition: IngrPort(2),SrcDev(*)
Flow Mirror (Activated):
-------------------------------------------------------------------------------------------------
| SID(*)  | DID(*)  | OXID | RXID | SOF    | EOF  |Frame_type| LUN(*) | Dir | Time-Stamp         |
-------------------------------------------------------------------------------------------------
| 040200  | 040f00  | 0ca0 | ffff | SOFi3  | EOFt | SCSIRead | 0000   | Rx  | Jul 12 06:29:13:639|
| 040200  | 040f00  | 0bea | 0be1 | SOFn3  | EOFn | Data     | ----   | Rx  | Jul 12 06:29:13:639|
| 040200  | 040f00  | 0f42 | ffff | SOFi3  | EOFt | SCSIWrite| 0000   | Rx  | Jul 12 06:29:13:639|
| 040200  | 040f00  | 0dc0 | ffff | SOFi3  | EOFt | SCSIRead | 0000   | Rx  | Jul 12 06:29:13:639|
| 040200  | 040f00  | 0592 | ffff | SOFi3  | EOFt | SCSIRead | 0000   | Rx  | Jul 12 06:29:13:639|
......
| 000000  | fffffe  | 801e | ffff | SOFi3  | EOFt | FLOGI    | ----   | Rx  | Jul 12 06:29:45:292|
| 040200  | fffffc  | 8024 | ffff | SOFi3  | EOFt | PLOGI    | ----   | Rx  | Jul 12 06:29:49:411|
| 040200  | fffffd  | 8028 | ffff | SOFi3  | EOFt | ELSframe | ----   | Rx  | Jul 12 06:29:49:411|
| 040200  | fffc04  | 88b9 | ffff | SOFi3  | EOFt | 01       | ----   | Rx  | Jul 12 06:29:51:614|
| 040200  | fffc04  | 802c | ffff | SOFi3  | EOFt | PRLI     | ----   | Rx  | Jul 12 06:29:51:614|
-------------------------------------------------------------------------------------------------
 No of Mirrored Frames : 528, No of RX Mirrored Frames : 528, No of TX Mirrored Frames : 0
-------------------------------------------------------------------------------------------------
=================================================================================================
```

Verbose information view of a Flow Mirror flow

To display all the information recorded for a flow, enter **flow --show** *flow_name* **-feature mirror -verbose**.

In the verbose information view, the first output line lists the flow name and the flow features; the second line lists the source and destination devices and ports; the third line identifies the active features. The following lines list for each frame the time stamp of the frame, the direction of the frame, the start of frame and end of frame values, the frame type, and the first 64 bytes (16 words) of the frame. The last data line displays the number of frames sent to the switch Control Processor Unit (CPU), the number of received frames and the number of transmitted frames. If any learned field (indicated by an asterisk (*) adjacent to the column name) is part of the flow definition, then that field is displayed in the show output (there will be a column in the output representing this field).

The following example displays all the information recorded for the Flow Mirror flow named "fmshow". The LUN column is a learned field in this example, and the "Frame Contents" column has been trimmed.

```
switch:admin> flow --show fmshow -feature mirror -verbose
=======================================================
Name      : fmshow Features: mir(Activated) noConfig: Off
Definition: IngrPort(2),SrcDev(*)
Flow Mirror (Activated):
-------------------------------------------------------------------------------------------------------
| Time-Stamp          | Dir | SOF    | EOF     | Frame_type  | LUN(*) | Frame Contents               |
```

