

Sampled Flow

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Overview

Sampled flow (sFlow) is a sampled flow monitoring technology that enables you to monitor real-time traffic in data networks with switches and routers, employs the sampling mechanism in sFlow agent software to monitor traffic, and forwards sample data to a central data collector.

- Enables monitoring of real-time traffic in data networks with switches and routers
- Employs a sampling mechanism in sFlow agent software to monitor traffic
- Forwards sample data to a central data collector

For more information about sFlow, see RFC 3176 .

sFlow Agent

The sFlow agent, which is embedded in the Cisco NX-OS software, periodically samples or polls the interface counters that are associated with a data source of the sampled packets. The data source can be an Ethernet interface, an EtherChannel interface, or a range of Ethernet interfaces. The sFlow agent queries the Ethernet port manager for the respective EtherChannel membership information and also receives notifications from the Ethernet port manager for membership changes.

When you enable sFlow sampling, based on the sampling rate and the hardware internal random number, the ingress packets and egress packets are sent to the CPU as an sFlow-sampled packet. The sFlow agent processes the sampled packets and sends an sFlow datagram to the sFlow analyzer. In addition to the original sampled packet, an sFlow datagram includes information about the ingress port, the egress port, and the original packet length. An sFlow datagram can have multiple sFlow samples.

Default Settings

The following table lists the default settings for sFlow parameters.

Table 1: Default sFlow Parameters

Parameters	Default
sFlow sampling rate	4096
sFlow sampling size	128
sFlow counter poll interval	20
sFlow maximum datagram size	1400
sFlow collector IP address	0.0.0.0
sFlow collector port	6343
sFlow agent IP address	0.0.0.0

Guidelines and Limitations

Prerequisites

- For Cisco Nexus 9332PQ, 9372PX, 9372TX, and 93120TX switches and for Cisco Nexus 9396PX, 9396TX, and 93128TX switches with the N9K-M6PQ generic expansion module (GEM), you must configure the sFlow and SPAN ACL TCAM region sizes for any uplink ports that are to be configured as an sFlow data source. To do so, use the **hardware access-list tcam region sflow** and **hardware access-list tcam region span** commands. See Configuring ACL TCAM Region Sizes for more information.

Note By default, the sflow region size is zero, and the span region size is non-zero. You need to configure the sflow region to 256 and allocate enough entries to the span region in order to configure the port as an sFlow data source.

- Egress sFlow of multicast traffic requires **hardware multicast global-tx-span** configuration

General Guidelines



Note For scale information, see the release-specific *Cisco Nexus 9000 Series NX-OS Verified Scalability Guide* .

- When sFlow is used to sample the Rx traffic from FEX HIF ports, additional VNTAG and 802.1q tags are present in the sampled traffic.
-
- sFlow is a software-driven feature, hardware only sends copies of traffic from the sFlow source interfaces to the CPU for further processing. Elevated CPU usage is expected. sFlow traffic sent to the CPU by hardware is rate-limited to protect the CPU.
- When you enable sFlow for an interface, it is enabled for both ingress and egress. You cannot enable sFlow for only ingress or only egress.

  For Cisco Nexus 9508 switches with Cisco Nexus 9636C-R and 9636Q-R line cards, sFlow can be enabled for an interface only in the ingress direction.
- The storm control feature does not work if you enable storm control on an interface where sFlow is also enabled.
- sFlow counters increment even for control packets that ingress on the sFlow data-source interfaces. These packets may be sampled and send out as sFlow datagrams (similar to data plane traffic).
- NX-OS provides flexible forwarding templates to utilize the hardware resources according to customer needs. For sFlow ingress IPv6 sampling to fill BGP information correctly in the sFlow record, a template which has all IPv6 routes on the line-card has to be selected. For example, customers can configure **system routing template-mpls-heavy** . For more information, please refer to the Cisco Nexus 9000 Series NX-OS Command Reference (Configuration Commands), Release 9.3(x). For command to take effect, system needs to be rebooted. This is applicable on GX modular chassis.

