Configuring NetFlow

This chapter contains the following sections:

Information about NetFlow

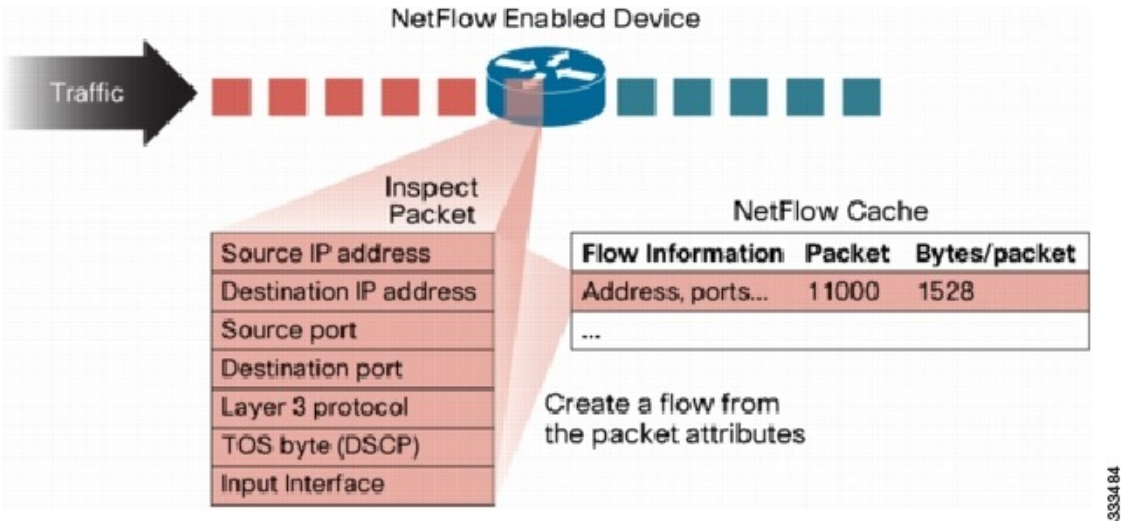
NetFlow lets you evaluate IP traffic and understand how and where it flows. NetFlow gives visibility into traffic transiting the virtual switch by characterizing IP traffic based on its source, destination, timing, and application information. This information is used to assess network availability and performance, assist in meeting regulatory requirements (compliance), and help with troubleshooting. NetFlow gathers data that can be used in accounting, network monitoring, and network planning.

What is a Flow

A flow is a one-directional stream of packets that arrives on a source interface (or subinterface), matching a set of criteria. All packets with the same source/destination IP address, source/destination ports, protocol

interface and class of service are grouped into a flow and then packets and bytes are tallied. This condenses a large amount of network information into a database called the NetFlow cache.

Figure 1: NetFlow Cache Example



You create a flow by defining the criteria it gathers. Flows are stored in the NetFlow cache. Flow information tells you the following:

- Source address tells you who is originating the traffic.
- Destination address tells who is receiving the traffic.
- Ports characterize the application using the traffic.
- Class of service examines the priority of the traffic.
- The device interface tells how traffic is being used by the network device.
- Tallied packets and bytes show the amount of traffic.

Flow Record Definition

A flow record defines the information that NetFlow gathers, such as packets in the flow and the types of counters gathered per flow. You can define new flow records or use the pre-defined Cisco Nexus 1000V flow record.

The following table describes the criteria defined in a flow record.

Table 1: Flow record criteria

Flow Record Criteria	Description
Match	Defines what information is matched for collection in the flow record. • ip: Data collected in the flow record matches one of the following IP options: ◦ protocol ◦ tos (type of service) • ipv4: Data collected in the flow record matches one of the following ipv4 address options: ◦ source address ◦ destination address • transport: Data collected in the flow record matches one of the following transport options: ◦ destination port ◦ source port
Collect	Defines how the flow record collects information. • counter: Collects Flow Record information in one of the following formats: ◦ bytes: collected in 32-bit counters unless the long 64-bit counter is specified. ◦ packets: collected in 32-bit counters unless the long 64-bit counter is specified. • timestamp sys-uptime: Collects the system up time for the first or last packet in the flow. • transport tcp flags: Collects the TCP transport layer flags for the packets in the flow.

