

53-1002999-01
9 September 2013



Flow Vision

Administrator's Guide

Supporting Fabric OS v7.2.0

BROCADE

Copyright © 2013 Brocade Communications Systems, Inc. All Rights Reserved.

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

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. shall have no liability or responsibility to any person or entity with respect to any loss, cost, liability, or damages arising from the information contained in this book 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>.

Brocade Communications Systems, Incorporated

Corporate and Latin American Headquarters
Brocade Communications Systems, Inc.
130 Holger Way
San Jose, CA 95134
Tel: 1-408-333-8000
Fax: 1-408-333-8101
E-mail: info@brocade.com

Asia-Pacific Headquarters
Brocade Communications Systems China HK, Ltd.
No. 1 Guanghua Road
Chao Yang District
Units 2718 and 2818
Beijing 100020, China
Tel: +8610 6588 8888
Fax: +8610 6588 9999
E-mail: china-info@brocade.com

European Headquarters
Brocade Communications Switzerland Sàrl
Centre Swissair
Tour B - 4ème étage
29, Route de l'Aéroport
Case Postale 105
CH-1215 Genève 15
Switzerland
Tel: +41 22 799 5640
Fax: +41 22 799 5641
E-mail: emea-info@brocade.com

Asia-Pacific Headquarters
Brocade Communications Systems Co., Ltd. (Shenzhen WFOE)
Citic Plaza
No. 233 Tian He Road North
Unit 1308 – 13th Floor
Guangzhou, China
Tel: +8620 3891 2000
Fax: +8620 3891 2111
E-mail: china-info@brocade.com

Document History

Title	Publication number	Summary of changes	Date
<i>Flow Vision Administrator's Guide</i>	53-1002999-01	First release	September 2013

Contents

About This Document

In this chapter.	vii
Supported hardware and software	vii
Document conventions	viii
Text formatting.	viii
Command syntax conventions	ix
Notes, cautions, and warnings.	ix
Key terms.	ix
Brocade Flow Vision terminology.	x
Notice to the reader	x
Additional information	x
Brocade resources	x
Other industry resources	xi
Getting technical help	xi
Document feedback.	xii

Chapter 1

Flow Vision

In this chapter.	1
Overview of Flow Vision	1
Flow Vision features	1
Flow Monitor	1
Flow Generator	1
Flow Mirror.	1
Flows	2
Flow definitions	2
Flow definition rules	3
Supported port configurations.	3
Flow frametype parameters	4
Numbers of flows supported	5
Flow learning	5
Viewing flows	5
Flow Vision references	6
Roles and access in Flow Vision	6
Flow Vision integration with MAPS.	6
Flow Vision licensing	6
Flow Vision configuration setup.	6
Firmware upgrading and downgrading and Flow Vision.	7
High Availability and Flow Vision	7

Chapter 2	Flow Monitor	
	In this chapter.	9
	Overview of Flow Monitor.	9
	Flow Monitor management	10
	Creating Flow Monitor flows	10
	Activating Flow Monitor flows	11
	Deactivating Flow Monitor flows	11
	Viewing Flow Monitor flows.	12
	Learning in Flow Monitor flows.	12
	Deleting Flow Monitor flows	12
	Resetting Flow Monitor flow statistics	13
	Flow Monitor examples	13
	Monitoring LUN level statistics.	13
	Viewing summary flow data for a specific device pair	14
	Monitoring flows using the learning functionality	14
	End-to-end monitor	15
	Frame monitor.	16
	Ingress or egress Top Talker monitor.	17
	Configuring Flow Monitor for a trunk group	18
	Monitoring Fibre Channel routed fabrics	19
	Monitoring FC router fabrics using port WWNs.	19
	Monitoring FC router fabrics using proxy IDs.	24
	Flow Monitor references	29
	Flow monitors and MAPS	29
	Flow monitors on Access Gateways	29
	Flow Monitor and High Availability	29
	Flow Monitor limitations	29
Chapter 3	Flow Generator	
	In this chapter.	31
	Overview of Flow Generator.	31
	Flow Generator setup	31
	Flow Generator management	32
	Creating Flow Generator flows	32
	Activating Flow Generator flows.	33
	Learning in Flow Generator flows.	34
	Viewing Flow Generator flows.	34
	Deactivating Flow Generator flows	36
	Deleting Flow Generator flows	36
	Resetting Flow Generator flow statistics	37
	Customizing Flow Generator flows.	37
	Flow Generator examples	38
	Creating a flow from a specific Source ID to a specific Destination ID	38
	Integrating Flow Generator with Flow Monitor	39
	Flow Generator references	40
	Commands related to Flow Generator.	40

SIM-Port attributes and configuration	41
Sending traffic using a Fabric Assigned WWN	42
Flow Generator and MAPS	43
Flow Generator and High Availability	43
Flow Generator limitations and considerations	43

Chapter 4 Flow Mirror

In this chapter.	45
Overview of Flow Mirror	45
Flow Mirror management.	46
Creating Flow Mirror flows	46
Activating Flow Mirror flows	47
Viewing Flow Mirror flows	48
Learning in Flow Mirror flows	51
Deactivating Flow Mirror flows	51
Deleting Flow Mirror flows	52
Resetting Flow Mirror flow statistics	52
Customizing Flow Mirror flows	52
Troubleshooting using Flow Mirror	53
Using Flow Mirror to diagnose SCSI reserve and SCSI release performance	53
Using Flow Mirror to troubleshoot protocol errors.	53
Using Flow Mirror to diagnose a slow-draining F_Port	53
Flow Mirror references	55
Flow Mirror and High Availability	55
Flow Mirror limitations	55

Index

About This Document

In this chapter

- [Supported hardware and software](#) vii
- [Document conventions](#) viii
- [Brocade Flow Vision terminology](#) x
- [Notice to the reader](#) x
- [Additional information](#) x
- [Getting technical help](#) xi
- [Document feedback](#) xii

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 guide 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 v7.2.0, 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:

- Fixed-port switches:
 - Brocade 300 switch
 - Brocade 5100 switch
 - Brocade 5300 switch
 - Brocade 5410 embedded switch
 - Brocade 5424 embedded switch
 - Brocade 5430 embedded switch
 - Brocade 5431 embedded switch
 - Brocade 5450 embedded switch
 - Brocade 5460 embedded switch
 - Brocade 5470 embedded switch
 - Brocade 5480 embedded switch
 - Brocade M6505 embedded switch
 - Brocade 6505 switch
 - Brocade 6510 switch

- Brocade 6520 switch
- Brocade 6547 embedded switch
- Brocade 7800 extension switch
- Brocade VA-40FC
- Brocade Encryption Switch
- Brocade DCX Backbone family:
 - Brocade DCX
 - Brocade DCX-4S
- Brocade DCX 8510 Backbone family:
 - Brocade DCX 8510-4
 - Brocade DCX 8510-8
- Brocade blades:
 - Brocade FC8-32E
 - Brocade FC8-48E

Document conventions

This section describes text formatting conventions and important notice formats used in this document.

Text formatting

The narrative-text formatting conventions that are used are as follows:

bold text	Identifies command names Identifies the names of user-manipulated GUI elements Identifies keywords and operands Identifies text to enter at the GUI or CLI
<i>italic text</i>	Provides emphasis Identifies variables Identifies paths and Internet addresses Identifies document titles
<code>code text</code>	Identifies CLI output Identifies command syntax examples

For readability, command names in the narrative portions of this guide are presented in mixed lettercase: for example, **switchShow**. In actual examples, command lettercase is often all lowercase. Otherwise, this manual specifically notes those cases in which a command is case-sensitive.

Command syntax conventions

Command syntax in this manual follows these conventions:

command	Commands are in bold.
--option, option	Command options are in bold.
-argument, arg	Arguments.
[]	Optional element.
<i>variable</i>	Variables are in italics.
...	Repeat the previous element, for example “member[;member...]”
value	Fixed values following arguments are in plain font. For example, --show WWN
	Boolean. Elements are exclusive. Example: --show -mode egress ingress

Notes, cautions, and warnings

The following notices and statements are used in this manual. They are listed below in 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 potential damage to hardware or data.



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.

Key terms

For definitions specific to Brocade and Fibre Channel, see the *Brocade Glossary*.

For definitions of SAN-specific terms, visit the Storage Networking Industry Association online dictionary at:

<http://www.snia.org/education/dictionary>

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.
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.

Notice to the reader

This document may contain references to the trademarks of the following corporations. These trademarks are the properties of their respective companies and corporations.

These references are made for informational purposes only.

Corporation	Referenced Trademarks and Products
Microsoft Corporation	Windows, Windows NT, Internet Explorer
Mozilla Corporation	Mozilla, Firefox
Netscape Communications Corporation	Netscape
Red Hat, Inc.	Red Hat, Red Hat Network, Maximum RPM, Linux Undercover
Oracle, Inc.	Sun, Solaris, Oracle, Java

Additional information

This section lists additional Brocade and industry-specific documentation that you might find helpful.

Brocade resources

To get up-to-the-minute information, go to <http://my.brocade.com> and register at no cost for a user ID and password.

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

<http://www.brocade.com/products-solutions/products/index.page>

For additional Brocade documentation, visit the Brocade Info Center and click the Resource Library location:

<http://www.brocade.com>

Release notes are available on the My Brocade website and are also bundled with the Fabric OS firmware.

Other industry resources

For additional resource information, visit the Technical Committee T11 website. This website provides interface standards for high-performance and mass storage applications for Fibre Channel, storage management, and other applications:

<http://www.t11.org>

For information about the Fibre Channel industry, visit the Fibre Channel Industry Association website:

<http://www.fibrechannel.org>

Getting technical help

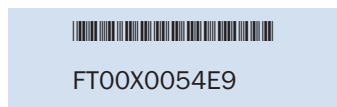
Contact your switch support supplier for hardware, firmware, and software support, including product repairs and part ordering. To expedite your call, have the following information available:

1. General Information

- Switch model
- Switch operating system version
- Error numbers and messages received
- **supportSave** command output
- Detailed description of the problem, including the switch or fabric behavior immediately following the problem, and specific questions
- Description of any troubleshooting steps already performed and the results
- Serial console and Telnet session logs
- syslog message logs

2. Switch serial number

The switch serial number and corresponding bar code are provided on the serial number label, as illustrated below.



The serial number label is located as follows:

- *Brocade 300, 5100, 5300, 6505, M6505, 6520, 6547, 7800, VA-40FC, and Brocade Encryption Switch*—On the switch ID pull-out tab located inside the chassis on the port side on the left
 - *Brocade 5410, 5424, 5430, 5431, 5450, 5460, 5470, 5480*—Serial number label attached to the module
 - *Brocade 6510*—On the pull-out tab on the front of the switch
 - *Brocade DCX and DCX 8510-8*—On the bottom right on the port side of the chassis
 - *Brocade DCX-4S and DCX 8510-4*—On the bottom right on the port side of the chassis, directly above the cable management comb
3. World Wide Name (WWN)

Use the **wwn** command to display the switch WWN.