Configuration Guidelines

1. If at least one sFlow data source is configured, the SPAN sessions cannot be brought up.
   - If at least one SPAN session is configured as **no shut** , sFlow data sources cannot be added.
   - The sampling mode that is used for sFlow is based on an algorithm that is known as LFSR. Due to the use of LFSR, it is not guaranteed that one in every few packets are sampled with the sampling rate of n. However, the number of packets that are sampled is equal to the total packets over a period of time.
2. When sFlow and SPAN are configured on the same interface, and the hardware rate-limiter is configured for sFlow, the Rate-Limiter Drops counter in the output of the **show hardware rate-limiter** command displays more drops than expected.
3. We recommend you configure the sampling rate that is based on the sFlow configuration and traffic in the system.
4. When sFlow is configured on N9K-C9508-FM-G with the N9K-X9716D-GX line card, disable sFlow before configuring SPAN sessions.

5. When ECMP is configured in BGP and in case of ECMP destination routes, the next-hop information in the extended gateway record of the exported sFlow record will be 0. Other BGP information like Autonomous System will be derived from the first path. The output interface in the sFlow record will be set to 0 (unknown) to indicate that the flow could be through any of the paths.
6. When you configure SPAN Tx on the same interface as the sFlow data-source port, the effective sFlow process samples are halved for that source port from the configured sampling rate.

Supported Features

1. The switch supports only one sFlow collector.
2. sFlow supports sampling IPv6 traffic .
3. The following Cisco Nexus switches support sFlow and SPAN together:
   - N9336C-FX2
   - N93240YC-FX2
   - N93360YC-FX2
4. Nexus 9000-EX, FX, GX family of switches only support sampling at the following values: 4096, 8192, 16384, 32768, 65536. Configuring values other than these results in the value being rounded off to the next supported value.

Not Supported Features

- sFlow is not supported on the SVIs.
- Subinterfaces are not supported for sFlow.
- sFlow does not support egress sampling for multicast, broadcast, or unknown unicast packets.
- sFlow and Network Address Translation (NAT) are not supported on the same port.

Limitations for Cisco Nexus 9804 switches

- For egress sampled packet, re-written information is not available in sFlow record
- Egress sFlow is not supported for directly connected host
- sFlow is not supported on the sub-interface traffic

Release Specification Limitations

Beginning with Cisco NX-OS Release 9.3(3)

- Cisco Nexus 9300-GX platform switches support both sFlow and SPAN together.

Beginning with Cisco NX-OS Release 10.1(1)

- sFlow and SPAN are supported on Cisco N9K-C93180YC-FX3 platform switches.

Beginning with Cisco NX-OS Release 10.1(2)

- sFlow is supported on the Cisco N9K-X9624D-R2 line card.
- sFlow supports VXLAN traffic on the Cisco N9K-C9508-FM-G cloud-scale fabric module with the N9K-X9716D-GX line card.

Beginning with Cisco NX-OS Release 10.2(1)

- sFlow Extended BGP (Gateway) is supported on the Cisco N9K-C93600CD-GX, N9K-C93240YC-FX2, N9K-C93180YC-EX, N9K-C93180YC-FX, N9K-C93180YC-FX3S, N9K-93600CD-GX platform switches, and Nexus 9500 with N9K-X9716D-GX and N9K-X9736C-FX line cards.
- Extended BGP data can now be collected. In order for sFlow to collect this data, a non-SVI Layer 3 interface such as a physical interface or port-channel must be configured as the sFlow source.
- Beginning with Cisco NX-OS Release 10.2(1q)F, sFlow is supported on the Cisco N9K-C9332D-GX2B platform switches.