Predefined Flow Records

Cisco Nexus 1000V Predefined Flow Record: Netflow-Original

```
switch# show flow record netflow-original
Flow record netflow-original:
    Description: Traditional IPv4 input NetFlow with origin ASs
    No. of users: 0
    Template ID: 0
    Fields:
        match ipv4 source address
        match ipv4 destination address
        match ip protocol
        match ip tos
        match transport source-port
```

```
        match transport destination-port
        match interface input
        match interface output
        match flow direction
        collect routing source as
        collect routing destination as
        collect routing next-hop address ipv4
        collect transport tcp flags
        collect counter bytes
        collect counter packets
        collect timestamp sys-uptime first
        collect timestamp sys-uptime last
switch#
```

Note Although the following lines appear in the output of the show flow record command, the commands they are based on are not currently supported in Cisco Nexus 1000V. The use of these commands has no affect on the configuration.

```
collect routing source as
collect routing destination as
collect routing next-hop address ipv4
```

Cisco Nexus 1000V Predefined Flow Record: Netflow IPv4 Original-Input

```
switch# show flow record netflow ipv4 original-input
Flow record ipv4 original-input:
    Description: Traditional IPv4 input NetFlow
    No. of users: 0
    Template ID: 0
    Fields:
        match ipv4 source address
        match ipv4 destination address
        match ip protocol
        match ip tos
        match transport source-port
        match transport destination-port
        match interface input
        match interface output
        match flow direction
        collect routing source as
        collect routing destination as
        collect routing next-hop address ipv4
        collect transport tcp flags
        collect counter bytes
        collect counter packets
        collect timestamp sys-uptime first
        collect timestamp sys-uptime last
switch#
```

Cisco Nexus 1000V Predefined Flow Record: Netflow IPv4 Original-Output

```
switch# show flow record netflow ipv4 original-output
Flow record ipv4 original-output:
    Description: Traditional IPv4 output NetFlow
    No. of users: 0
    Template ID: 0
    Fields:
        match ipv4 source address
        match ipv4 destination address
        match ip protocol
        match ip tos
        match transport source-port
        match transport destination-port
        match interface input
        match interface output
        match flow direction
        collect routing source as
        collect routing destination as
```

```
        collect routing next-hop address ipv4
        collect transport tcp flags
        collect counter bytes
        collect counter packets
        collect timestamp sys-uptime first
        collect timestamp sys-uptime last
switch#
```

Cisco Nexus 1000V Predefined Flow Record: Netflow Protocol-Port

```
switch# show flow record netflow protocol-port
Flow record ipv4 protocol-port:
    Description: Protocol and Ports aggregation scheme
    No. of users: 0
    Template ID: 0
    Fields:
        match ip protocol
        match transport source-port
        match transport destination-port
        match interface input
        match interface output
        match flow direction
        collect counter bytes
        collect counter packets
        collect timestamp sys-uptime first
        collect timestamp sys-uptime last
switch#
```

Accessing NetFlow Data

There are two primary methods used to access NetFlow data:

- Command Line Interface (CLI)
- NetFlow Collector

Command Line Interface for NetFlow

Use the Command Line Interface (CLI) to access NetFlow data, and to view what is happening in your network now.

The CLI uses the Flow Monitor and Flow Exporter to capture and export flow records to the Netflow Collector. Cisco Nexus 1000V supports the NetFlow Version 9 export format.

Note Cisco Nexus 1000V supports UDP as the transport protocol for exporting data to up to two exporters per monitor.

Flow Monitor

A flow monitor creates an association between the following NetFlow components:

- a flow record—consisting of matching and collection criteria
- a flow exporter—consisting of the export criteria

This flow monitor association enables a set, consisting of a record and an exporter, to be defined once and re-used many times. Multiple flow monitors can be created for different needs. A flow monitor is applied to a specific interface in a specific direction.