If you cannot use the **wwn** command because the switch is inoperable, you can get the WWN from the same place as the serial number, except for the Brocade DCX Backbone family. For the Brocade DCX Backbone family, access the numbers on the WWN cards by removing the Brocade logo plate at the top of the nonport side of the chassis.

For the Brocade 5424 embedded switch, provide the license ID. Use the **licenseIDShow** command to display the WWN.

Document feedback

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. Forward your feedback to:

documentation@brocade.com

Provide the title and version number of the document and as much detail as possible about your comment, including the topic heading and page number and your suggestions for improvement.

Flow Vision

In this chapter

- [Overview of Flow Vision](#) 1
- [Flow Vision features](#) 1
- [Flows](#) 2
- [Flow Vision references](#) 6

Overview of Flow Vision

Flow Vision is a Fibre-Channel SAN network diagnostic tool supported on all platforms supported by Fabric OS 7.2 and later, that provides you with a comprehensive vision of fabric traffic flows and with the ability to non-disruptively create and capture copies of traffic flows for later analysis. 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. You cannot run Flow Vision and Advanced Performance Monitor (APM), or Port Mirroring at the same time on a chassis (across logical switches).

Flow Vision features

Flow Vision has three features: Flow Monitor, Flow Generator, and Flow Mirror. The following sections describe each feature and provides a sample use case link.

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. See [“Flow Monitor”](#) on page 9 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. See [“Flow Generator”](#) on page 31 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. See [“Flow Mirror”](#) on page 45 for a complete description and sample use cases.

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 [Table 3](#) on page 4 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 travelling from x to y and traffic travelling from y to x are both desired flows.

Figure 1 illustrates how the frame and port parameters apply to a flow.

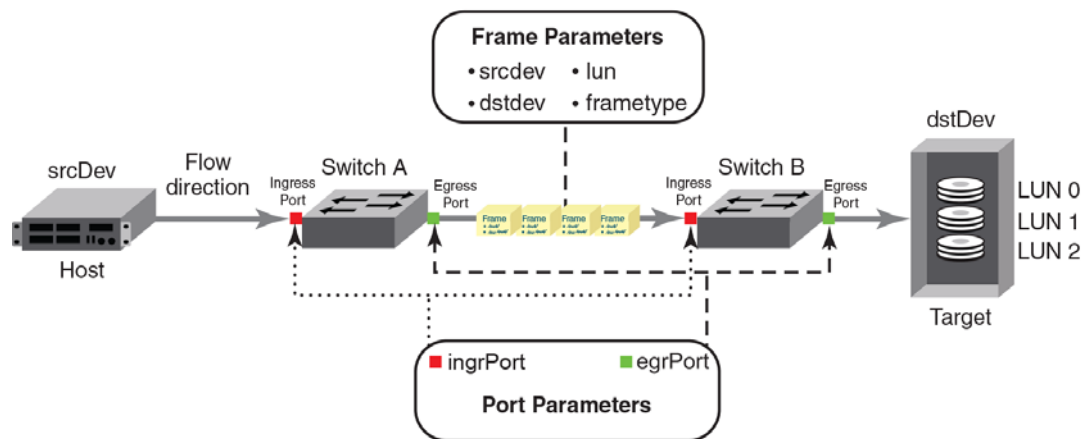


FIGURE 1 Frame and port parameters

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 and can either be explicitly defined or Flow Vision can learn them through observation.

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 knows only its own 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 in the flow command. For example:

```
flow --create flowname -feature monitor,generator <parameters>
flow --show flowname -feature mirror,generator <parameters>
```

Flow definition rules

The rules listed in [Table 1](#) identify what parameters can be used to define a flow.

TABLE 1 Flow definition rules

Parameters	Field names	Rules
Port	ingrport egrport	<ul style="list-style-type: none"> One field only must be specified Values must be explicit
Frame	srcdev dstdev lun frametype ¹	<ul style="list-style-type: none"> 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

1. Refer to [Table 3](#) for more information on frame types.

Supported port configurations

[Table 2](#) lists the supported configurations for each Flow Vision feature using only the basic flow identification parameters (ingrport and srcdev, egrport and dstdev).

TABLE 2 Port configurations supported in Flow Vision

Feature	Platforms		Switch Configuration Mode	
	16 Gbps-capable Fibre Channel ¹	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 only)	Not Supported	Not Supported	Supported
Flow Monitor	Supported (E_Ports, EX_Ports, and F_Ports only)	Supported (F_Ports only)	Supported (F_Ports only)	Supported

1. 16Gbps-capable platforms include the Brocade FC8-32E and FC8-48E blades.

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.

NOTE

Neither ranges nor lists are supported for any parameter.

Flow frametype parameters

Frame monitoring can be done for a variety of frames using predefined **-frametype** parameters. [Table 3](#) list these parameters and the frames counted for each.

On 8 Gbps-capable Fibre Channel platforms, possible frame monitoring flow classifiers include egrport, dstdev, and lun. On 16 Gbps-capable Fibre Channel platforms, including the Brocade FC8-32E and FC8-48E blades, possible frame monitoring flow classifiers include ingrport, egrport, dstdev, srcdev, and lun.

TABLE 3 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
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 ¹	Only SCSI command status frames
scsigoodstatus	Only SCSI status frames with status marked as good (all 0s (zeros) in status byte)
scsichkstatus	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
scsixferdy	Only SCSI FCP XFER_RDY (transfer ready) frames

1. This parameter is valid only for Flow Mirror. It implicitly assumes **-bidir** and looks for both SCSI command and status frames.

Numbers of flows supported

Flow Vision supports a maximum of 512 flows on chassis-based platforms and a maximum of 128 flows on fixed-port platforms. However, there is a combined limit from all features of 64 flows (including static flows, root flows, and sub-flows, whether active or inactive) for any one port. In addition, there are individual limits for each Flow Vision feature; [Table 4](#) lists these limits. A verification is done for each flow when it is created or activated to ensure that there is no identical flow active. Refer to the limitations section of each feature for additional feature-specific restrictions.

TABLE 4 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, root flows, and sub-flows.
Flow Generator	Up to 4 active flows per port, including static flows, root flows, and sub-flows.
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 identify all the devices. 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 12 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 34 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 51 for additional information.

Flow Vision uses an asterisk (*) to indicate a learned flow. When you enter an asterisk as part of the command, you must enclose it in double quotes (“*”).

Learning source device (srcdev) or destination device (dstdev) values is only supported on 16 Gbps-capable Fibre Channel ports.

Viewing flows

To display all Flow Vision flows, enter **flow --show**. To display all flows for a specific feature, enter **flow --show -feature featurename**. To display the definition for a specific flow, enter **flow --show flowname -feature featurename**. When you run **flow --show** with a flow name, then 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 on the ingress or egress port specified in the flow definition.

1 Flow Vision references

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
local	gen	-	019200	13	-	no	-	-
flow2	gen+,mon+	010900	01c100	1/9	-	no	-	-
flow1	gen+,mon+	01c100	-	8/1	-	no	-	-

+ Denotes feature is currently activated for the flow

Refer to the “viewing” section of each individual feature to see feature-specific output.

Flow Vision references

The following sections provide additional information about Flow Vision.

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 integration with MAPS

Statistics generated using Flow Vision can be monitored with the Monitoring and Alerting Policy Suite (MAPS) threshold service. Refer to the MAPS section of each individual feature in this manual 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 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 Administrator's Guide* for more specific information on licenses.

Flow Vision configuration setup

The Flow Vision configuration can be saved through the **configdownload** command and uploaded through the **configupload** command. The **configdefault** command deletes all flows and simulation ports (SIM-Ports) from the switch.

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.

NOTE

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

Firmware upgrading and downgrading and Flow Vision

There are no restrictions on upgrading the firmware of a switch that has Flow Vision installed. 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. 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.

High Availability and Flow Vision

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

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).

Refer to the individual feature's HA section for information on how that feature is treated under HA:

- [“Flow Monitor and High Availability”](#) on page 29
- [“Flow Generator and High Availability”](#) on page 43
- [“Flow Mirror and High Availability”](#) on page 55

NOTE

While disabling a SIM-Port that is receiving traffic may produce class 3 discards for the simulated traffic, this will have no effect on other traffic flows.

1 Flow Vision references

Flow Monitor

In this chapter

- [Overview of Flow Monitor](#) 9
- [Flow Monitor management](#)..... 10
- [Flow Monitor examples](#) 13
- [Monitoring Fibre Channel routed fabrics](#) 19
- [Flow Monitor references](#) 29

Overview of Flow Monitor

Flow Monitor provides you with the following abilities:

- Comprehensive visibility into application flows in the fabric, including the ability to learn (discover) flows automatically.
- Monitoring of application flows (for example: a flow within a fabric from a Host to a Target/LUN) at a given port.
- Capture of statistics for specified flows, providing 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.
- When N_Port ID Virtualization (NPIV) is used on the host, users can monitor VM (Virtual Machine) to LUN level performance as well.
- Monitoring of various frame types at a switch port to provide deeper insights into storage I/O access pattern at a LUN, reservation conflicts, and I/O errors. For example: SCSI Aborts, SCSI Read, SCSI Write, SCSI Reserve, all rejected frames, and many others. See Table 3 on page 4 for a list and description of the frame types that can be monitored.
- Integration with the Monitoring and Alerting Policy Suite (MAPS) service to enable threshold-based monitoring and alerting for flows.

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 13 provides an example of the command and the results for this use case.

The existing Advanced Performance Monitor provides the following monitors: End-to-End, Frame-based, ISL, and Top Talker. Flow Monitor expands on these options by allowing you to monitor any hardware-supported flow parameters and define your own flows using combinations of ingress and egress ports, source and destination devices, LUNs, and frame types as parameters to create a flow definition for a specific use case.

For information on replicating standard Advanced Performance Monitor functionality using Flow Monitor, refer to [“End-to-end monitor”](#), [“Frame monitor”](#), and [“Ingress or egress Top Talker monitor”](#) on page 15.

Flow Monitor management

The following sections describe how to manage the Flow Monitor feature.

Creating Flow Monitor flows

To create a Flow Monitor flow, enter the **flow --create flowname -feature monitor parameters** command using the parameters in Table 5. Figure 1 on page 2 illustrates how the frame and port parameters apply to a flow.

Table 5 shows the supported Flow Monitor flow parameter combinations.

TABLE 5 Flow Monitor flow parameter combinations

Parameters	Field names	Description
Port	ingrport egrport	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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		
	-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 11 for an example of this option.