```
-------------------------------------------------------------------------------------------------------
| Jul 12 06:29:13:637 | Rx  | SOFn3  | EOFn    | Data        | ----   | 01040f00 00040200 08000008 … |
| Jul 12 06:29:51:614 | Rx  | SOFi3  | EOFt    | PRLI        | ----   | 22fffc04 00040200 01290000 … |
| Jul 12 06:29:51:622 | Rx  | SOFi3  | EOFt    | 01          | ----   | 23fffc04 00040200 01990000 … |
| Jul 12 06:29:51:625 | Rx  | SOFi3  | EOFt    | 01          | ----   | 23fffc04 00040200 01990000 … |
| Jul 12 06:30:10:951 | Rx  | SOFi3  | EOFt    | Abort       | ----   | 81fffffc 00040200 00090000 … |
| Jul 12 06:30:12:970 | Rx  | SOFi3  | EOFt    | 20          | ----   | 02fffffc 00040200 20290000 … |
     (output truncated)
-------------------------------------------------------------------------------------------------------
 No of Mirrored Frames : 530, No of RX Mirrored Frames : 530, No of TX Mirrored Frames : 0
-------------------------------------------------------------------------------------------------------
=======================================================================================================
```

Viewing a Flow Mirror flow in time blocks

To display all the information recorded for a Flow Mirror flow blocked out using a specific time interval, enter **flow --show** *flow_name* **-feature mirror -t** *num*.

The “-t” parameter applies only to Flow Mirror flows. The *num* value is the number of seconds between samples, and can be 6, 7, 8, 9, or 10. The default value is 7. Using this parameter updates the output on the console at the specified time interval until you press **Ctr+C**. In time interval output, only frames that were mirrored in the time window between t and t+t (for example at 6, 12, 18, 24… seconds) are displayed.

The following examples shows the frame rates for the Flow Mirror flow named “fmshow” at 6-second intervals. The time stamp for each frame is for the frame, not the time block. At the bottom of each interval block, a data line displays the total number of mirrored frames sent to the CPU, the total number of received mirrored frames and the total number of frames mirrored during the previous interval.

This example shows the result of mirroring the flow to the CPU (CFM).

```
switch:admin> flow --show fmtime_cfm -feature mirror -time 6
=======================================================================================================
Name      : fmtime_cfm    Features: mir(Activated)    noConfig: Off
Definition: EgrPort(15),SrcDev(0x010e00),DstDev(0x010f00),BiDir

Flow Mirror (Activated):
-------------------------------------------------------------------------------------
| OXID | RXID | SOF    | EOF      | Frame_type  | LUN(*) | Dir | Time-Stamp          |
-------------------------------------------------------------------------------------
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 09:45:34:100 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 09:45:34:100 |
 (output truncated)
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 09:45:38:110 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 09:45:38:110 |
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 09:45:38:110 |
-------------------------------------------------------------------------------------
 No of Mirrored Frames : 1280, No of RX Mirrored Frames : 640, No of TX Mirrored Frames : 640
-------------------------------------------------------------------------------------
=======================================================================================================
=======================================================================================================
Name      : fmtime_cfm    Features: mir(Activated)    noConfig: Off
Definition: EgrPort(15),SrcDev(0x010e00),DstDev(0x010f00),BiDir

Flow Mirror (Activated):
-------------------------------------------------------------------------------------
| OXID | RXID | SOF    | EOF      | Frame_type  | LUN(*) | Dir | Time-Stamp          |
-------------------------------------------------------------------------------------
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 09:45:41:100 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 09:45:41:100 |
 (output truncated)
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 09:45:45:109 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 09:45:45:109 |
-------------------------------------------------------------------------------------
 No of Mirrored Frames : 1280, No of RX Mirrored Frames : 640, No of TX Mirrored Frames : 640
-------------------------------------------------------------------------------------
=======================================================================================================
=======================================================================================================
Name      : fmtime_cfm    Features: mir(Activated)    noConfig: Off
Definition: EgrPort(15),SrcDev(0x010e00),DstDev(0x010f00),BiDir
```

```
Flow Mirror (Activated):
-------------------------------------------------------------------------------------
| OXID | RXID | SOF    | EOF      | Frame_type  | LUN(*) | Dir | Time-Stamp          |
-------------------------------------------------------------------------------------
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 09:45:47:100 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 09:45:47:100 |
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 09:45:47:100 |
 (output truncated)
| 0001 | ffff | SOFn3  | EOFn     | Data        | ----   | Tx  | Jun 05 09:45:51:109 |
| 0044 | ffff | SOFn3  | EOFn     | Data        | ----   | Rx  | Jun 05 09:45:51:109 |
-------------------------------------------------------------------------------------
 No of Mirrored Frames : 1280, No of RX Mirrored Frames : 640, No of TX Mirrored Frames : 640
-------------------------------------------------------------------------------------
=====================================================================================
(output truncated)
```

This example shows the result of mirroring the flow to a local port (LFM).