Flow Exporter

Use the flow exporter to define where the flow records are sent from the cache to the reporting server, called the NetFlow Collector. An exporter definition includes the following.

- Destination IP address
- Source interface
- UDP port number (where the collector is listening)
- Export format

NetFlow Collector

You can export NetFlow from the Cisco Nexus 1000V NetFlow cache to a reporting server called the NetFlow Collector. The NetFlow Collector assembles the exported flows and combines them to produce reports used for traffic and security analysis. NetFlow export, unlike SNMP polling, pushes information periodically to the NetFlow reporting collector. The NetFlow cache is constantly filling with flows. Cisco Nexus 1000V searches the cache for flows that have terminated or expired and exports them to the NetFlow collector server.

The following steps implement NetFlow data reporting:

- NetFlow records are configured to define the information that NetFlow gathers.
- Netflow monitor is configured to capture flow records to the NetFlow cache.
- NetFlow export is configured to send flows to the collector.
- Cisco Nexus 1000V searches the NetFlow cache for flows that have terminated and exports them to the NetFlow collector server.
- Flows are bundled together based on space availability in the UDP export packet or based on export timer.
- The NetFlow collector software creates real-time or historical reports from the data.

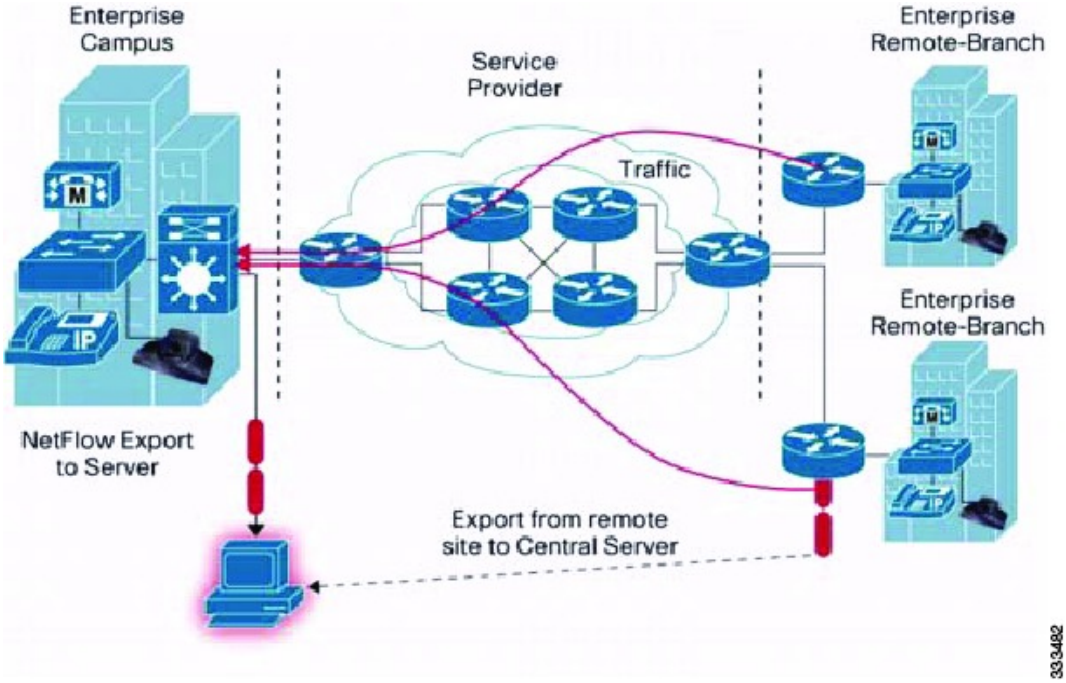
Exporting Flows to the NetFlow Collector Server

Timers determine when a flow is exported to the NetFlow Collector Server. A flow is ready for export when one of the following occurs:

- The flow is inactive for a certain time during which no new packets are received for the flow.
- The flow has lived longer than the active timer, for example, a long FTP download.

- The flow cache is full and some flows must be aged out to make room for new flows.