ATTENTION

Flow creation is not allowed if Advanced Performance Monitor 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

To create an inactive Flow Monitor flow, enter the **flow --create** command with the **-noactivate** keyword.

```
flow --create flowname -feature monitor flow_parameters -noactivate
```

Refer to “[Activating Flow Monitor flows](#)” on page 11 for information on activating a Flow Monitor flow. The following example creates an inactive Flow Monitor flow named “sflow8” from device 020a00 to device 01c000 ingressing through port 10.

```
switch:admin> flow --create sflow8 -feature mirror -ingrport 10 -srcdev 0x020a00 -dstdev 0x01c000  
-noactivate
```

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

To deactivate a Flow Monitor flow, enter **flow --deactivate flowname -feature monitor**. 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 all Flow Monitor flows if any of the following 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 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 this flow.
- The ingress or egress port type changes to anything other than an F_Port or SIM-Port for a flow that has a lun or frametype value specified. The flow will not automatically reactivate if the port type is changed back. You must manually reactivate this 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, IO per second and I/O data transferred on a read/write basis
- Learn Statistics: All learned (“*”) flows on a given F_Port and the throughput and frame statistics for each learned flow on 16 Gbps-capable Fibre Channel platforms

For illustrations of **flow --show** command output, refer to [“Flow Monitor examples”](#) on page 13.

Repeating Flow Monitor output

To specify the number of times the output should be repeated, enter the **flow --show flowname -feature monitor** command with the **-count num** parameter. The *num* value can range from 1 through 10. The default value is 1.

```
flow --create flowname -feature monitor flow_parameters -count num
```

Sorting Flow Monitor output

To sort the data output for a flow, enter the **flow --show flowname -feature monitor** command with the **-sortby column_num** parameter. The *column_num* value is the number of the output column on which the data is to be sorted.

```
flow --create flowname -feature monitor flow_parameters -sortby column_num
```

In Flow Monitor, frames can be sorted whether or not sub-flows are present. The **-sortby** parameter can only be applied when there is only one feature specified in the **flow --show flowname** command.

Learning in Flow Monitor flows

To apply learning to a Flow Monitor flow, use an asterisk inside quotation marks (“*”) to specify the parameter to be learned. The following example creates a Flow Monitor learning flow named “IngressTT” ingressing through port 30. Refer to [“Monitoring flows using the learning functionality”](#) on page 14 to view how the data captured using this flow is displayed.

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

Only 16 Gbps-capable Fibre Channel platforms have the capability to learn flows on a specified port, and learning is possible on F_Ports only. Only one active flow per ASIC can be a learning flow.

Deleting Flow Monitor flows

To delete a flow, enter **flow --delete flowname**. The following example deletes a Flow Monitor flow named “Flow1”.

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

You do not need to include **-feature monitor**, as you can only delete the entire flow; you cannot delete an individual feature from a flow. Deleting a flow automatically clears all the flow statistics for that flow. Deleting a flow removes all instances of that flow; you cannot delete an individual feature from a flow. Deleting an active flow automatically deactivates the flow before it is deleted.

Resetting Flow Monitor flow statistics

To clear the statistics for a Flow Monitor flow, enter `flow --reset flowname -feature monitor`. The following example clears the statistics for the Flow Monitor flow named "Flow1".

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

Flow Monitor examples

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

- [Monitoring LUN level statistics](#)
- [Viewing summary flow data for a specific device pair](#)
- [Monitoring flows using the learning functionality](#)
- [End-to-end monitor](#)
- [Frame monitor](#)
- [Ingress or egress Top Talker monitor](#)
- [Monitoring Fibre Channel routed fabrics](#)

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 "lunFlow1" which monitors traffic ingressing on port 5 between device 010502 and device 030700 that uses lun 4, and then displays the results of that flow. [Figure 2](#) provides an illustration of what is happening in the example.

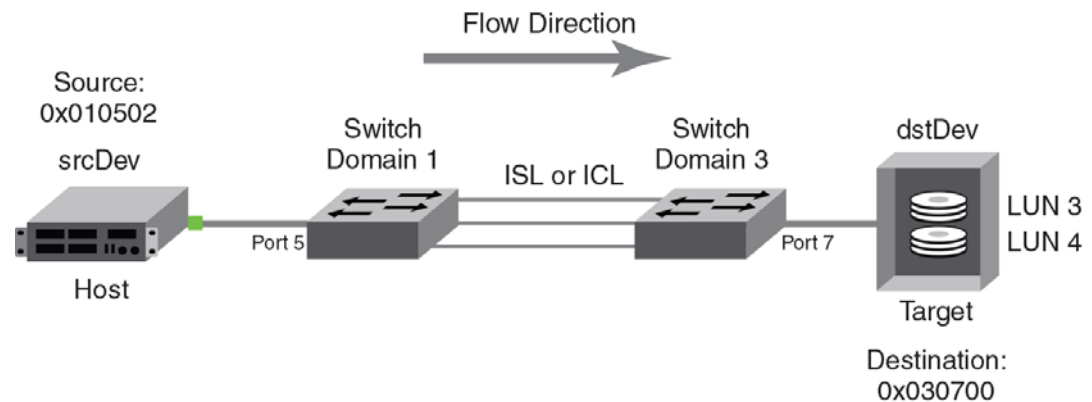


FIGURE 2 A LUN monitoring flow

```
switch:admin> flow --create lunFlow1 -feature monitor -ingrport 5 -srcdev 0x010502 -dstdev 0x030700
-lun 4
switch:admin> flow --show lunFlow1 -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 |
```

2 Flow Monitor examples

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 either an E, EX, 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
sumflow1	mon+	010000	010100

IngrPt	EgrPt	BiDir	LUN	FrameType
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. The defined flow will monitor for frames ingressing on port 30 between all devices.

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

Flow Name	Feature	SrcDev	DstDev
ingressTT	mon+	*	*

```

-----\
|IngrPt|EgrPt |BiDir| LUN  | FrameType|
|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 Count | Rx Frames per Sec. | Rx Bytes Count | Rx Throughput(Bps) \
-----\
|010000|010100| 9.92G           | 201.22k             | 18.87T         | 399.93M           \
|010000|010200| 9.92G           | 201.23k             | 18.87T         | 399.93M           \
|010000|010300| 9.92G           | 201.23k             | 18.87T         | 399.93M           \
|010000|010400| 9.92G           | 201.22k             | 18.87T         | 399.93M           \
-----\
| *    | *    | 39.69G         | 804.91k             | 75.48T         | 1.56G             \
-----\
=====
| Avg Rx Frm Sz(Bytes) |
| 2092                  |
| 2092                  |
| 2092                  |
| 2092                  |
| 2092                  |
-----\
=====

```

The Flow Vision interface provides a single interface for flow management that unifies legacy use cases such as end-to-end (EE) monitors, frame monitors, and so on. The following examples show how to implement the equivalent functionality using Flow Monitor.

End-to-end monitor

You can use the **-bidir** keyword 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 endtoendflow -feature monitor -egrport 4/10 -dstdev 023a00 -srcdev 02d8c0
-bidir
switch:admin> flow --show endtoendflow
=====
Name      : endtoendflow      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)      \
| Tx / Rx / Total | Tx / Rx / Total | Tx / Rx / Total | Tx / Rx / Total \

```

2 Flow Monitor examples

```
-----\
| 65.11M/129.63M/194.75M|962.52k/653.84k/ 1.61M| 99.49G/185.44G/284.93G|958.32M/957.77M/ 1.87G \
-----\
```

```
-----\
| Frame Size(Bytes) |
| Tx / Rx          |
| 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|
|-----|
```

Frame monitor

You can use the **-frametype** parameter to create the equivalent to 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 |
|-----|
| f1                 | mon             | 030300          | 030400          | 3      | -     | no    |
| lrn0               | mon+            | *               | *               | 0      | -     | no    |
| lrn89              | mon+            | *               | *               | 89     | -     | no    |
| scsirw             | mon+            | -               | -               | -      | 2     | no    |
|-----|
```

+ Denotes feature is currently activated for the flow

```
-----\
| LUN | FrameType |
|-----|
| 0   | -         |
| -   | -         |
| -   | -         |
| -   | 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            |
|-----|
```

Ingress or egress Top Talker monitor

You can use the learn flow (“*”) parameter to create the equivalent to a Top Talker monitor. A Top Talker monitor is used to identify high volume flows passing a port. This monitor is only supported on F_Ports. 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
ingresstt	mon+	*	*	41	-	no
egresstt	mon+	*	*	30	-	no

+ Denotes feature is currently activated for the flow

LUN	FrameType
-	-
-	-

```
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 Count	Rx Frames per Sec.	Rx Bytes Count	Rx Throughput(Bps)
012900	051e00	3.97M	112.68k	5.68G	165.06M
012900	020600	7.95M	225.64k	15.09G	438.13M
012900	010700	4.52M	128.62k	4.36G	127.08M
012900	020900	7.90M	224.21k	11.31G	328.43M
*	*	24.36M	691.16k	36.44G	1.03G

Avg Rx Frm Sz(Bytes)
1536
2036
1036
1536
1606

2 Flow Monitor examples

```
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 Count | Tx Frames per Sec. | Tx Bytes Count | Tx Throughput(Bps) \
-----\
|022900|051e00|      7.99M      |      1.86k        |      9.19G      |      2.19M      \
|012c00|051e00|      4.50M      |      1.04k        |      4.35G      |      1.03M      \
|022800|051e00|      7.99M      |      1.86k        |      7.71G      |      1.83M      \
|012a00|051e00|      2.25M      |           524     |      3.22G      |      787.35k    \
|022a00|051e00|      7.38M      |      1.71k        |           14G    |      3.33M      \
|012b00|051e00|      4.50M      |      1.04k        |      4.35G      |      1.03M      \
|012900|051e00|      2.25M      |           524     |      4.27G      |      1.01M      \
-----\
|   *  |   *  |      36.89M     |      8.58k        |      47.11G     |      11.23M     \
-----\
-----
| Avg Tx Frm Sz(Bytes) |
-----
|           1236       |
|           1036       |
|           1036       |
|           1532       |
|           2032       |
|           1036       |
|           2032       |
-----
|           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.

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, this flow is 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.

To view the Flow Monitor statistical data for the entire trunk group, enter **flow --show flowname -feature monitor**. 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 **flow --show** on a flow that is defined using the master port. Flow statistics are not displayed for slave trunk ports.

NOTE

You cannot create a learned flow in a trunk group.

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 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. In the following examples, the flow definitions are based on the Edge 1 Fabric's perspective.

When monitoring an FC router 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.