Beginning with Cisco NX-OS Release 10.2(3)F

- sFlow flow-cache size is increased from 3k route entries in earlier releases to 30k v4 and 30k v6 route entries. This feature is supported on Cisco Nexus C93600CD-GX, C93240YC-FX2, C93180YC-EX, C93180YC-FX, C93180YC-FX3S, 93600CD-GX, and X9716D-GX platform switches.

Beginning with Cisco NX-OS Release 10.3(1)F

- sFlow is supported on the Cisco Nexus 9808 platform switches.
- For egress sampled packet, re-written information is not available in sFlow record.
- Egress sFlow is not supported for directly connected host. However, beginning with Cisco NX-OS Release 10.4(2)F, Egress sFlow is supported for directly connected host.
- sFlow is not supported on the sub-interface traffic.
- sFlow supports IPv6 collector. However, at a time, only one collector can be configured, either IPv4 or IPv6. Also, the source ip address and the collector ip address must belong to the same address family, that is, either IPv4 or IPv6 address family.

Beginning with Cisco NX-OS Release 10.4(1)F

- sFlow is supported on Cisco Nexus 9804 switch, Cisco Nexus C9332D-H2R switch and Cisco Nexus X98900CD-A and X9836DM-A line cards with Cisco Nexus 9808 and 9804 switches.

Beginning with Cisco NX-OS Release 10.4(2)F

- sFlow is supported on Cisco Nexus 93400LD-H1 platform switches.

Beginning with Cisco NX-OS Release 10.5(3)F

- sFlow is supported on Cisco N9364E-SG2-O and N9364E-SG2-Q TOR switches. However, these switches do not support sFlow on the sub-interface traffic. For egress sampled packet, re-written information is not available in the sFlow record.

Beginning with Cisco NX-OS Release 10.6(1)F

- For egress sampled packet, re-written information is not available in sFlow record.
- sFlow is not supported on the sub-interface traffic.

- Egress Layer 2 source interface is not supported.
- sFlow is supported on the Cisco N9336C-SE1 switch.

N9300 Smart Switch Guidelines

Beginning with NX-OS Release 10.6(2)F, sFlow is supported on the N9324C-SE1U and N9348Y2C6D-SE1U switches. The guidelines and limitations include:

- For egress sampled packet, re-written information is not available in sFlow record.
- Egress Layer 2 source interface is not supported.
- sFlow is not supported on the sub-interface traffic.
- sFLow is not supported on Service-Ethernet or Service-Port-channels.

Enable sFlow Feature

You must enable the sFlow feature before you can configure sFlow settings on the switch.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Enable or disable sFlow using the command [**no**] **feature sflow**

Example:

```
switch(config)# feature sflow
```

Step 3 Display the enabled and disabled features using the command **show feature**

Example:

```
switch(config)# show feature
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

This example shows how to configure sFlow:

```
feature sflow
sflow sampling-rate 4096
sflow max-sampled-size 200
sflow counter-poll-interval 100
sflow max-datagram-size 2000
sflow collector-port 7000
sflow agent-ip 192.0.2.3
sflow collector-ip 192.0.2.5 vrf management
sflow data-source interface ethernet 1/5
```

What to do next

Use these commands to display the sFlow configuration.

Table 2: sFlow Show Commands

Command	Purpose
show sflow	Displays all the data sources of the sFlow samplers and the sFlow agent configuration.
show process	Verifies whether the sFlow process is running.
show system internal sflow consistency issu-pss	Verifies that there is no discrepancy before and after an upgrade. **Note** Post ISSU from an earlier release to NX-OS Release 10.5(3)F or later releases, this command requires that the `sflow_pss_cc_upgrade_post_snapshot.txt` and `sflow_pss_cc_upgrade_pre_snapshot.txt` files to be present. If either of the files are missing, the command does not display the expected output, instead displays information about the missing files, either pre upgrade, post upgrade, or both the snapshot files.
show running-config sflow [**all**]	Displays the current sFlow running configuration.

Use the **show sflow statistics** command to display the sFlow statistics. Use the following commands to clear the sFlow statistics:

Command	Description
clear sflow statistics	Clears most of the sFlow statistics from the **show sflow statistics** command.
clear counters interface all	Clears the Total Packets field from the **show sflow statistics** command.
clear hardware rate-limiter sflow	Clears the Total Samples field from the **show sflow statistics** command.

Configure Sampling Rate

Configure the sampling rate for sFlow.

You can configure the sampling rate for sFlow.

Before you begin

Make sure that you have enabled sFlow.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Configure the sFlow sampling rate for packets using the command [**no**] **sflow sampling-rate** *sampling-rate*

Example:

```
switch(config)# sflow sampling-rate 50000
```

The *sampling-rate* can be an integer between 4096 and 1000000000.

Note
Nexus 9000-EX, FX, GX, FX2, FX3, GX2 , and HX family of switches support sampling only at the following values: 4096, 8192, 16384, 32768, 65536. Configuring values other than these will result in the value being rounded off to the next supported value.

Step 3 Display the sFlow configuration using the command **show sflow**

Example:

```
switch(config)# show sflow
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

Configure Maximum Sampled Size

You can configure the maximum number of bytes that should be copied from a sampled packet.

Before you begin

Make sure that you have enabled sFlow.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Configure the sFlow maximum sampling size using the command [**no**] **sflow max-sampled-size** *sampling-size*

Example:

```
switch(config)# sflow max-sampled-size 200
```

The range for the *sampling-size* is from 64 to 256 bytes.

Step 3 Display the sFlow configuration using the command **show sflow**

Example:

```
switch(config)# show sflow
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

Configure Counter Poll Interval

Before you begin

Make sure that you have enabled sFlow.

You can configure the maximum number of seconds between successive samples of the counters that are associated with the data source. A sampling interval of 0 disables counter sampling.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Configure the sFlow poll interval for an interface using the command [**no**] **sflow counter-poll-interval** *poll-interval*

Example:

```
switch(config)# sflow counter-poll-interval 100
```

The range for *poll-interval* is from 0 to 2147483647 seconds.

Step 3 Display the sFlow configuration using the command **show sflow**

Example:

```
switch(config)# show sflow
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

Configure Maximum Datagram Size

Configure the maximum number of data bytes that can be sent in a single sample datagram.

You can configure the maximum number of data bytes that can be sent in a single sample datagram.

Before you begin

Make sure that you have enabled sFlow.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Configure the sFlow maximum datagram size using the command [**no**] **sflow max-datagram-size** *datagram-size*

Example:

```
switch(config)# sflow max-datagram-size 2000
```

The range for the *datagram-size* is from 200 to 9000 bytes.

Step 3 Display the sFlow configuration using the command **show sflow**

Example:

```
switch(config)# show sflow
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

Configure sFlow Collector Address

Configure the IPv4 or IPv6 address of the sFlow data collector that is connected to the management port.

You can configure the IPv4 or IPv6 address of the sFlow data collector that is connected to the management port.

Before you begin

Make sure that you have enabled sFlow.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Configure the IPv4 or IPv6 address for the sFlow collector using the command [**no**] **sflow collector-ip** *ip-address* **vrf** *vrf* [**source** *ip-address*]

Example:

```
switch(config)# sflow collector-ip 192.0.2.5 vrf management
switch(config)# sflow collector-ip 2001::1 vrf management
```

If the IP address is set to 0.0.0.0, all samples will be dropped. The *vrf* can be one of the following:

- A user-defined VRF name—You can specify a maximum of 32 alphanumeric characters.
- **vrf management** —You must use this option if the sFlow data collector is on the network connected to the management port.
- **vrf default** —You must use this option if the sFlow data collector is on the network connected to the front-panel ports.

The **source** *ip-address* option causes the sent sFlow datagram to use the source IP address as the IP packet source address. The source IP address has to be already configured on one of the switch local interfaces; otherwise, an error message appears. If the interface with the source IP address is changed or removed after this option is configured, the sFlow datagram will no longer be sent out, and an event history error and syslog error will be logged. When the **source** *ip-address* option is not configured, Cisco NX-OS picks the IP packet source address automatically for the sent sFlow datagram.

Step 3 Display the sFlow configuration using the command **show sflow**

Example:

```
switch(config)# show sflow
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

Configure Collector Port

You can configure the destination port for sFlow datagrams.