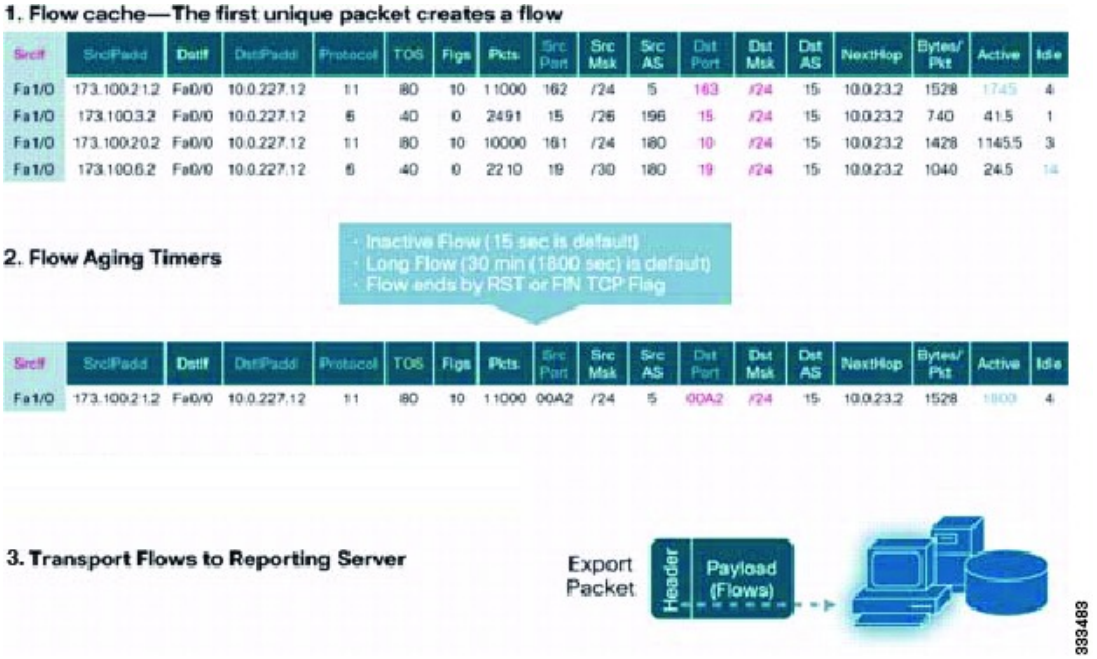
Figure 2: Exporting Flows to the NetFlow Collector Server



What NetFlow Data Looks Like

The following figure shows an example of NetFlow data.

Figure 3: NetFlow Cache Example



Network Analysis Module

You can also use the Cisco Network Analysis Module (NAM) to monitor NetFlow data sources. NAM enables traffic analysis views and reports such as hosts, applications, conversations, VLAN, and QoS.

High Availability for NetFlow

Cisco Nexus 1000V supports stateful restarts for NetFlow. After a reboot or supervisor switchover, Cisco Nexus 1000V applies the running configuration.

Prerequisites for NetFlow

- You must be aware of resource requirements since NetFlow consumes additional memory and CPU resources.
- Memory and CPU resources are provided by the VEM hosting the flow monitor interface. Resources are limited by the number of CPU cores present on the VEM.

Configuration Guidelines and Limitations for NetFlow

- In Cisco Nexus 1000V, Mgmt0 interface IP address is configured by default as the source IP address for an exporter. You can change the source IP address if needed.
- Cisco Nexus 1000V includes the following predefined flow records that can be used instead of configuring a new one.
  - netflow-original

    Cisco Nexus 1000V predefined traditional IPv4 input NetFlow with origin ASs

    Note The routing-related fields in this predefined flow record are ignored.

  - netflow ipv4 original-input

    Cisco Nexus 1000V predefined traditional IPv4 input NetFlow
  - netflow ipv4 original-output

    Cisco Nexus 1000V predefined traditional IPv4 output NetFlow
  - netflow protocol-port

    Cisco Nexus 1000V predefined protocol and ports aggregation scheme
- Cisco Nexus 1000V InterCloud supports a configuration of 32 monitors on 300 interfaces.

