



Sampled NetFlow

This feature module describes the Sampled NetFlow feature. It includes information on the benefits of the feature, supported platforms, supported standards, and the commands necessary to configure the Sampled NetFlow feature.

Feature History

Release	Modification
12.0(11)S	This feature was introduced on the Cisco 12000 series Internet router.
12.0(14)ST	This feature was integrated into Cisco IOS Release 12.0(14)ST.
12.0(18)S	This feature was introduced on Cisco 12000 series Engine 2 Packet-over-SONET (POS) line cards.
12.0(21)S	This feature was introduced on Cisco 12000 series (Engine 2) 3-Port Gigabit Ethernet line cards.
12.0(24)S	This feature was introduced on Cisco 12000 series IP Service Engine (ISE) line cards as an output feature called Output Sampled NetFlow.
12.0(26)S	This feature was introduced on Cisco 12000 series 8-Port OC-3 STM-1 ATM line cards.

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Corporate Headquarters:
Cisco Systems, Inc., 170 West Tasman Drive, San Jose, CA 95134-1706 USA

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Feature Overview

On an interface, Sampled NetFlow allows you to collect NetFlow statistics for a subset of incoming (ingress) IPv4 traffic on the interface, selecting only one out of “N” sequential packets, where “N” is a configurable parameter.

These sampling packets will substantially decrease the CPU utilization needed to account for NetFlow packets by allowing the majority of the packets to be switched faster because they will not need to go through additional NetFlow processing.

Benefits

Forwarding rates on a Cisco 12000 series Internet router are an order of magnitude greater than traditional platforms that support NetFlow. “Touching” every switched packet for NetFlow accounting becomes a challenge at these high switching rates. However, collecting characteristic statistics on IP traffic being forwarded, such as source and destination IP addresses, route prefixes, and autonomous system numbers is still a necessary tool for managing and planning a network.

The Sampled NetFlow feature was developed to alleviate the performance penalty incurred by turning on NetFlow on Cisco 12000 series Internet routers. In order to scale to higher forwarding rates, NetFlow will now allow the user to sample one out of every “x” IP packets being forwarded. These sample packets will be accounted for in the NetFlow cache on the router. The user can configure the “x” interval. This feature will substantially decrease the CPU utilization needed to account for NetFlow packets by allowing a majority of the packets to be switched faster because they will not need to go through additional NetFlow processing.

Restrictions

The Sampled NetFlow feature will be available only on the Cisco 12000 series Internet routers. The Cisco 12000 series Internet router has only one image, and no special packaging is necessary.

In IOS Release 12.0(24)S and later releases, the Sampled NetFlow feature is supported on Cisco 12000 series IP Service Engine (ISE) line cards as an output feature, called Output Sampled NetFlow, providing NetFlow statistics for outgoing traffic. The following restrictions apply to the implementation of Output Sampled NetFlow on Cisco 12000 series ISE line cards:

- The input interface is reported as Null in all flows.
- Starting in IOS Release 12.0(26)S, the input interface is reported as the lowest interface number on the ingress line card where a network flow arrived. For example, if the input subinterface of the current flow is POS3/2.10, Output Sampled Netflow will report POS3/0.

For more information about how to configure and use the Output Sampled NetFlow feature, refer to <http://www.cisco.com/univercd/cc/td/doc/product/software/ios120/120newft/120limit/120s/120s24/12soutfl.htm>.

Supported Platforms

This feature is supported on the following platforms:

- Cisco 12000 series Engine 0 line cards
- Cisco 12000 series Engine 1 line cards

- Cisco 12000 series Engine 2 line cards
- Cisco 12000 series IP Service Engine (ISE) line cards
- Cisco 12000 series Engine 4 Plus (E4+) line cards

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

Supported Standards, MIBs, and RFCs

Standards

None

MIBs

None

For descriptions of supported MIBs and how to use MIBs, see the Cisco MIB web site on CCO at <http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>.

RFCs

None

Prerequisites

The Sampled NetFlow feature must be enabled explicitly.

Configuration Tasks

See the following sections for configuration tasks for the Sampled NetFlow feature.

- [Configuring Sampled NetFlow Mode on an Interface](#)
- [Configuring the Sampling Mode and the Sampling Interval](#)

Configuring Sampled NetFlow Mode on an Interface

To configure NetFlow in the sampled mode on an interface, use the following command in interface configuration mode:

Command	Purpose
Router(config-if)# ip route-cache flow sampled	Enables NetFlow switching in the sampled mode.

**Note**

When the Sampled NetFlow feature is disabled on an interface, normal NetFlow also becomes disabled. This restriction was made to prevent the interface from being overwhelmed by the sudden transition from sampled NetFlow to normal Netflow. You need to explicitly re-enable NetFlow if so desired. The default value for the sampling interval is 4 billion. This default packet interval was designed to protect the router from being choked by a misconfiguration. You need to explicitly configure a usable packet interval for your case.