Monitoring FC router fabrics using port WWNs

The following examples present the flow definitions using **deviceidmode** set to WWN mode.

```
flow --control -deviceidmode wwn
```

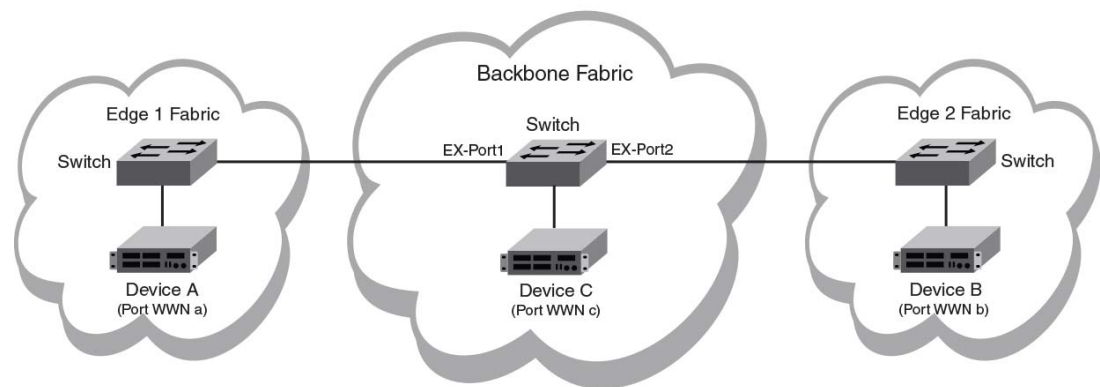


FIGURE 3 An FC router fabric

2 Monitoring Fibre Channel routed fabrics

In Figure 3, the physical devices are A, B, and C, and have the port WWNs a, b, and c, respectively. Figure 4 provides the port WWN values for the following examples.

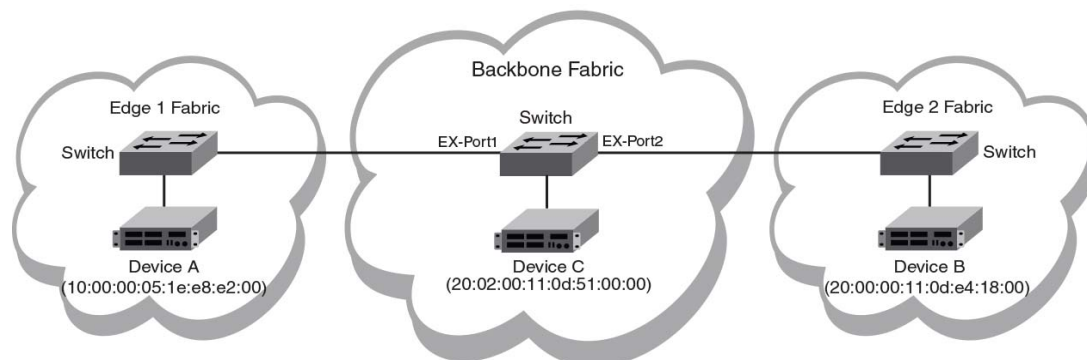


FIGURE 4 An FC router fabric annotated with port WWN values

Edge-to-edge through an ingress port

To monitor a flow from Device A to Device B 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 left to right).

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 FC 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.

```
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
"Wasp_edge2" (fabric id = 50 )(Trunk master)
 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
"Honeybee_edge1" (fabric id = 100 )(Trunk master)
E-Port 50:00:51:e4:91:9e:0f:28 "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 |
-----
```

Edge-to-edge through an egress port

To monitor a flow from Device B to Device A 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).

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 FC 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.

```
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
"Wasp_edge2" (fabric id = 50 )(Trunk master)
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
"Honeybee_edgel" (fabric id = 100 )(Trunk master)
E-Port 50:00:51:e4:91:9e:0f:28 "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 | IngrPt|EgrPt | BiDir| LUN | \
----- \
e2e_dst_dcx |mon+ | 20:00:00:11:0d:e4:18:00|10:00:00:05:1e:e8:e2:00|- | 219 |no | - | \
----- \
```

```
-----
| FrameType|
|- |
-----
```

+ 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 |
-----
```

Backbone-to-edge

To monitor a flow from Device C to Device A 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).

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 FC 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.

```
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
"Wasp_edge2" (fabric id = 50 )(Trunk master)
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
"Honeybee_edgel" (fabric id = 100 )(Trunk master)
E-Port 50:00:51:e4:91:9e:0f:28 "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 | IngrPt|EgrPt | BiDir | LUN | \
----- \
b2e_dst_dcx | mon+ | 20:02:00:11:0d:51:00:00 | 10:00:00:05:1e:e8:e2:00 | - | 219 | no | - | \
----- \
| FrameType |
| - |
-----
```

+ 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 |
-----
```

Edge-to-backbone

To monitor a flow from Device A to Device C ingress 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 left to right).

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 FC 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.

```
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 "Wasp_edge2"
(fabric id = 50 )(Trunk master)
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 "Honeybee_edg
e1" (fabric id = 100 )(Trunk master)
E-Port 50:00:51:e4:91:9e:0f:28 "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	IngrPt	EgrPt	BiDir	LUN
e2b_src_dcx	mon+	10:00:00:05:1e:e8:e2:00	20:02:00:11:0d:51:00:00	219	-	no	-

```
-----
| FrameType |
| -         |
-----
+ 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 FC router fabrics using proxy IDs

The following examples present flow definitions using `deviceidmode` set to PID mode.

```
flow --control -deviceidmode pid
```

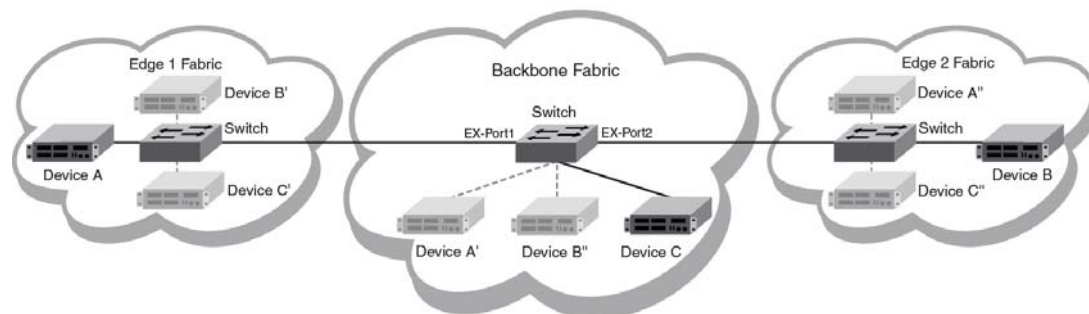


FIGURE 5 An FC router fabric

In Figure 5, the physical devices are A, B, and C. The proxy devices are Device A', B', C', A'', B'', and C'', representing the physical devices A, B, and C, respectively. Figure 6 provides the PID, FID, and proxy PID values for the following examples.

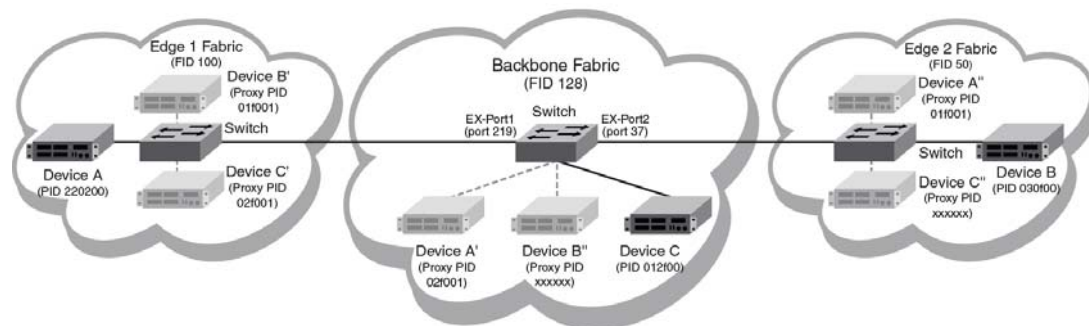


FIGURE 6 An FC router fabric annotated with PID, FID, and proxy PID values

NOTE

The proxy PID values for devices B'' and C'' were not generated for the following examples, they are indicated by "xxxxxx" in Figure 6.

Edge-to-edge through an ingress port

To monitor a flow from Device A to Device B 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).

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 portwnn mode rather than deviceid mode. The first two commands show the available ports and the available FC routers. The third command creates a Flow Monitor flow named "e2e_src_dcx_wnn" between device 220200 and device 01f001 ingressing through port 219, and the last command displays the results of the flow.

```
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
    "Wasp_edge2" (fabric id = 50 )(Trunk master)
 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
    "Honeybee_edgel" (fabric id = 100 )(Trunk master)
    E-Port 50:00:51:e4:91:9e:0f:28 "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_wnn -feature monitor -ingrport 219 -srcdev 220200
-dstdev 01f001
```

```
DCX_Backbone128:admin> flow --show
```

```
----- \
Flow Name | Feature | SrcDev | DstDev | IngrPt | EgrPt | BiDir | LUN |
----- \
e2e_src_dcx_wnn | mon+ | 220200 | 01f001 | 219 | - | no | - |
----- \
| FrameType |
| - |
-----
```

+ Denotes feature is currently activated for the flow

```
DCX_Backbone128:admin> flow --show e2e_src_dcx_wnn -feature monitor
```

```
Name : e2e_src_dcx_wnn 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 |
-----
```

Edge-to-edge through an egress port

To monitor a flow from Device B to Device A 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 right to left).

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 FC 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.

```
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
"Wasp_edge2" (fabric id = 50 )(Trunk master)
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
"Honeybee_edgel" (fabric id = 100 )(Trunk master)
E-Port 50:00:51:e4:91:9e:0f:28 "fcr_xd_2_100"
```

```
DCX_Backbone128:admin> fcrproxydevshow
Proxy WNN 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 | IngrPt|EgrPt |BiDir| LUN | \
----- \
e2e_dst_dcx | mon+ | 01f001 | 220200 | - | 219 | no | - | \
----- \
| FrameType |
| - |
-----
```

+ 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 |
-----
```

Backbone-to-edge

To monitor a flow from Device C to Device A 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 right to left).

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 FC routers. The third command creates a Flow Monitor flow named "b2e_dst_dcx" between device 01f001 and device 220200 egressing through port 219, and the last command displays the results of the flow.

```
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
"Wasp_edge2" (fabric id = 50 )(Trunk master)
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
"Honeybee_edgel" (fabric id = 100 )(Trunk master)
E-Port 50:00:51:e4:91:9e:0f:28 "fcr_xd_2_100"
```

```
DCX_Backbone128:admin> fcrproxydevshow
Proxy WNN 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 | IngrPt | EgrPt | BiDir | LUN | \
----- \
b2e_dst_dcx | mon+ | 02f001 | 220200 | - | 219 | no | - | \
----- \
```

```
-----
| FrameType |
| - |
-----
```

+ 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 |
-----
```

2 Monitoring Fibre Channel routed fabrics

Edge-to-backbone

To monitor a flow from Device A to Device C 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).