```
switch:admin> flow --show fmtime_lfm -feature mirror -time 6
=====================================================================================
Name      : fmtime_lfm    Features: mir(Activated)    noConfig: Off
Definition: EgrPort(15),SrcDev(0x010e00),DstDev(0x010f00),MirPort(16)

Flow Mirror (Activated):
-------------------------------------------------------------------------------------
 No of Mirrored Frames : 481442, No of RX Mirrored Frames : 0, No of TX Mirrored Frames : 481442
-------------------------------------------------------------------------------------
=====================================================================================
=====================================================================================
Name      : fmtime_lfm    Features: mir(Activated)    noConfig: Off
Definition: EgrPort(15),SrcDev(0x010e00),DstDev(0x010f00),MirPort(16)

Flow Mirror (Activated):
-------------------------------------------------------------------------------------
 No of Mirrored Frames : 716244, No of RX Mirrored Frames : 0, No of TX Mirrored Frames : 716244
-------------------------------------------------------------------------------------
=====================================================================================
=====================================================================================
Name      : fmtime_lfm    Features: mir(Activated)    noConfig: Off
Definition: EgrPort(15),SrcDev(0x010e00),DstDev(0x010f00),MirPort(16)

Flow Mirror (Activated):
-------------------------------------------------------------------------------------
 No of Mirrored Frames : 951046, No of RX Mirrored Frames : 0, No of TX Mirrored Frames : 951046
-------------------------------------------------------------------------------------
=====================================================================================
(output truncated)
```

Learning in Flow Mirror flows

Flow Mirror supports learning for both source and destination devices. To specify learning in a Flow Mirror flow, identify the parameter to be learned by using an asterisk inside quotation marks ("*") for the device identifier.

For a flow using learning, if the frame type is specified in the flow definition, the value for **-frametype** must be a fixed value for the flow to work. Refer to Flow frametype parameters on page 19 for a list of valid **-frametype** values.

The following example creates a Flow Mirror flow using the learning capability to mirror traffic from any device to any device that is ingressing through port 1/20.

```
switch:admin> flow --create fmir_learn1-20 -feature mirror -ingrport 1/20 -srcdev "*"
-dstdev "*"
```

Deactivating Flow Mirror flows

Flow Mirror flows can be deactivated without deleting them. This allows you to have a “library” of flows that you can activate as needed without having to create them repeatedly.

To manually deactivate a Flow Mirror flow, enter **flow --deactivate** *flow_name* **-feature mirror**.

The following example deactivates the Flow Mirror flow named “Flow1”:

```
switch:admin> flow --deactivate Flow1 -feature mirror
```

Automatic deactivation of a Flow Mirror flow

Flow Vision automatically deactivates a Flow Mirror flow if any of the following changes to a port defined as part of the mirrored flow occur:

- An ingress or egress port defined in the flow has the port type change to other than an F_Port or F_Port Trunk. You must correct the port type error and then manually reactivate the flow.
- Slot power being powered off for ingress or egress ports. Reactivation occurs automatically when the power is restored.

Customizing Flow Mirror CFM flow frame retention

You can change how frames mirrored to a CPU are retained in the Flow Mirror buffer when it is full.

To have the Flow Mirror buffer overwrite existing frames in the buffer on a first-in-first-out basis when full (replacing the oldest frames with newer ones), enter **flow --control -feature mirror -enable_wrap**.

To have the Flow Mirror buffer discard any additional mirrored frames once the buffer is full, enter **flow --control -feature mirror -disable_wrap**.

The **-enable_wrap** and **-disable_wrap** keywords affect only Flow Mirror flows, but they apply to all Flow Mirror flows, so you cannot specify a flow name. By default, **-enable_wrap** is active.

ATTENTION
All Flow Mirror flows must be inactive to use **-enable_wrap** or **-disable_wrap** as part of a **flow --control** command. If any Flow Mirror flow is active when you run the command, it will fail and an error message will be displayed in the interface.

To see the current buffer setting, enter **flow --show -ctrlcfg** (the buffer status appears in the last line of the following example, and is called out).