Configuring the Sampling Mode and the Sampling Interval

To configure the sampling mode (that is, the type of sampling) and the sampling interval value, use the following command in global configuration mode:

Command	Purpose
Router(config)# ip flow-sampling-mode packet-interval <i>value</i>	Enables sampling mode and the sampling interval for NetFlow sampling.

Monitoring and Maintaining Sampled NetFlow

To monitor sampled NetFlow, use the following command in EXEC mode:

Command	Purpose
Router# show ip flow sampling	Displays the sampling mode and sampling interval settings.

Configuration Examples

This section provides the following configuration examples:

- [Configuring Sampled NetFlow on an Interface Example](#)
- [Configuring the Sampling Mode and Packet Interval Example](#)

Configuring Sampled NetFlow on an Interface Example

```
interface FastEthernet9/0/0
mac-address 4000.0209.0000
ip address 150.1.2.2 255.255.255.0
no ip directed-broadcast
ip route-cache flow sampled
ip route-cache distributed
no ip mroute-cache
no keepalive
!\
```

Configuring the Sampling Mode and Packet Interval Example

```
ip classless
ip route 20.1.1.1 255.255.255.255 Null0
ip route 171.69.1.129 255.255.255.255 10.0.101.1
ip flow-export version 5
ip flow-export destination 10.42.42.1 9991
ip flow-sampling-mode packet-interval 100
!
```

Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

The following is a modified Cisco IOS command:

- **ip route-cache flow**

The following is a list of new Cisco IOS commands:

- **ip flow-sampling-mode**
- **show ip flow sampling**

ip route-cache flow

To enable NetFlow switching for IP routing, use the **ip route-cache flow** command in interface configuration mode. To disable NetFlow switching, use the **no** form of this command.

ip route-cache flow [**sampled** [**input** | **output**]]

no ip route-cache flow [**sampled** [**input** | **output**]]

Syntax	Description
sampled	(Optional) Enables NetFlow cache in sampled mode.
input	(Optional) Enables NetFlow sampling for incoming IPv4 traffic on a Cisco 12000 series ISE interface.
output	(Optional) Enables NetFlow sampling for outgoing IPv4 traffic on a Cisco 12000 series ISE interface.

Defaults This command is not enabled by default.

Command Modes Interface configuration

Command History	Release	Modification
	11.1	This command was introduced.
	12.0(11)S	The sampled keyword was added.
	12.0(24)S	The input and output keywords were added for use on Cisco 12000 series ISE line cards.

Usage Guidelines NetFlow is an accounting and acceleration mechanism that captures a rich set of traffic statistics. These traffic statistics include user, protocol, port, and type of service information that can be used for a wide variety of purposes such as network analysis and planning, accounting, and billing. To export NetFlow data, use the **ip flow-export** global configuration command.



Caution

Entering the **ip flow-export** or **no ip flow-export** command on the Cisco 12000 Series Internet Routers and specifying any version format other than version 1 (in other words, entering the **ip flow-export** or **no ip flow-export** command and specifying either the **version 5** or **version 9** keyword) causes packet forwarding to stop for a few seconds while NetFlow reloads the route processor and line card CEF tables. To avoid interruption of service to a live network, apply this command during a change window, or include it in the startup-config file to be executed during a router reboot.

NetFlow is supported on IP and IP encapsulated traffic over all interface types and encapsulations except for Inter-Switch Link/VLAN, ATM, and Frame Relay interfaces when more than one input access control list is used on the interface, and ATM local area network emulation (LANE).

In conventional switching at the network layer, each incoming packet is handled on an individual basis with a series of functions to perform access list checks, capture accounting data, and switch the packet. With NetFlow, after a flow has been identified and access list processing of the first packet in the flow has been performed, all subsequent packets are handled on a “connection-oriented” basis as part of the flow, where access list checks are bypassed and statistics capture are performed in tandem.

A network flow is identified as a unidirectional stream of packets between a source and destination—both defined by a network-layer IP address and transport-layer port number. Specifically, a flow is identified as the combination of the following fields:

- Source IP address
- Destination IP address
- Source port number
- Destination port number
- Protocol type
- Type of service
- Input interface

NetFlow operates by creating a flow cache that contains the information needed to perform access list check for all active flows. The NetFlow cache is built by processing the first packet of a flow through the standard fast switching path. As a result, each flow is associated with an incoming and outgoing interface port number and with a specific security access permission and encryption policy. The cache also includes entries for traffic statistics that are updated in tandem with the switching of subsequent packets. After the NetFlow cache is created, packets identified as belonging to an existing flow have their traffic statistic counters increased and security access list checks bypassed. Flow information is maintained within the NetFlow cache for all active flows.