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 FC 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.

```
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
"Wasp_edge2" (fabric id = 50 )(Trunk master)
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
"Honeybee_edgel" (fabric id = 100 )(Trunk master)
E-Port 50:00:51:e4:91:9e:0f:28 "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 | IngrPt | EgrPt | BiDir | LUN |
-----\
e2b_src_dcx | mon+ | 220200 | 02f001 | 219 | - | no | - |
-----\
```

```
-----
| FrameType |
| - |
-----
```

+ 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 |
-----
```


Flow Monitor references

The following sections provide additional information about Flow Monitor.

Flow monitors and MAPS

Flow Monitor statistics can be viewed using 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 deviceIDMode is blocked on Access Gateways. This means that the **-devicelDMode WWN** operand is not permitted, so the device ID mode always remains "PID" on Access Gateways.

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 re-activated. Flow Monitor always re-creates these sub-flows based on the order in which the switch learns the flows.

Refer to ["High Availability and Flow Vision"](#) on page 7 for more information.

Flow Monitor limitations

The following limitations apply to all Flow Monitor flows:

- 16 Gbps-capable Fibre Channel platforms, including the Brocade FC8-32E and FC8-48E blades, can support a maximum of 2 flows defined using a combination of ingress port and frame type parameters per ASIC chip.
- 16 Gbps-capable Fibre Channel platforms, including the Brocade FC8-32E and FC8-48E blades, can support a maximum of 12 flows on each port that use both egress port and frame type parameters.
- 8 Gbps-capable Fibre Channel platforms do not support monitoring flows using both ingress port and frame type parameters.
- 8 Gbps-capable Fibre Channel platforms can support a maximum of 12 flows on each port that use both egress port and frame type parameters, except for the Brocade 300, 5300, 5410, 5424, 5450, 5460, 5470, 5480, and 7800 platforms, which support a maximum of 8 flows per port.
- 8 Gbps-capable Fibre Channel platforms and blades cannot show statistics for SIM-Ports.
- 8 Gbps-capable Fibre Channel platforms do not support learning.

2 Flow Monitor references

- Learning is supported on 16 Gbps F_Ports only.
- Only one learned flow is supported per ASIC.
- Flow Monitor can only monitor flows using EX_Ports 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 are not monitored.
- Flow Monitor is not supported on ports with Encryption or Compression enabled.
- Inter-Fabric Link (IFL) flows can be monitored only on EX_Ports in a Fibre Channel router.
- Flow Monitor cannot monitor IFL flows on E_Ports or F_Ports.
- Flow Monitor cannot monitor flows that are using frame redirection for encryption.
- Flow Monitor cannot monitor traffic between logical switches using XISL ports.
- Flow Monitor flows cannot be converted to Fabric OS 7.1 flow performance monitors.
- The calculated Rx and Tx frame size values displayed in the output are accurate to a range of -4 through +8 bytes.

Flow Generator

In this chapter

- [Overview of Flow Generator](#) 31
- [Flow Generator management](#)..... 32
- [Flow Generator examples](#) 38
- [Flow Generator references](#) 40

Overview of Flow Generator

Flow Generator is a test traffic generator for pre-testing the SAN infrastructure (including internal connections) for robustness before deploying it. Flow Generator provides you with the ability to:

- Configure a 16G FC-capable port as a simulated device that can transmit frames at full 16G line rate.
- Emulate a 16G SAN without actually having any 16G 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 standard 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 41 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 to a Destination ID to validate routing and throughput. [“Creating a flow from a specific Source ID to a specific Destination ID”](#) on page 38 provides an example of the command and the results for this use case.



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 setup

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 41.

3 Flow Generator management

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. Figure 7 illustrates this concept.

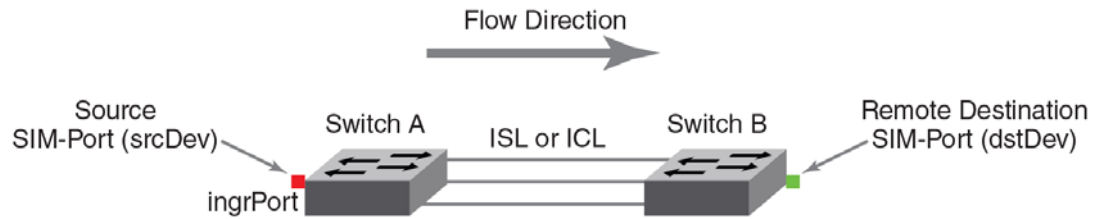


FIGURE 7 A Flow Generator flow structure

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 OXID value for frames is random and cannot be specified.

Flow Generator management

The following sections describe how to work with the Flow Generator flows.

Creating Flow Generator flows

To create a Flow Generator flow, enter the **flow --create flowname -feature generator parameters command** using the parameters described in Table 6.

Table 6 shows the supported Flow Generator flow parameter combinations.

TABLE 6 Flow Generator supported flow parameter combinations

Parameter	Field name	Description
Port	ingrport egrport	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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.

Parameter usage exceptions

- 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.

The following example (illustrated in [Figure 8](#)) creates a Flow Generator flow named “Flow1” generates traffic using the ingress SIM-Port 1/1 from device 040100 (Domain 4) to device 050200 (Domain 5).

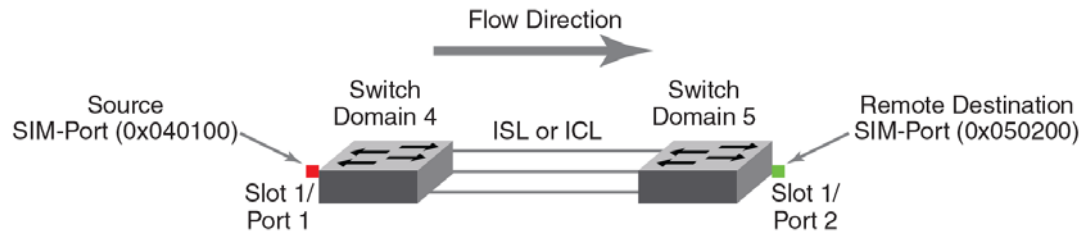


FIGURE 8 A Flow Generator flow between two switches

```
switch:admin> flow --create Flow1 -feature generator -ingrport 1/1 -srcdev 040100
                -dstdev 050200
```

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 33 for an example.

ATTENTION

Flow creation is not allowed if Advanced Performance Monitor 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 the **flow --create** command with the **-noactivate** keyword.

```
flow --create flowname -feature generator flow_parameters -noactivate
```

Refer to [“Activating Flow Generator flows”](#) on page 33 for information on activating a Flow Generator flow. The following example creates an inactive Flow Generator flow named “sflow8” from device 020a00 to device 01c000 ingress through SIM-Port 10.

```
switch:admin> flow --create sflow8 -noactivate -feature generator -ingrport 10
                -srcdev 0x020a00 -dstdev 0x01c000
```

Activating Flow Generator flows

To activate an inactive Flow Generator flow, enter **flow --activate flowname -feature generator**. 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 four Source ID-Destination ID pairs in the zone database that are registered in the Name Server.

3 Flow Generator management

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.

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

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

NOTE

A flow can be activated with SIM-Ports that are offline or which have not been created. If such a flow is activated, an alert message noting that the activated flow is not enforced is displayed.

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.
- On slot power-on if the port parameter only is part of the slot being powered on if the flow was active when the slot was powered off.
- On a High Availability (HA) failover or 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 four flows per source ID to zoned destination IDs. The rest of the destination IDs are not tested. For learned flows, no zone enforcement is applied to either the source or destination SIM-Ports.

If the source or destination port for a sub-flow goes offline, the root flow is deactivated and traffic will be stopped on all sub-flows of that root flow.

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 4. To view the data generated by this flow, refer to [“Viewing the output of a learned Flow Generator flow”](#) on page 35.

```
switch:admin> flow --create fgflow12 -feature generator -ingrport 4 -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 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

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
```

Repeating Flow Generator output

To specify the number of times the output should be repeated, enter the **flow --show flowname -feature generator** command with the **-count num** parameter. The *num* value can range from 1 through 10. The default value is 1.

```
flow --create flowname -feature monitor flow_parameters -count num
```

Sorting Flow Generator output

To sort the data output for a flow, enter the **flow --show flowname -feature generator** command with the **-sortby column_num** parameter. The *column_num* value is the number of the output column on which the data is to be sorted.

```
flow --create flowname -feature monitor flow_parameters -sortby column_num
```

In Flow Generator, frames can be sorted whether or not sub-flows are present. The **-sortby** parameter can only be applied when there is only one feature specified in the **flow --show flowname** command.

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 flowname -feature generator, monitor**).
- If there is more than one static flow active on the port, Flow Generator will append a note stating such at the bottom of the output.

Deactivating Flow Generator flows

To manually deactivate a Flow Generator flow, enter **flow --deactivate flowname -feature generator**. The following example deactivates the Flow Generator flow named “Flow1”.

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

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.

Automatic deactivation of a Flow Generator flow

Flow Vision automatically deactivates all Flow Generator flows and causes existing flow traffic to stop if any of the following occurs:

- Any of the SIM-Ports or devices defined in the flow go offline. For example, HA events on a remote switch will automatically deactivate flows on the local switch. The source or destination device can go offline due to user action, link level issues or due to switch actions (as part of switch bring up).
- A SIM-port configuration is deleted while the port is online.

Refer to [“Flow Generator and High Availability”](#) on page 43 for additional details.

Deleting Flow Generator flows

To delete a Flow Generator flow, enter **flow --delete flowname**. You do not need to include **-feature generator**, as you can only delete the entire flow; you cannot delete an individual feature from a flow.

When you delete a Flow Generator flow, the following happens:

- The flow statistics for that flow remain.
- Associated sub-flows are removed.
- If the flow is active, the flow is automatically deactivated before it is deleted. Refer to [“Deactivating Flow Generator flows”](#) on page 36 for more information.
- You are not asked to confirm the deletion.

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

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


Resetting Flow Generator flow statistics

To manually clear the frame count statistics for a Flow Generator flow, enter **flow --reset flowname -feature generator**. The following example clears the statistics for the Flow Generator flow named “Flow1”.

```
switch:admin> flow --reset 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. There are two ways to change the frame payload size: changing the default payload size and changing the payload size for a single flow. You can use **flow --show -ctrlcfg** to see the current payload size. If you include the flow name in the command, it will show the current payload size for only that flow.

The frame payload size value must be either 0 (which produces frames of random size) or a multiple of 4 in the range from 64 through 2048. (64, 120, 140, 320, 512 and so on). The default payload size value is 2048.

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 a flow frame size

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 “F1” to 1024 bytes.

```
switch:admin> flow --control F1 -feature generator -size 1024
```

Frame payload pattern

Flow Generator allows you to define the pattern to be used as the frame payload. There are two ways to change a frame payload pattern: changing the default payload pattern and changing the payload pattern for a single flow. You can use **flow --show -ctrlcfg** to see the current payload pattern. If you include the flow name in the command, it will show the current payload pattern for only that flow.

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.