```
switch:admin> flow --show -ctrlcfg
SimPort Information
-----|------|--------|-------------------------|------------------|------------------
Slot | Port |  PID   |          PWWN           | SID Frame Count  | DID Frame Count |
-----|------|--------|-------------------------|------------------|------------------
  1  |  2   | 050200 | 20:02:00:05:1e:e2:8e:00 |      0K          |      19480K     |
-----|------|--------|-------------------------|------------------|------------------
Addressing mode information
Port Addressing Mode : index
Device Addressing Mode: PID
Flow Generator Information
Size: 2048
Pattern: Random (Default)
Flow mirror Information
  enable_wrap <- current buffer setting
```

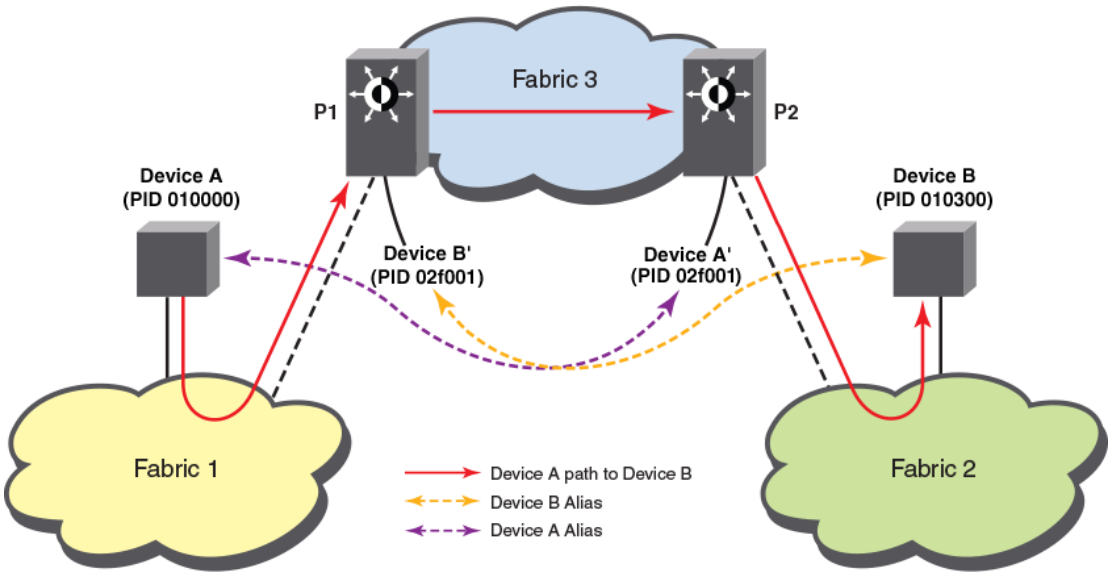
Mirroring traffic flowing to remote fabrics

Flow Vision allows you to mirror traffic that is flowing to a remote fabric.

To mirror traffic that is flowing to a remote fabric, in the flow definition you must specify the imported port ID or real PWWN of the device in the other fabric.

The following illustration shows how such a mirroring situation might be constructed. In this illustration, if the flow definition is made on Device A (a switch in Fabric 1), then you must use the imported port ID for B′ to mirror to a port on device B in Fabric 2. If the flow definition is given in WWN mode, then the real PWWN of Device B can be used instead.

FIGURE 15 Mirroring traffic flowing to a remote fabric



The following example creates shows the proxy identifications and output of such a flow.

```
switchP1:admin> fcrproxydevshow
  Proxy           WWN             Proxy      Device    Physical    State
 Created                           PID       Exists      PID
in Fabric                                   in Fabric
-------------------------------------------------------------------------
     1   20:00:00:11:0d:07:00:00  02f001        2       010300   Imported
Total devices displayed: 1

switchP2:admin> fcrproxydevshow
  Proxy           WWN             Proxy      Device    Physical    State
 Created                           PID       Exists      PID
in Fabric                                   in Fabric
-------------------------------------------------------------------------
     2   10:00:8c:7c:ff:25:9b:00  02f001        1       010000   Imported
Total devices displayed: 1

switchP2:admin> flow --create fm_edge1_edge2 -srcdev 010000 -dstdev 02f001 -feature mirror -ingrport
3/22 -mirrorport 3/43
Mirror feature(s) have been activated.

switch2:admin> flow --show
-------------------------------------------------------------------------------------------------
Flow Name           |Feature |  SrcDev |  DstDev |IngrPt|EgrPt|BiDir|LUN  |FrameType |SFID|DFID|MirPt |
-------------------------------------------------------------------------------------------------
sys_gen_all_simports|gen     |*        |*        |*     |*    |no   |-    |-         |-   |-   |-     |
fm_edge1_edge2      |mir+    |010000   |02f001   |3/22  |-    |no   |-    |-         |-   |-   |3/43  |
-------------------------------------------------------------------------------------------------
```