NetFlow is not one of the available switching modes. When you configure NetFlow on an interface, you must have some other switching method to actually switch the packet. Also, with NetFlow you can export data (traffic statistics) to a remote workstation for further processing.

NetFlow accounting is based on identifying packet flows and maintaining statistics and access list processing within a router. It does not involve any connection-setup protocol either between routers or to any other networking device or end station and does not require any change externally—either to the traffic or packets themselves or to any other networking device. Thus, NetFlow is completely transparent to the existing network, including end stations and application software and network devices like LAN switches. Also, because NetFlow is performed independently on each internetworking device, it does not need to be operational on each router in the network. Network planners can selectively invoke NetFlow accounting (and NetFlow data export) on a router/interface basis to gain traffic performance, control, or accounting benefits in specific network locations.



When sampled NetFlow is disabled on an interface, normal NetFlow also becomes disabled. This restriction was made to prevent the interface from being overwhelmed by the sudden transition from sampled NetFlow to normal NetFlow. You need to explicitly re-enable NetFlow if so desired. The default value for the sampling interval is 4 billion. This default packet interval was designed to protect the router from being choked by a misconfiguration. You need to explicitly configure a usable packet interval for your case.

**Note**

NetFlow does consume additional memory and CPU resources in comparison with other switching modes; therefore, it is important to understand the resources required on your router before enabling NetFlow.

Starting in IOS Release 12.0(24)S, Sampled NetFlow is supported on Cisco 12000 series ISE line cards as an output feature, called Output Sampled NetFlow, providing NetFlow statistics for outgoing traffic. Output Sampled NetFlow uses the output interface on an ISE line card as a key flow field instead of the input interface. The input interface is reported as Null in all flows. Starting in IOS Release 12.0(26)S, the input interface is reported as the lowest interface of the ingress line card on which a flow arrives. For example, if the current flow arrives on ISE input subinterface POS3/2.10, it is reported as POS3/0.

To enable Output Sampled NetFlow on a Cisco 12000 series ISE interface, use the **ip route-cache flow sampled [input | output]** command in interface configuration mode.

Examples

The following example enables NetFlow switching on the interface:

```
interface ethernet 0/5/0
 ip address 17.252.245.2 255.255.255.0
 ip route-cache flow
```

Related Commands

Command	Description
ip flow-export	Enables the exporting of information in NetFlow cache entries.

ip flow-sampling-mode

To enable sampling mode in the NetFlow cache, use the **ip flow-sampling-mode** global configuration command. To disable sampling mode, use the **no** form of this command.

ip flow-sampling-mode packet-interval *value*

no ip flow-sampling-mode packet-interval

Syntax Description	packet-interval	Samples a single packet out of a user-defined interval.
	<i>value</i>	Number of intervals to the next sampled packet in the NetFlow cache. The valid range is from 10 to 16382. The default is 4 billion.

Defaults This command is not enabled by default.

Command Modes Global configuration

Command History	Release	Modification
	12.0(11)S	This command was introduced.

Examples The following example shows how to enable sampling mode and to set the sampling interval to 100:

```
ip flow-sampling-mode packet-interval 100
```

show ip flow sampling

To display the settings of the sampling type and sampling interval, use the **show ip flow sampling EXEC** command.

show ip flow sampling

Syntax Description This command has no keywords and arguments.

Defaults No default behavior or values.

Command Modes EXEC

Command History	Release	Modification
	12.0(11)S	This command was introduced.

Examples The following example displays NetFlow sampling by using the **show ip flow sampling** command:

```
show ip flow sampling
```

```
Flow sampling is enabled
  'Packet Interval' sampling mode is configured.
  1 out of every 100 packets is being sampled.
```

Debug Commands

This section documents the new **debug ip flow sampling** command. All other commands used with this feature are documented in the Cisco IOS Release 12.1 command reference publications.

debug ip flow sampling

To help debug sampling-related activities, use the **debug ip flow sampling** command in EXEC mode.

debug ip flow sampling

Syntax Description This command has no keywords and arguments.

Defaults No default behavior or values.

Command Modes EXEC

Command History	Release	Modification
	12.0(11)S	This command was introduced.

Examples The following example displays NetFlow sampling by using the **debug ip flow sampling** command:

```
debug ip flow sampling
```

```
IP Flow sampling mode events debugging is on
```

The following example displays a configuration of a sampled mode and sampling interval:

```
ip flow-sampling-mode packet-interval 100
debug ip flow sampling
```

```
01:58:18: Flow sampling is enabled
01:58:18: Sampling parameters: mode = 'Packet Interval', interval = 100
01:58:18: IPFLOW: Sending sampling config message to all LC
```

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