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"
```

3 Flow Generator examples

Changing a flow frame payload pattern

Assigning a frame payload pattern explicitly to a flow affects only that flow and overrides the existing frame payload pattern for 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.

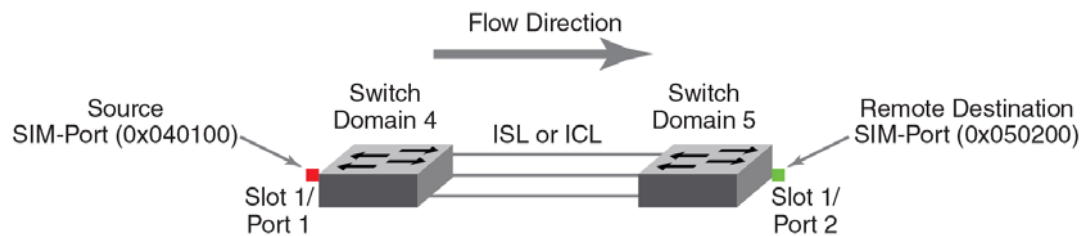


FIGURE 9 A flow from a specific source ID to a specific destination ID

The following example creates the flow as shown in [Figure 9](#). 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 | OK | 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 and Flow Monitor features that share the ingress or egress port. The following example illustrates this integration.

```

switch:admin> flow --create flowCase3Src -feature generator,monitor -ingrPort 1/1 -srcDev 0x010100
-dstDev "*"
switch:admin> flow --show flowCase3Src -feature generator,monitor
Name: flowcase3src 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        |
-----

```

Flow Generator references

The following sections provide additional information about Flow Generator.

Commands related to Flow Generator

The following commands affect or are affected by Flow Generator.

portcfgshow

Entering **portcfgshow** for a specified port shows the configuration of the SIM-Port. (Highlighted in red 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
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 Generator flow statistics”](#) on page 37 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

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. 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. 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 four active flows per ingress SIM-Port and takes 52 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, but that is all that Flow Generator uses zones for.

SIM-Port criteria

Flow Generator 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 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 wildcard (*) but 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 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
- 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 PWWN, unless a user-defined Virtual Port Worldwide Name is assigned to it.
 - Each SIM-Port registers itself into the Name Server database.
- If a port is configured as a SIM Port:
 - You cannot enable QoS.
 - You cannot enable CSCTL_mode.
 - You can set Ingress Rate Limit.
- If a port is configured with QoS on, you cannot configure it as a SIM-Port.
- If a port is configured with CSCTL_mode enabled, you cannot configure it as a SIM-Port.
- If a port has an Ingress Rate Limit set, you can configure it as a SIM-Port.

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 Fabric Assigned Worldwide Name (WWN) 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, causing traffic to be disrupted.

Flow Generator and MAPS

MAPS can be used to monitor SIM-Port traffic thresholds while Flow Generator flows are running. Because MAPS treats SIM-Ports as F_Ports, MAPS can issue warnings on these ports if threshold values are triggered. If you do not want to see MAPS warnings for SIM-Ports, 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.

Flow Generator and High Availability

On a High Availability (HA) failover, HA reboot, or a power cycle and reboot, both local and remote flows are automatically deactivated. 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. Remote flows are not reactivated. Inactive flows are re-created but not activated by an HA failover, HA reboot, or a power cycle and reboot. For a power cycle and reboot, local flows are re-created but not reactivated.

ATTENTION

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

Refer to [“High Availability and Flow Vision”](#) on page 7 for more information.

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.

3 Flow Generator references

Flow Mirror

In this chapter

- [Overview of Flow Mirror](#) 45
- [Flow Mirror management](#) 46
- [Troubleshooting using Flow Mirror](#) 53
- [Flow Mirror references](#) 55

Overview of Flow Mirror

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, frames during link bring up, and others.

Select the type of frames you want to be mirrored. Flow Mirror provides the ability to select a traffic pattern and mirror this traffic to the switch Control Processor Unit (CPU), thus enabling you to perform debugging without disturbing existing connections. You can also use this feature as a way to view traffic passing through a port.

Flow mirroring is enabled by creating a copy of the flow you want to examine. Flow Mirror flows can be in an active state or an 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. [“Using Flow Mirror to diagnose a slow-draining F_Port”](#) on page 53 provides an example of the command and the results for this use case.

Figure 10 provides a diagram of a mirrored flow with the `ingrPort` mirroring the traffic flow to the CPU. Flow Mirror can also 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), you must use the `-bidir` option.

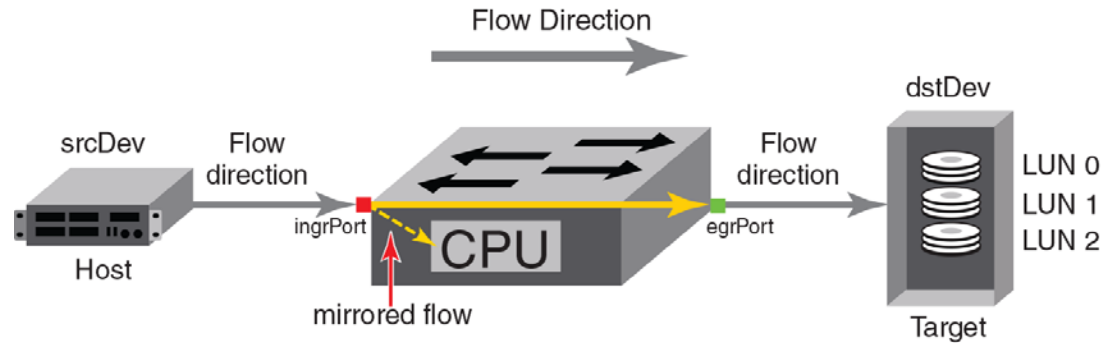


FIGURE 10 A flow being mirrored to the CPU

Flow Mirror management

The following sections describe how to work with Flow Mirror.

Creating Flow Mirror flows

To create a Flow Mirror flow, enter the `flow --create flowname -feature mirror parameters` command using the parameters described in Table 7. Figure 1 on page 2 illustrates how the frame and port parameters apply to a flow.

Table 7 shows the supported Flow Mirror flow parameter combinations.

TABLE 7 Flow Mirror supported flow parameter combinations

Parameters	Field names	Description
Port	<code>ingrport</code> <code>egrport</code>	<ul style="list-style-type: none"> One field only must be specified Values must be explicit Can only be an <code>F_Port</code> local to the switch; for an ingress port, this may be a <code>SIM-Port</code>
Frame	<code>srcdev</code> <code>dstdev</code> <code>lun</code> <code>frametype</code>	<ul style="list-style-type: none"> Only one field can be specified Values for <code>srcdev</code> and <code>dstdev</code> can be explicit or <code>"*"</code> (<code>"*"</code> indicates learned flows) Values for <code>lun</code> and <code>frametype</code> must be explicit
Optional keyword parameters		
	<code>-bidir</code>	Adding this keyword makes the application mirror traffic in both directions.
	<code>-noactivate</code>	Adding this keyword creates the flow without activating it.
	<code>-noconfig</code>	Adding this keyword creates the flow without saving the flow to the configuration.

Parameter usage exceptions

The `frametype` and `-bidir` parameters cannot be specified together for a Flow Mirror flow.

The following example creates a Flow Mirror 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 mirror -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 Mirror”](#) on page 47 for an example.

ATTENTION

Flow creation is not allowed if Advanced Performance Monitor 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 Mirror

To create an inactive Flow Mirror flow enter the **flow --create** command with the **-noactivate** keyword.

```
flow --create flowname -feature mirror flow_parameters -noactivate
```

Refer to [“Activating Flow Mirror flows”](#) on page 47 for information on activating a Flow Mirror flow. The following example creates an inactive Flow Mirror flow (sflow8) from device 020a00 to device 01c000 ingressing through port 10.

```
switch:admin> flow --create sflow8 -noactivate -feature mirror -ingrport 10
                -srcdev 0x020a00 -dstdev 0x01c000
```

Activating Flow Mirror flows

To activate an inactive Flow Mirror flow, enter **flow --activate flowname -feature mirror**. Activating a flow automatically clears all the flow statistics for that flow. The following example activates the Flow Mirror flow named “Flow1”.

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

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.
- On slot power-on if the port parameter is part of the slot being powered on if 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.

Flow Mirror will not automatically re-activate a flow if the port types are other than 16 Gbps-platform F_Ports running at 8 Gbps or less.

Viewing Flow Mirror flows

The following sections describe the different ways you can view Flow Mirror flows.

Summary information view of a Flow Mirror flow

To display the summary view of Flow Mirror flows, enter **flow --show flowname -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 following lines list for each frame 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. The last data line displays the number of frames sent to the CPU, the number of received frames and the number of transmitted frames. An asterisk (*) adjacent to a column name indicates that it is a learned field. A learned field column is added to the output only if the flow definition does not contain the field for this column.

The following example uses **flow --show fmshow -feature mirror** to display the summary information recorded for the Flow Mirror flow named "fmshow".

```
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 the flow, enter the **flow --show flowname -feature mirror** command with the **-verbose** keyword.

```
flow --create flowname -feature mirror flow_parameters -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 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 is part of the flow definition, then that field is not displayed in the show output (that is, there will be no column in the output representing this field).

The following example displays all the information recorded for the Flow Mirror flow named "fmshow".

```
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 dd0000
|                   |     |       |       | 1c 0c1a0ca3 0000e700 b5b5b5b5 b5b5b5b5 b5b5b5b5 b5b5b5b5 b5b5b5b5 b5b5b5b5 b5b5b5b5
|                   |     |       |       | b5 b5b5b5b5 b5b5b5b5 |
| .....
| Jul 12 06:29:51:614 | Rx  | SOFi3 | EOFt  | PRLI       | ----  | 22fffc04 00040200 01290000 4a0000
|                   |     |       |       | 00 802cffff 00000000 20100014 08002000 00000000 00000000 000005a2 |
| Jul 12 06:29:51:622 | Rx  | SOFi3 | EOFt  | 01         | ----  | 23fffc04 00040200 01990000 4b0000
|                   |     |       |       | 00 88bbffff 00000000 02100014 08002100 00000000 00000000 00000022 |
| Jul 12 06:29:51:625 | Rx  | SOFi3 | EOFt  | 01         | ----  | 23fffc04 00040200 01990000 4c0000
|                   |     |       |       | 00 88bcffff 00000000 02000000 |
| Jul 12 06:30:10:951 | Rx  | SOFi3 | EOFt  | Abort      | ----  | 81ffffffc 00040200 00090000 000000
|                   |     |       |       | 00 802affff 00000000 |
| Jul 12 06:30:12:970 | Rx  | SOFi3 | EOFt  | 20         | ----  | 02ffffffc 00040200 20290000 4d0000
|                   |     |       |       | 00 8030ffff 00000000 01000000 fc020000 02170000 00000000 00040200 00000100 00000000 000000
|                   |     |       |       | 00 00000000 00000000 |
-----
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 the **flow --show flowname -feature mirror** command with the **-t num** parameter. The *num* value is the number of seconds between samples.

```
flow --create flowname -feature mirror -t num
```

The *num* value can range from 7 through 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 (that is, between *t* and *t*+10) are displayed. This parameter applies only to Flow Mirror flows.