```
  + Denotes feature is currently activated for the flow

switchP2:admin> flow --show fm_edge1_edge2 -feature mirror
=================================================================================================================
Name      : fm_edge1_edge2      Features: mir(Activated)        noConfig: Off
Definition: IngrPort(3/22),SrcDev(0x010000),DstDev(0x02f001),MirPort(3/43)

Flow Mirror (Activated):
-----------------------------------------------------------------------------------------
No of Mirrored Frames : 1903144, No of RX Mirrored Frames : 1903144, No of TX Mirrored Frames : 0
-----------------------------------------------------------------------------------------
=================================================================================================================
```

Troubleshooting using Flow Mirror

The following use cases describe how to use Flow Mirror to troubleshoot typical fabric performance problems.

Diagnosing excessive SCSI reserve and release activity

If there is excessive SCSI reserve and release activity in a virtualized environment, you can use Flow Mirror to identify the affected LUNs.

The following example creates a flow to mirror all the SCSI release frames from multiple servers to LUNs on the target on port 1/20. You can then analyze the mirrored frames to determine the impacted LUNs.

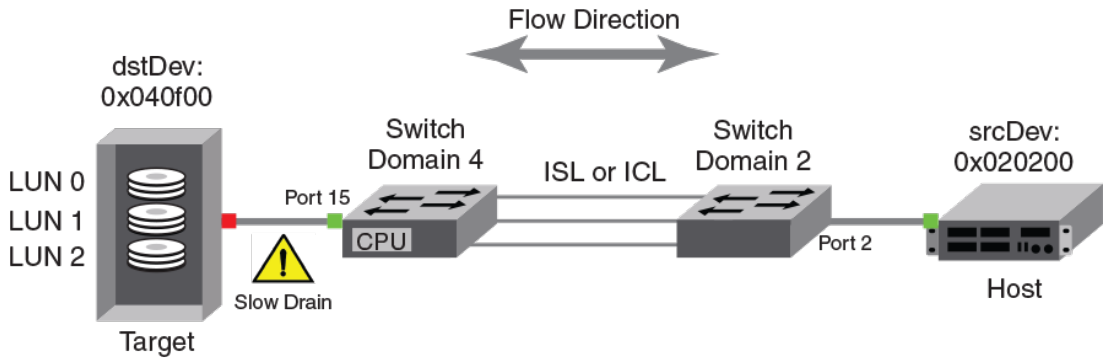
```
switch:admin> flow --create flow_scsi -feature mirror -egrport 1/20 -srcdev "*" -dstdev "*" -frametype
scsiresrel
-------------------------------------------------------------------------------------------------------------
| SID(*)  | DID(*)  | OXID | RXID | SOF    | EOF   | Frame_type  | LUN(*) | Dir | Time-Stamp          |
-------------------------------------------------------------------------------------------------------------
| b28600  | a2bd00  | 0f27 | ffff | SOFi3  | EOFt  | SCSI3_Rel   | 0003   | Tx  | Jul 16 17:21:47:253 |
| b28000  | a2bd00  | 09de | ffff | SOFi3  | EOFt  | SCSI3_Rel   | 0002   | Tx  | Jul 16 17:21:47:253 |
| b2c680  | a2bd00  | 0afe | ffff | SOFi3  | EOFt  | SCSI3_Rel   | 0001   | Tx  | Jul 16 17:21:47:253 |
| b28600  | a2bd00  | 0f51 | ffff | SOFi3  | EOFt  | SCSI3_Rel   | 0005   | Tx  | Jul 16 17:21:47:253 |
| b28000  | a2bd00  | 09f0 | ffff | SOFi3  | EOFt  | SCSI3_Res   | 0002   | Tx  | Jul 16 17:21:47:253 |
| b28600  | a2bd00  | 0f1f | ffff | SOFi3  | EOFt  | SCSI3_Rel   | 0004   | Tx  | Jul 16 17:21:47:253 |
       (output truncated)
```

Diagnosing a slow-draining F_Port

A slow-draining F_Port can be challenging to diagnose. Bottleneck detection allows you to identify the slow draining F_Port, and Flow Mirroring helps you identify the affected LUN on that F_Port.

The following example creates a flow to mirror traffic passing in both directions from device 0x020200 to F_Port 15 on device 0x040F00, and then displays the output. (The “Frame Contents” column has been trimmed in this example.) The following image provides a illustration of what is happening in the example.

FIGURE 16 A Flow Mirror revealing a slow drain