Default Settings for NetFlow

Parameters	Default
NetFlow version	9
source interface	mgmt0
match	direction and interface (incoming/outgoing)
flow monitor active timeout	1800
flow monitor inactive timeout	300
flow monitor cache size	65536
flow exporter UDP port transport udp command	9995
DSCP	default/best-effort (0)
VRF	default

Enabling the NetFlow Feature

Before You Begin

You are logged in to the CLI in EXEC mode.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **feature netflow**	Enables the NetFlow feature.
Step 3	switch(config)# **show feature**	(Optional) Displays the available features and whether or not they are enabled.
Step 4	switch(config)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

This example shows how to enable the NetFlow feature:

```
switch# configure terminal
switch(config)# feature netflow
switch(config)#
```

Configuring NetFlow

Defining a Flow Record

Before You Begin

- You know which of the options you want this flow record to match.
- You know which options you want this flow record to collect.

Note Although the following lines appear in the output of the show flow record command, the commands they are based on are not currently supported in Cisco Nexus 1000V. The use of these commands has no affect on the configuration.

```
collect routing source as
collect routing destination as
collect routing next-hop address ipv4
```

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **flow record** *name*	Creates a Flow Record by name, and places you in the CLI Flow Record Configuration mode for that specific record.
Step 3	switch(config#) **description** *string*	(Optional) Adds a description of up to 63 characters to the Flow Record and saves it to the running configuration.
Step 4	switch(config#) **match** {**ip** {**protocol** | **tos**} | **ipv4** {**destination address** | **source address**} | **transport** {**destination-port** | **source-port**}}	Defines the Flow Record to match one of the following and saves it in the running configuration. • ip: Matches one of the following IP options: ◦ protocol ◦ tos (type of service) • ipv4: Matches one of the following ipv4 address options: ◦ source address ◦ destination address • transport: Matches one of the following transport options: ◦ destination port ◦ source port
Step 5	switch(config)# **collect** {**counter** {**bytes** [**long**] | **packets** [**long**]} | **timestamp sys-uptime** | **transport tcp flags**}	Specifies a collection option to define the information to collect in the Flow Record and saves it in the running configuration. • counter: Collects Flow Record information in one of the following formats: ◦ bytes: collected in 32-bit counters unless the long 64-bit counter is specified. ◦ packets: collected in 32-bit counters unless the long 64-bit counter is specified. • timestamp sys-uptime: Collects the system up time for the first or last packet in the flow. • transport tcp flags: Collects the TCP transport layer flags for the packets in the flow.

	Command or Action	Purpose
Step 6	switch(config)# **show flow record** *name*	(Optional) Displays information about Flow Records.
Step 7	switch(config)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

The following example shows how to create a flow record:

```
switch# configure terminal
switch(config)# flow record RecordTest
switch(config-flow-record)# description Ipv4flow
switch(config-flow-record)# match ipv4 destination address
switch(config-flow-record)# collect counter packets
switch(config-flow-record)# show flow record RecordTest
Flow record RecordTest:
    Description: Ipv4flow
    No. of users: 0
    Template ID: 0
    Fields:
        match ipv4 destination address
        match interface input
        match interface output
        match flow direction
        collect counter packets
switch(config-flow-record)#
```

Defining a Flow Exporter

A Flow Exporter defines where and how Flow Records are exported to the NetFlow Collector Server.

- Export format version 9 is supported.
- A maximum of two flow exporters per monitor are permitted.

Before You Begin

- You know the destination IP address of the NetFlow Collector Server.
- You know the source interface that Flow Records are sent from.
- You know the transport UDP that the Collector is listening on.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)#**flow exporter** *name*	Creates a Flow Exporter, saves it in the running configuration, and then places you in CLI Flow Exporter Configuration mode.