4 Flow Mirror management

The following example shows the frame rates for the Flow Mirror flow named “fmshow” at 10-second intervals. In this output at the beginning of *t* (time), the frame rate is not displayed, but at *t*+10, *t*+20, and so on, the frame rate is displayed. This rate is based on the difference between the cumulative number of frames mirrored within the specified interval. Notice that the number of frames mirrored during the previous interval is displayed, and the time stamp for each frame is for the frame, not the time chunk.

```
switch:admin> flow --show fmshow -feature mirror -t 10
=====
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 | 804e | ffff | SOFi3 | EOFt | Abort      | ---- | Rx | Jul 12 06:31:40:322 |
| 040200 | 040f00 | 04c2 | ffff | SOFi3 | EOFt | Abort      | ---- | Rx | Jul 12 06:31:40:322 |
-----
No of Mirrored Frames: 2, No of RX Mirrored Frames: 2, No of TX Mirrored Frames: 0
-----
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 | 8052 | ffff | SOFi3 | EOFt | Abort      | ---- | Rx | Jul 12 06:31:50:506 |
| 040200 | 040f00 | 8054 | ffff | SOFi3 | EOFt | ELSframe   | ---- | Rx | Jul 12 06:31:50:506 |
-----
No of Mirrored Frames: 2, No of RX Mirrored Frames: 2, No of TX Mirrored Frames: 0
-----
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 | 14c2 | ffff | SOFi3 | EOFt | SCSIFrame  | 0000 | Rx | Jul 12 06:32:06:039 |
| 040200 | 040f00 | 077e | ffff | SOFi3 | EOFt | SCSIRead   | 0000 | Rx | Jul 12 06:32:06:039 |
| 040200 | 040f00 | 0980 | ffff | SOFi3 | EOFt | SCSIRead   | 0000 | Rx | Jul 12 06:32:06:059 |
| 040200 | 040f00 | 0f64 | ffff | SOFi3 | EOFt | SCSIFrame  | 0000 | Rx | Jul 12 06:32:08:159 |
-----
No of Mirrored Frames: 4, No of RX Mirrored Frames: 4, No of TX Mirrored Frames: 0
-----
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 | 8056 | ffff | SOFi3 | EOFt | ELSframe   | ---- | Rx | Jul 12 06:32:11:091 |
```

```
| 040200 | 040f00 | 8058 | ffff | SOFi3 | EOFt | ELSframe | ---- | Rx | Jul 12 06:32:11:091 |
-----
No of Mirrored Frames: 2, No of RX Mirrored Frames: 2, No of TX Mirrored Frames: 0
-----
=====
[1]+ Stopped
```

Repeating Flow Mirror output

To specify the number of times the output should be repeated, enter the **flow --show flowname -feature mirror** command with the **-count num** parameter. The *num* value can range from 1 through 10. The default value is 1.

```
flow --create flowname -feature mirror flow_parameters -count num
```

Sorting Flow Mirror output

To sort the data output for a flow, enter the **flow --show flowname -feature generator** command with the **-sortby column_num** parameter. The *column_num* value is the number of the output column on which the data is to be sorted.

```
flow --create flowname -feature mirror flow_parameters -sortby column_num
```

In Flow Mirror, mirrored frames can be sorted whether or not sub-flows are present. The **-sortby** parameter can only be applied when there is only one feature specified in the **flow --show flowname** command.

Learning in Flow Mirror flows

Flow Mirror supports learning for both source and destination devices. To apply learning to a Flow Mirror flow, use an asterisk inside quotation marks ("*") to specify the parameter to be learned. For a learning flow, if the frame type is specified in the flow definition, the **-frametype** value must be a fixed value for the flow to work. Refer to [“Flow frametype parameters”](#) on page 4 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 ingressing through port 1/20.

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

Deactivating Flow Mirror flows

To deactivate a Flow Mirror flow, enter **flow --deactivate flowname -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 flow occur:

- An ingress or egress port defined in the flow has the port type change to other than an F_Port. You must manually reactivate the flow.
- A port speed changes to be greater than 8 Gbps. You must manually reactivate the flow.
- Slot power being powered off for ingress or egress ports. Reactivation occurs automatically when the power is restored.

Deleting Flow Mirror flows

To delete a Flow Mirror flow, enter **flow --delete flowname**. You do not need to include **-feature mirror**, as you can only delete the entire flow; you cannot delete an individual feature from a flow. Deleting a flow automatically clears all the flow statistics for that flow. Deleting an active flow automatically deactivates the flow before it is deleted. The following example deletes the Flow Mirror flow named “Flow1”.

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

Resetting Flow Mirror flow statistics

To clear all the mirrored frames and frame statistics for a Flow Mirror flow, enter **flow --reset flowname -feature mirror**. The following example clears the statistics for a Flow Mirror flow named “Flow1”.

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

Customizing Flow Mirror flows

You can change how mirrored frames 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 the **flow --control -feature mirror** command with the **-enable_wrap** keyword.

```
flow --control -feature monitor -enable_wrap
```

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

```
flow --control -feature monitor -disable_wrap
```

These 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 this command. If any Flow Mirror flow is active when you run this command, the command will fail and an error message will be displayed in the CLI.

To see the current buffer setting, enter **flow --show -ctrlcfg** (highlighted in red for illustration).

```
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
```


Troubleshooting using Flow Mirror

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

Using Flow Mirror to diagnose SCSI reserve and SCSI release performance

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)

Using Flow Mirror to troubleshoot protocol errors

You can use Flow Mirror to mirror protocol error frames. The following example mirrors only ABTS frames egressing through port 1/20 to identify the ABTS protocol condition. The Flow Mirror output provides you with samples of the ABTS frames for detailed analysis.

```
switch:admin> flow --create flow_protocol -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.

Using Flow Mirror to diagnose a slow-draining F_Port

The following example creates a flow to mirror traffic passing in both directions from device 0x010200 to F_Port 15 on device 0x040500, and then displays the output. The collected frame data may help you diagnose the slow-draining device. [Figure 11](#) provides a diagram of what is happening in this example.

4 Troubleshooting using Flow Mirror

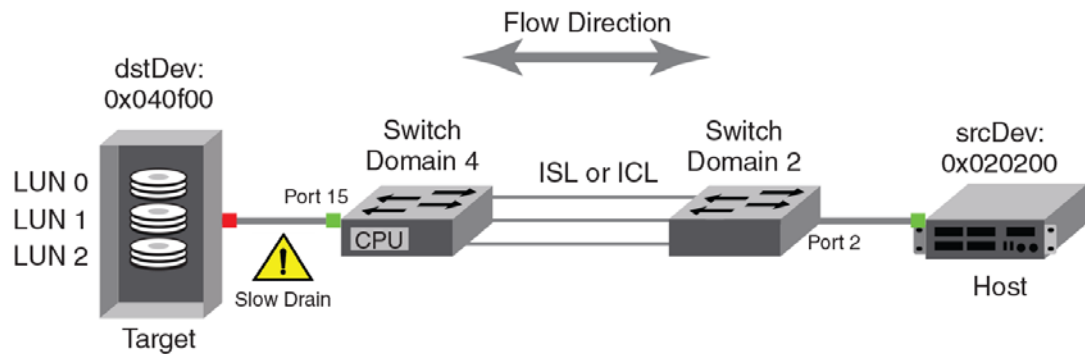


FIGURE 11 A Flow Mirror revealing a slow drain

```
switch:admin> flow --create flow_slowdrain -feature mirror -egrport 15 -dstdev 0x040500 -srcdev 0x010200
-bidir
```

```
switch:admin> flow --show flow_slowdrain -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
| 6900001d 097e0c3f 0000ef40 4a4a4a4a 4a4a4a4a 4a4a4a4a 4a4a4a4a 4a4a4a4a 4a4a4a4a 4a4a4a4a
| 4a4a4a4a 4a4a4a4a 4a4a4a4a 4a4a4a4a |
| Jul 12 06:29:13:639 | Rx  | SOFi3 | EOFt  | SCSIRead  | 0000  | 06040f00 00020200 08290000
| 07000000 0ca0ffff 00000000 00000000 00000000 00000002 28000000 27000001 00000000
| 00000000 00020000 |
| Jul 12 06:29:13:639 | Rx  | SOFi3 | EOFt  | SCSIWrite | 0000  | 06040f00 00020200 08290000
| 04000000 0f42ffff 00000000 00000000 00000000 00000001
| 2a000000 0e000001 00000000 00000000 00020000 |
| Jul 12 06:29:13:639 | Rx  | SOFi3 | EOFt  | SCSIRead  | 0000  | 06040f00 00020200 08290000
| 05000000 0dc0ffff 00000000 00000000 00000000 00000002 28000000 18000001 00000000
| 00000000 00020000 |
| Jul 12 06:29:13:639 | Rx  | SOFn3 | EOFn  | Data       | ----  | 01040f00 00020200 08000008
| dd000028 0c1a0ca3 00014a00 b5b5b5b5 b5b5b5b5 65310005 da000015 00001ca5 b5b5b5b5
| b5b5b5b5 b5b5b5b5 b5b5b5b5 b5b5b5b5 |
| Jul 12 06:29:13:639 | Rx  | SOFi3 | EOFt  | SCSIRead  | 0000  | 06040f00 00020200 08290000
| 02000000 0592ffff 00000000 00000000 00000000 00000002 28000000 1b000001 00000000
| 00000000 00020000 |
| Jul 12 06:29:49:398 | Rx  | SOFi3 | EOFt  | FLOGI     | ----  | 22ffffffe 00000000 01290000
| 00000000 8020ffff 00000000 04000000 20090030 a0000840 00ff0002 000007d0 10000005
| 1ee8e200 20000005 1ee8e200 00000000 |
| Jul 12 06:29:49:411 | Rx  | SOFi3 | EOFt  | PLOGI     | ----  | 22ffffffc 00020200 01290000
| 43000000 8024ffff 00000000 03000000 20090030 80000840 00ff0002 000007d0 10000005
| 1ee8e200 20000005 1ee8e200 00000000 |
| Jul 12 06:29:49:411 | Rx  | SOFi3 | EOFt  | ELSframe  | ----  | 22ffffffd 00020200 01290000
| 44000000 8028ffff 00000000 62000000 01000003 |
| Jul 12 06:29:51:614 | Rx  | SOFi3 | EOFt  | PRLI      | ----  | 22fffc04 00020200 01290000
| 4a000000 802cffff 00000000 20100014 08002000 00000000 00000000 000005a2 |
| .....
| Jul 12 06:30:10:951 | Rx  | SOFi3 | EOFt  | Abort     | ----  | 81ffffffc 00020200 00090000
| 00000000 802affff 00000000 |
-----
```