```
switch:admin> flow --create slwdrn -feature mirror -egrport 15 -dstdev 0x040f00 -srcdev 0x020200 -bidir

switch:admin> flow --show slwdrn -feature mirror -verbose
Name       : flow_slowdrain  Features: mir(Active)
Definition: EgrPort(15),SrcDev(0x020200),DstDev(0x040f00),BiDir
Flow Mirror (Active):
-------------------------------------------------------------------------------------------------
| Time-Stamp          | Dir | SOF    | EOF   | Frame_type | LUN(*) | Frame Contents                |
-------------------------------------------------------------------------------------------------
| Jul 12 06:29:13:637 | Rx  | SOFn3 | EOFn | Data       | ----   | 01040f00 00020200 08000008 … |
| Jul 12 06:29:13:639 | Rx  | SOFi3 | EOFt | SCSIRead   | 0000   | 06040f00 00020200 08290000 … |
| Jul 12 06:29:13:639 | Rx  | SOFi3 | EOFt | SCSIWrite  | 0000   | 06040f00 00020200 08290000 … |
| Jul 12 06:29:13:639 | Rx  | SOFi3 | EOFt | SCSIRead   | 0000   | 06040f00 00020200 08290000 … |
| Jul 12 06:29:13:639 | Rx  | SOFn3 | EOFn | Data       | ----   | 01040f00 00020200 08000008 … |
| Jul 12 06:29:13:639 | Rx  | SOFi3 | EOFt | SCSIRead   | 0000   | 06040f00 00020200 08290000 … |
| Jul 12 06:29:49:398 | Rx  | SOFi3 | EOFt | FLOGI      | ----   | 22ffffe 00000000 01290000 … |
| Jul 12 06:29:49:411 | Rx  | SOFi3 | EOFt | PLOGI      | ----   | 22ffffc 00020200 01290000 … |
| Jul 12 06:29:49:411 | Rx  | SOFi3 | EOFt | ELSframe   | ----   | 22fffffd 00020200 01290000 … |
| Jul 12 06:29:51:614 | Rx  | SOFi3 | EOFt | PRLI       | ----   | 22fffc04 00020200 01290000 … |
     (output truncated)
-------------------------------------------------------------------------------------------------
 No of Mirrored Frames : 530, No of RX Mirrored Frames : 530, No of TX Mirrored Frames : 0
-------------------------------------------------------------------------------------------------
```

Tracking SCSI commands

There are many reasons why you might want to see the SCSI commands being initiated by a host. For example, such a flow could be used to find all the targets that the host is communicating with. Getting this data can help identify the favorite targets of a host, which would then allow you to provide additional privileges like QoS or TI path creation between those devices.

If you want to see all the SCSI frames being initiated by a host device (for example, the host H1 connected to port F1 on switch SW Dom1 in the following figure), you would create a pair of flow definitions such as the following on the switch SW Dom 2:

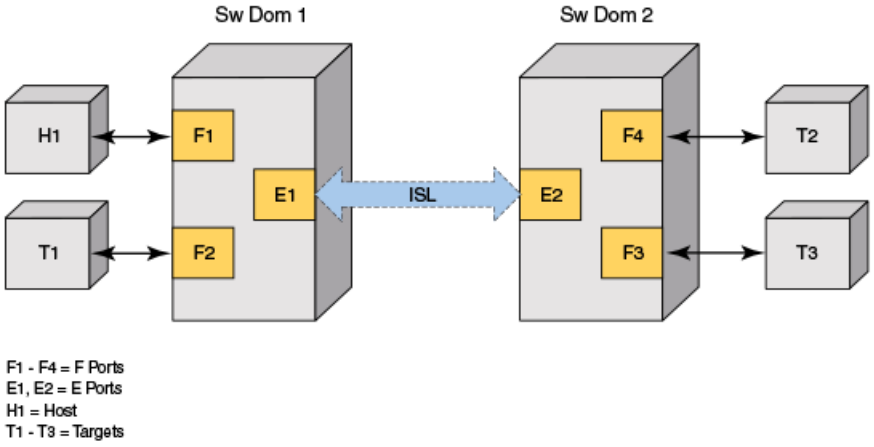
```
switch:admin> flow -create SCSIflow1 -feature mirror -egrport F3 -srcdev H1 -
frametype scsicmd
switch:admin> flow -create SCSIflow1 -feature mirror -ergrport F4 -srcdev H1 -
frametype scsicmd
```

Then you would create a flow definition similar to the following on the switch SW Dom 1:

```
switch:admin> flow -create SCSIflow2 -feature mirror -ingrport F1 -frametype scsicmd
```

This flow will mirror all the frames containing SCSI commands that ingress through port F1. As you can have only one mirror flow active at a time for a chassis or fixed port switch, you cannot trap all the frames initiated by H1 to both T2 and T3 at the same time. This makes it almost impossible to capture all the SCSI command frames initiated by H1. However, by using the **–frametype** option along with **–ingrport** option, you can still track frames between a given initiator and target pair. This will help you view any of the SCSI frames which are being sent out by H1 to any target in the zone.

FIGURE 17 SCSI command tracking

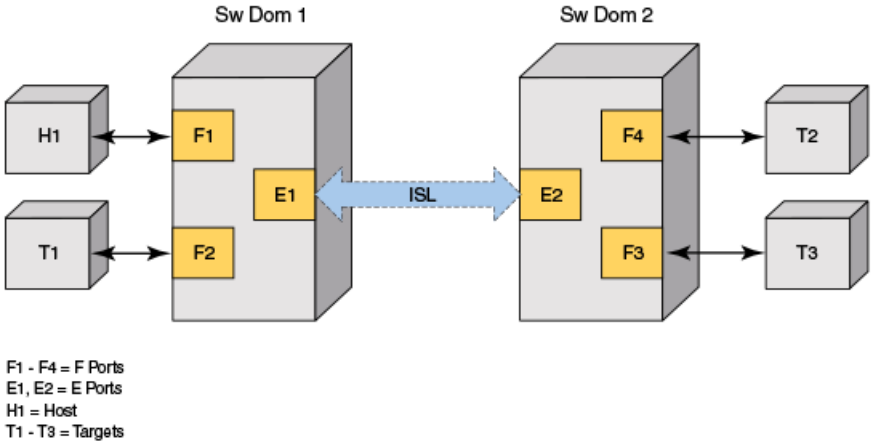


Tracking latency between a host and all connected targets

In order to smooth out application performance, you may want to track the latency of SCSI Initiator-Target pairs so that you can load balance them.

The following examples capture all the SCSI commands and their status frames initiated by device H1 ingressing through port F1, as illustrated by the following figure. This will capture all the SCSI commands and status frames that can be viewed using Flow Vision. You can then deduce the latency between a SCSI command and its respective status frame for a CPU-mirrored flow at the host port by viewing the output of the Flow Mirror flow using the **flow --show** command, and for a local mirrored flow by viewing the mirrored frame data.

FIGURE 18 SCSI command tracking for latency



NOTE
In both of the following examples, specifying **-frametype scsicmdsts** implicitly makes the flow capture bidirectional.

Tracking latency using a CPU-mirrored flow

To track the latency using a CPU-mirrored flow, you create the flow and then use the **flow --show** command to view the captured results. In this case, the latency is an approximate latency (best effort latency), because the latency is an approximate latency block completion time. You can use the time stamps on the appropriate frames and deduce the latency from those values. The following example shows a typical command for this purpose; be aware that the output is dependent on the fabric topology.

```
switch:admin> flow --create fm_scsicmdsts -feature mirror -srcdev 10:00:8c:7c:ff:25:aa:00 -ingrport
3/11 -frametype scsicmdsts
Mirror feature(s) have been activated.

switch:admin> flow --show fm_scsicmdsts -feature mirror
================================================================================================
Name      : fm_scsicmdsts    Features: mir(Activated)    noConfig: Off
Definition: IngrPort(3/11),SrcDev(10:00:8c:7c:ff:25:aa:00),FrameType(scmdsts)