	Command or Action	Purpose
Step 3	switch(config-flow-exporter)# **description** *string*	Adds a description of up to 63 characters to this Flow Exporter and saves it in the running configuration.
Step 4	switch(config-flow-exporter)# **destination** {*ipv4-address* | *ipv6-address*}	Specifies the IP address of the destination interface for this Flow Exporter and saves it in the running configuration.
Step 5	switch(config-flow-exporter)# **dscp** *value*	Specifies the differentiated services codepoint value for this Flow Exporter, between 0 and 63, and saves it in the running configuration.
Step 6	switch(config-flow-exporter)# **source mgmt** *lc-exp*	Specifies the line card, from which the Flow Records are sent to the NetFlow Collector Server, and saves it in the running configuration.
Step 7	switch(config-flow-exporter)# **transport udp** *port-number*	Specifies the destination UDP port, between 0 and 65535, used to reach the NetFlow collecton, and saves it in the running configuration.
Step 8	switch(config-flow-exporter)# **version** {**9**}	Specifies NetFlow export version 9, saves it in the running configuration, and places you into the export version 9 configuration mode.
Step 9	switch(config-flow-exporter-version-9)# **option** {**exporter-stats** | **interface-table** | **sampler-table**} **timeout** *value*	Specifies one of the following version 9 exporter resend timers and its value, between 1 and 86400 seconds, and saves it in the running configuration. • exporter-stats • interface-table • sampler-table
Step 10	switch(config-flow-exporter-version-9)# **template data timeout** *seconds*	Sets the template data resend timer and its value, between 1 and 86400 seconds, and saves it in the running configuration.
Step 11	switch(config-flow-exporter-version-9)# **show flow exporter** [*name*]	(Optional) Displays information about the Flow Exporter.
Step 12	switch(config-flow-exporter-version-9)# **copy running-config startup-config**	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

The following example displays the output of the command **show flow exporter** [*exp2-192*]:

```
switch(config-flow-exporter)# show flow exporter ExportTest
Flow exporter exp2-192:
Destination: 10.106.192.200
VRF: management (1)
Destination UDP Port 9012
Source IP Address 10.106.192.137/24
```

```
Export from Line Card
Export Version 9
Data template timeout 1800 seconds
Exporter Statistics
Number of Flow Records Exported 27060
Number of Templates Exported 175
Number of Export Packets Sent 10674
Number of Export Bytes Sent 595388
Number of Destination Unreachable Events 0
Number of No Buffer Events 0
Number of Packets Dropped (No Route to Host) 0
Number of Packets Dropped (other) 0
Number of Packets Dropped (LC to RP Error) 0
Number of Packets Dropped (Output Drops) 0
Time statistics were last cleared: Never
```

Defining a Flow Monitor

A Flow Monitor is associated with a Flow Record and a Flow Exporter.

A maximum of one flow monitor per interface per direction is permitted.

Before You Begin

- You know the name of an existing Flow Exporter to associate with this flow monitor.
- You know the name of an existing Flow Record to associate with this flow monitor. You can use either a flow record you previously created, or one of the following Cisco Nexus 1000V predefined flow records:
  - netflow-original
  - netflow ipv4 original-input
  - netflow ipv4 original-output
  - netflow protocol-port

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **flow monitor** *name*	Creates a flow monitor by name, saves it in the running configuration, and then places you in the CLI Flow Monitor Configuration mode.
Step 3	switch(config-flow-monitor)# **description** *string*	(Optional) For the specified flow monitor, adds a descriptive string of up to 63 alphanumeric characters, and saves it in the running configuration.
Step 4	switch(config-flow-monitor)# **exporter** *name*	For the specified flow monitor, adds an existing flow exporter and saves it in the running configuration.

	Command or Action	Purpose
Step 5	switch(config-flow-monitor)# **record** {*name* | **netflow** {**ipv4**}}	For the specified flow monitor, adds an existing flow record and saves it in the running configuration. • name: The name of a flow record you have previously created, or the name of a Cisco provided pre-defined flow record. • netflow: Traditional NetFlow collection schemes ipv4: Traditional IPv4 NetFlow collection schemes
Step 6	switch(config-flow-monitor)# **show flow monitor** [*name*]	(Optional) Displays information about existing flow monitors.
Step 7	switch(config-flow-monitor)# **copy running-config startup-config**	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