```
No of Mirrored Frames : 530, No of RX Mirrored Frames : 530, No of TX Mirrored Frames : 0
-----
```

Flow Mirror references

The following sections provide additional information about Flow Mirror.

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 7 for more information.

Flow Mirror limitations

The following limitations apply specifically to Flow Mirror:

- Only mirroring to the switch Control Processor Unit is supported in FOS v7.2.0.
- Flow Mirror is supported only on 16 Gbps-capable Fibre Channel platforms.
- Flow Mirror is supported only on F_Ports operating at 8 Gbps or lower speeds.
- Flow Mirror can only mirror Flow Generator flows at the ingress port.
- Only one active Flow Mirror flow is supported per chassis or fixed-port switch.
- If a flow monitor flow defined using **-frametype** is installed on a ingress port and a matching flow mirror flow is installed on an egress port, then traffic egressing through the egress port is not mirrored.
- Flow Mirror is not supported:
 - On F_Port trunks
 - On SIM-Ports specified as egress ports
 - In Access Gateway mode
- Flow Mirror cannot mirror:
 - Frames from a remote Control Unit Port (CUP) on the egress port
 - Link Control Frames on the egress port
 - Domain Controller addresses used as source ID on the egress port
- Only the first 256 frames (for fixed-port switches) or 1024 frames (for chassis-based systems) are mirrored. If a greater number of frames that match the flow definition within a second are identified, those later frames are discarded.

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.

[Table 8](#) shows the maximum frame rate and mirroring capacity for each platform type.

TABLE 8 Flow Mirror 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

4 Flow Mirror references

Index

A

Access Gateways, flow monitoring on, 29

activating

Flow Generator flows, 33

Flow Mirror flows, 47

Flow Monitor flows, 11

asterisk (*) to indicate a learned flow, 5

B

backward compatibility in Flow Monitor, 30

C

command

configdefault, 6

configdownload, 6

configupload, 6

fapwwn -assign, 42

flow

--activate, 11, 33, 45, 47

--control, 37, 41, 52

--create, 10, 32, 33, 46, 47

--deactivate, 11, 36, 51

--delete, 12, 18, 36, 52

--reset, 13, 37, 40, 52

--show, 5, 12, 34, 35, 37, 48, 49, 51

--show -ctrlcfg, 37, 52

fmmonitor, 16

licenseidshow, xii

portcfgshow, 40

portperfshow, 40

portstatsclear, 40

portstatsshow, 40

slotstatsclear, 40

supportsave, xi

switchshow, 41

wwn, xii

configdefault command, 6

configdownload command, 6

configupload command, 6

configuration database and statistics, 6

configuration, saving, 6

creating

Flow Generator flows, 32

Flow Mirror flows, 46

Flow Monitor flows, 10

inactive flows in Flow Generator, 33

inactive flows in Flow Mirror, 47

inactive flows in Flow Monitor, 11

customizing

Flow Generator flows, 37

Flow Mirror flows, 52

D

deactivating

Flow Generator flows, 36

Flow Mirror flows, 51

Flow Monitor flows, 11

deleting

Flow Generator flows, 36

Flow Mirror flows, 52

Flow Monitor flows, 12

downgrading firmware, 7

duplicate SIM port IDs, 42

E

egress Top Talker monitor, Flow Vision equivalent, 17

End-to-End monitor, Flow Vision equivalent, 15

F

fapwwn -assign command, 42

firmware downgrade considerations, 7

firmware upgrade considerations, 7

flow

activating

Flow Generator flows, 33

Flow Mirror flows, 47

Flow Monitor flows, 11

- creating
 - Flow Generator flows, 32
 - Flow Mirror flows, 46
 - Flow Monitor flows, 10
- customizing
 - Flow Generator flows, 37
 - Flow Mirror flows, 52
- deactivating
 - Flow Generator flows, 36
 - Flow Mirror flows, 51
 - Flow Monitor flows, 11
- defined, 2
- deleting
 - Flow Generator flows, 36
 - Flow Mirror flows, 52
 - Flow Monitor flows, 12
- frametype parameters, 4
- generating, 31–43
- learned output, viewing, 35
- learning
 - Flow Generator flows, 34
 - Flow Mirror flows, 51
 - Flow Monitor flows, 12
 - Flow Vision flows, 5
- mirroring, 45–56
- monitor management, 10–13
- monitoring, 9–30
- monitors and MAPS, 29
- monitors on Access Gateways, 29
- numbers supported, 5
- parameters, frametype, 4
- resetting
 - Flow Generator flows, 37
 - Flow Mirror flows, 52
 - Flow Monitor flows, 13
- statistical data and configuration database, 6
- status, 34
- viewing
 - Flow Generator flows, 34
 - Flow Mirror flows, 48–51
 - Flow Monitor flows, 12
- flow command
 - activate, 11, 33, 45, 47
 - control, 37, 41, 52
 - create, 10, 32, 33, 46, 47
 - deactivate, 11, 36, 51
 - delete, 12, 18, 36, 52
 - reset, 13, 37, 40, 52
 - show, 5, 12, 34, 35, 37, 48, 49, 51
 - show -ctrlcfg, 37, 52
 - noactivate keyword, 10, 11, 18, 32, 33, 34, 46, 47
- flow count restrictions, 5
- flow definition
 - defined, 2
 - rules, 3
 - viewing, 5
- flow direction, defined, 2
- flow frametype parameters, 4
- Flow Generator, 31–43
 - and zoning, 43
 - creating inactive flows, 33
 - customizing flows, 37
 - examples, 38–39
 - flow activation, 33
 - flow creation, 32
 - flow deactivation, 36
 - flow deletion, 36
 - flow learning, 34
 - flow parameter combinations, 32
 - frame payload pattern, 37
 - frame payload size, 37
 - High Availability considerations, 43
 - integrating with Flow Monitor, 39
 - limitations, 43
 - MAPS and, 43
 - options, 31
 - prerequisites, 43
 - repeating output, 35
 - resetting flows, 37
 - setup, 31
 - sorting output, 35
 - viewing flows, 34
- flow learning, 5
 - Flow Generator, 34
 - Flow Mirror, 51
 - Flow Vision, 5
- Flow Mirror, 45–56
 - configuration, 45
 - creating inactive flows, 47
 - customizing flows, 52
 - flow activation, 47
 - flow creation, 46
 - flow deactivation, 51
 - flow deletion, 52
 - flow learning, 51
 - flow parameter combinations, 46
 - High Availability considerations, 7, 55
 - limitations, 55
 - maximum mirroring frame rate, 55
 - options, 45
 - repeating output, 51
 - resetting flows, 52
 - setup, 45
 - sorting output, 51

- supported functionality, 45
- time block view, 49
- viewing flows, 48–51
- Flow Monitor, 9–30
 - backward compatibility, 30
 - creating inactive flows, 11
 - flow activation, 11
 - flow creation, 10
 - flow deactivation, 11
 - flow deletion, 12
 - flow learning, 12
 - flow parameter combinations, 10
 - High Availability, 29
 - limitations, 29
 - management, 10–13
 - MAPS and, 29
 - overview, 9
 - repeating output, 12
 - resetting flows, 13
 - sorting output, 12
 - viewing flows, 12
- Flow Vision
 - configuration database, 6
 - flow learning, 5
 - licensing, 6
- Flow Vision integration with MAPS, 6
- Flow Monitor, integrating with Flow Generator, 39
- Flow Vision
 - components, 1
 - described, 1
 - feature overview, 1
 - Flow Generator, 31–43
 - Flow Mirror, 45–56
 - Flow Monitor, 9–30
 - flow, defined, 2
 - legacy equivalents
 - egress Top Talker monitor, 17
 - End-to-End monitor, 15
 - ingress Top Talker monitor, 17
 - legacy function equivalents, 15–18
 - overview, 1–7
 - supported port configurations, 3
- flows
 - described, 2–6
 - number supported per SIM port, 41
 - viewing definitions, 5
- fmmonitor command, 16
- frame parameters, defined, 2
- frame payload pattern in generated flows, 37
- frame payload size in generated flows, 37
- frame rate, mirroring maximum, 55
- frametype parameters, 4

G

- generated flows
 - activating, 33
 - customizing, 37
 - deactivating, 36
 - deleting, 36
 - learning, 34
 - resetting, 37
 - viewing, 34
- generating flows, 31–43

H

- High Availability
 - Flow Generator, 43
 - Flow Mirror, 7, 55
 - Flow Monitor, 29

I

- inactive flows
 - creating in Flow Generator, 33
 - creating in Flow Mirror, 47
 - creating in Flow Monitor, 11
- ingress Top Talker monitor, Flow Vision equivalent, 17

K

- keyword
 - bidir, 10, 15, 32, 46
 - disable_wrap, 52
 - enable_wrap, 52
 - noactivate, 10, 11, 18, 32, 33, 34, 46, 47
 - noconfig, 10, 32, 46
 - verbose, 48

L

- learned flow indicator, 5
- learned flow, viewing output, 35
- learning
 - Flow Generator flows, 34
 - Flow Mirror flows, 51
 - Flow Monitor flows, 12
 - Flow Vision flows, 5
- learning flows, 5
- licenseidshow command, xii
- licensing Flow Vision, 6

M

MAPS

- Flow Generator and, 43
- Flow Monitor and, 29
- Flow Vision and, 6
- SIM ports, 43

mirrored flows

- activating, 47
- customizing, 52
- deactivating, 51
- deleting, 52
- learning, 5, 51
- resetting, 52
- viewing, 48–51

mirroring flows, 45–56

monitor flows

- activating, 11
- creating, 10
- deactivating, 11
- deleting, 12
- learning, 12
- resetting, 13
- viewing, 12

Monitoring and Alerting Policy Suite. See: MAPS.

monitoring flows, 9–30

monitoring trunk ports, 18

N

N_Port ID Virtualization (NPIV), 9

P

port parameters, defined, 2

portcfgshow command, 40

portperfshow command, 40

portstatsclear command, 40

portstatsshow command, 40

R

resetting

- Flow Generator flows, 37
- Flow Mirror flows, 52
- Flow Monitor flows, 13

S

serial number, location on switch, *xi*

SIM port

- attributes, 41–42
- characteristics, 41
- configuration, 41–42
- disallowed port types, 42
- duplication error, 42
- MAPS, 43
- number of flows supported, 41
- zoning, 41

slotstatsclear command, 40

statistical data and configuration database, 6

supportsave command, *xi*

switch serial number location, *xi*

switchshow command, 41

T

time blocks, Flow Mirror, 49

Top Talker monitor, 17

trunk ports, monitoring, 18

U

upgrading firmware, 7

V

viewing

all flow information, 48, 49

flow status, 34

Flow Generator flows, 34

Flow Mirror flows, 48–51

Flow Monitor flows, 12

flows in time blocks, 49

output of a learned flow, 35

virtual wwn, 42

W

wwn command, *xii*

wwn duplication, 42

wwn, virtual, 42

Z

zoning and SIM ports, 41