Before you begin

Make sure that you have enabled sFlow.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Configure the UDP port of the sFlow collector using the command [**no**] **sflow collector-port** *collector-port*

Example:

```
switch(config)# sflow collector-port 7000
```

The range for the *collector-port* is from 1 to 65535.

Step 3 Display the sFlow configuration using the command **show sflow**

Example:

```
switch(config)# show sflow
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

Configure Agent Address

Configure the sFlow agent address to enable sFlow functionality on the device.

You can configure the IPv4 or IPv6 address of the sFlow agent.

Before you begin

Make sure that you have enabled sFlow.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Configure the IPv4 or IPv6 address of the sFlow agent using the command [**no**] **sflow agent-ip** *ip-address*

Example:

```
switch(config)# sflow agent-ip 192.0.2.3
```

```
switch(config)# sflow agent-ip 2001::10
```

The default IP address is 0.0.0.0, which means that all samples will be dropped. You must specify a valid IP address to enable sFlow functionality.

Note
This IP address is not necessarily the source IP address for sending the sFlow datagram to the collector.

The agent ip address and the collector ip address must belong to the same address family, that is, either IPv4 or IPv6 address family.

Step 3 Display the sFlow configuration using the command **show sflow**

Example:

```
switch(config)# show sflow
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

Configure Sampling Data Source

Before you begin

Make sure that you have enabled sFlow. If you want to use a port channel as the data source, make sure that you have already configured the port channel and you know the port channel number. Make sure that the sFlow and SPAN ACL TCAM region sizes are configured for any uplink ports that are to be configured as an sFlow data source on the following devices: Cisco Nexus 9332PQ, 9372PX, 9372TX, and 93120TX switches and Cisco Nexus 9396PX, 9396TX, and 93128TX switches with the N9K-M6PQ generic expansion module (GEM).

You can configure the source of the data for the sFlow sampler as an Ethernet port, a range of Ethernet ports, or a port channel.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Configure the sFlow sampling data source using the command [**no**] **sflow data-source interface** [**ethernet** *slot* / *port* [- *port*] | **port-channel** *channel-number*]

Example:

```
switch(config)# sflow data-source interface ethernet 1/5-12
```

For an Ethernet data source, *slot* is the slot number, and *port* can be either a single port number or a range of ports designated as *port-port* .

Step 3 Display the sFlow configuration using the command **show sflow**

Example:

```
switch(config)# show sflow
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

Configure Extended BGP (Gateway)

You can configure sFlow Extended BGP on the switch.

Before you begin

Make sure that you have enabled sFlow.

Make sure that the source port is a non-SVI Layer 3 interface, such as a physical interface or port-channel.

Procedure

Step 1 Enter global configuration mode using the command **configure terminal**

Example:

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

Step 2 Configure extended bgp on the switch using the command [**no**] **sflow extended bgp**

Example:

```
switch(config)# sflow extended bgp
```

Sampled sFlow packets with destination IP address to BGP installed routes will include extended gateway (bgp) data in the exported sFlow record.

Step 3 Display the sFlow configuration using the command **show sflow**

Example:

```
switch(config)# show sflow
```

This is an optional step.

Step 4 Copy the running configuration to the startup configuration using the command **copy running-config startup-config**

Example:

```
switch(config)# copy running-config startup-config
```

This is an optional step.

Related Documents

This section provides a reference to related documents for ACL TCAM regions.

Related Topic	Document Title
ACL TCAM regions	Configuring IP ACLs