Flow Mirror (Activated):
------------------------------------------------------------------------------------------------
| DID(*)  | OXID | RXID | SOF    | EOF      | Frame_type  | LUN(*) | Dir | Time-Stamp          |
------------------------------------------------------------------------------------------------
| 072300  | 0772 | ffff | SOFi3  | EOFt     | SCSIRead    | 0000   | Rx  | Jun 05 12:23:50:334 |
| 072300  | 0b5c | ffff | SOFi3  | EOFt     | SCSIRead    | 0000   | Rx  | Jun 05 12:23:50:334 |
(output truncated)
| 072b00  | 0c30 | 0d3d | SOFi3  | EOFt     | SCSIGoodSts | ----   | Tx  | Jun 05 12:24:09:347 |
| 07cac0  | 056c | ffff | SOFi3  | EOFt     | SCSIWrite   | 0000   | Rx  | Jun 05 12:24:09:347 |
------------------------------------------------------------------------------------------------
 No of Mirrored Frames : 5120, No of RX Mirrored Frames : 2567, No of TX Mirrored Frames : 2553
------------------------------------------------------------------------------------------------
================================================================================================
```

Tracking latency using a local mirrored flow

To track the latency using a locally mirrored flow, you must first specify the mirror port, and then create the flow using that mirror port. You can then deduce the latency by viewing the mirrored frames. In this case, the latency is close to the exact latency, because the latency I/O Block completion time is close to the actual I/O Block time. The following example shows a typical command for this purpose; the output can be viewed on an analyzer.

```
switch:admin> portcfgmirrorport 9 --enable

switch:admin> flow --create LocalMirrorflow -feature mirror -ingrport F1 -srcdev H1 -
frametype scsicmdsts -mirrorport 9
```

Troubleshooting protocol errors

You can use Flow Mirror to mirror protocol error frames by creating a flow that tracks the error frames you want to know about.

The following example mirrors only SCSI abort (ABTS) frames egressing through port 1/20. The Flow Mirror output provides you with samples of the ABTS frames for detailed analysis.

```
switch:admin> flow --create fprotocol_errors -feature mirror -egrport 1/20 -srcdev
"*" -dstdev "*" -frametype abts
```

NOTE
This can also be set up to mirror frames based on the total ABTS count provided by Flow Monitor. The following example creates such a flow to the CPU and then shows the output. IF you wanted to mirror to a local port (LFM), you would add **-mirrorport** *port_ID* at the end of the command.

```
switch:admin> flow --create fm_abts -feature mirror -srcdev "*" -dstdev "*" -ingrport 3/4 -frametype
abts
Mirror feature(s) have been activated.
```

```
switch:admin> flow --show fm_abts
=================================================================================================================
=
Name       : fm_abts    Features: mir(Activated)    noConfig: Off
Definition: IngrPort(3/4),SrcDev(*),DstDev(*),FrameType(abts)

Flow Mirror (Activated):
-----------------------------------------------------------------------------------------------------------------
-
| SID(*)   | DID(*)   | OXID | RXID | SOF    | EOF    | Frame_type   | LUN(*) | Dir | Time-Stamp
|
-----------------------------------------------------------------------------------------------------------------
-
| 072400   | 07ce40   | f59b | ffff | SOFn3  | EOFn   | Abort        | ----   | Rx  | Jun 05 13:18:24:982
|
| 072400   | 07ce40   | f59b | ffff | SOFn3  | EOFn   | Abort        | ----   | Rx  | Jun 05 13:18:24:982
|
| 072400   | 07ce40   | f59b | ffff | SOFn3  | EOFn   | Abort        | ----   | Rx  | Jun 05 13:18:24:982
|

     (output truncated)

| 072400   | 07ce40   | f59b | ffff | SOFn3  | EOFn   | Abort        | ----   | Rx  | Jun 05 13:18:43:983
|
| 072400   | 07ce40   | f59b | ffff | SOFn3  | EOFn   | Abort        | ----   | Rx  | Jun 05 13:18:43:983
|
-----------------------------------------------------------------------------------------------
 No of Mirrored Frames : 5120, No of RX Mirrored Frames : 5120, No of TX Mirrored Frames : 0
-----------------------------------------------------------------------------------------------
=================================================================================================================
=
```

Flow Mirror and High Availability

On High Availability (HA) failover, HA reboot, or a power cycle, Flow Mirror will stop mirroring frames until the system recovers; at which point it will resume mirroring. This could be as early as when the **hashow** command indicates that both control processor units (CPUs) are in sync, but it could occur after HA sync, in which case **switchshow** output would then indicate the correct switch port status. All flow statistics are cleared and reset after a failover recovery. Refer to High Availability and Flow Vision on page 32 for more information.