The following example shows how to create a flow monitor:

```
switch# configure terminal
switch(config)# flow monitor MonitorTest
switch(config-flow-monitor)# description Ipv4Monitor
switch(config-flow-monitor)# exporter ExportTest
switch(config-flow-monitor)# record RecordTest
switch(config-flow-monitor)# show flow monitor MonitorTest
Flow Monitor monitortest:
Description :Ipv4Monitor
Use count: 0
 Flow Record: RecordTest
    Flow Exporter: ExportTest

switch(config-flow-monitor)#
```

Assigning a Flow Monitor to an Interface

Before You Begin

- You know the name of the flow monitor you want to use for the interface.
- You know the interface type and its number.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **interface** *interface-type interface-number*	Places you in the CLI Interface Configuration mode for the specified interface.

	Command or Action	Purpose
Step 3	switch(config)# **ip flow monitor** *name* {**input** | **output**}	For the specified interface, assigns a flow monitor for input or output packets and saves it in the running configuration.
Step 4	switch(config)# **show flow** *interface-type interface-number*	(Optional) For the specified interface, displays the NetFlow configuration.
Step 5	switch(config)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

The following example shows how to assign a flow monitor to an interface:

```
switch# configure terminal
switch(config)# interface veth 2
switch(config-if)# ip flow monitor MonitorTest output
switch(config-if)# show flow interface veth 2
Interface veth 2:
    Monitor: MonitorTest
    Direction: Output
switch(config-if)#
```

Adding a Flow Monitor to a Port Profile

Before You Begin

- You are logged in to the CLI in EXEC mode.
- You have already created the flow monitor.
- If using an existing port profile, you have already created the port profile and you know its name.
- If creating a new port profile, you know the type, and you know the name you want to give it.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **port-profile** [**type** vethernet}] *name*	Enters port profile configuration mode for the named port profile.
Step 3	switch(config-port-prof)# **ip flow monitor** *name* {**input** | **output**}	Applies a named flow monitor to the port profile for either incoming (input) or outgoing (output) traffic.
Step 4	switch(config-port-prof)# **show port-profile** [**brief** | **expand-interface** | **usage**] [**name** *profile-name*]	(Optional) Displays the configuration for verification.

	Command or Action	Purpose
Step 5	switch(config-port-prof)# **copy running-config startup-config**	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

This example shows how to add a flow monitor to a port profile:

```
switch# configure terminal
switch(config)# port-profile AccessProf
switch(config-port-prof)# ip flow monitor allacces4 output
switch(config-port-prof)# show port-profile name AccessProf
port-profile AccessProf
  type: vethernet
  status: disabled
  capability l3control: no
  pinning control-vlan: -
  pinning packet-vlan: -
  system vlans: none
  port-group:
  max ports: 32
  inherit:
  config attributes:
    ip flow monitor allaccess4 output
  evaluated config attributes:
    ip flow monitor allaccess4 output
  assigned interfaces:
switch(config-port-prof)#
```

Verifying the NetFlow Configuration

Use one of the following commands to verify the configuration:

Command	Purpose
show flow exporter [*name*]	Displays information about NetFlow flow exporter maps.
show flow interface [*interface-type number*]	Displays information about NetFlow interfaces.
show flow monitor [*name* [**cache module** *number* | **statistics module** *number*]]	Displays information about NetFlow flow monitors. **Note** The **show flow monitor cache module** command differs from the **show flow monitor statistics module** command in that the cache command also displays cache entries . Since each processor has its own cache, all output of these commands is based on the number of processors on the server (also called module or host). When more than one processor is involved in processing packets for a single flow, then the same flow appears for each processor.

Command	Purpose
show flow record [*name*]	Displays information about NetFlow flow records.

Related Documents for NetFlow

Related Topic	Document Title
Cisco NetFlow Overview	http://cisco.com/en/US/products/ps6601/products_ios_protocol_group_home.html

Feature History for NetFlow

This table includes only the updates for those releases that have resulted in additions or changes to the feature.

Feature Name	Releases	Feature Information
NetFlow	Release 5.2(1)IC1(1.2)	NetFlow was introduced.