Configuring NetFlow Aggregation Caches

This module contains information about and instructions for configuring NetFlow aggregation caches. The NetFlow main cache is the default cache used to store the data captured by NetFlow. By maintaining one or more extra caches, called aggregation caches, the NetFlow Aggregation feature allows limited aggregation of NetFlow data export streams on a router. The aggregation scheme that you select determines the specific kinds of data that are exported to a remote host.

NetFlow is a Cisco IOS application that provides statistics on packets flowing through the router. It is emerging as a primary network accounting and security technology.

- Finding Feature Information, page 1
- Prerequisites for Configuring NetFlow Aggregation Caches, page 2
- Restrictions for Configuring NetFlow Aggregation Caches, page 2
- Information About Configuring NetFlow Aggregation Caches, page 3
- How to Configure NetFlow Aggregation Caches, page 27
- Configuration Examples for Configuring NetFlow Aggregation Caches, page 33
- Additional References, page 37
- Feature Information for Configuring NetFlow Aggregation Caches, page 39
- Glossary, page 40

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table at the end of this module.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Prerequisites for Configuring NetFlow Aggregation Caches

Before you enable NetFlow, you must:

- Configure the router for IP routing
- Ensure that one of the following is enabled on your router, and on the interfaces that you want to configure NetFlow on: Cisco Express Forwarding (CEF), distributed CEF, or fast switching
- Understand the resources required on your router because NetFlow consumes additional memory and CPU resources

If you intend to use Version 8 export format with an aggregation cache, configure Version 5 export format for the main cache.

If you need autonomous system (AS) information from the aggregation, make sure to specify either the **peer-as**or **origin-as** keyword in your export command if you have not configured an export format version.

You must explicitly enable each NetFlow aggregation cache by entering the **enabled** keyword from aggregation cache configuration mode.

Router-based aggregation must be enabled for minimum masking.

Restrictions for Configuring NetFlow Aggregation Caches

Cisco IOS Releases 12.2(14)S, 12.0(22)S, or 12.2(15)T

If your router is running a version of Cisco IOS prior to releases 12.2(14)S, 12.0(22)S, or 12.2(15)T the **ip route-cache flow** command is used to enable NetFlow on an interface.

If your router is running Cisco IOS release 12.2(14)S, 12.0(22)S, 12.2(15)T, or later the **ip flow ingress** command is used to enable NetFlow on an interface.

Memory Impact

During times of heavy traffic, the additional flows can fill up the global flow hash table. If you need to increase the size of the global flow hash table, increase the memory of the router.

Performance Impact

Configuring Egress NetFlow accounting with the **ip flow egress** command might adversely affect network performance because of the additional accounting-related computation that occurs in the traffic-forwarding path of the router.

NetFlow Data Export

Restrictions for NetFlow Version 9 Data Export

- Backward compatibility--Version 9 is not backward-compatible with Version 5 or Version 8. If you need Version 5 or Version 8, you must configure it.

- Export bandwidth--Export bandwidth use increases for Version 9 (because of template flowsets) versus Version 5. The increase in bandwidth usage versus Version 5 varies with the frequency with which template flowsets are sent. The default is to resend templates every 20 packets, which has a bandwidth cost of about 4 percent. If necessary, you can lower the resend rate with the **ip flow-export template refresh-rate** *packets* command.
- Performance impact--Version 9 slightly decreases overall performance, because generating and maintaining valid template flowsets require additional processing.

Restrictions for NetFlow Version 8 Export Format

Version 8 export format is available only for aggregation caches, and it cannot be expanded to support new features.

Information About Configuring NetFlow Aggregation Caches

NetFlow Aggregation Caches

NetFlow Cache Aggregation Benefits

Aggregation of export data is typically performed by NetFlow collection tools on management workstations. Router-based aggregation allows limited aggregation of NetFlow export records to occur on the router. Thus, you can summarize NetFlow export data on the router before the data is exported to a NetFlow data collection system, which has the following benefits:

- Reduces the bandwidth required between the router and the workstations
- Reduces the number of collection workstations required
- Improves performance and scalability on high flow-per-second routers

NetFlow Cache Aggregation Schemes

Cisco IOS NetFlow aggregation maintains one or more extra caches with different combinations of fields that determine which flows are grouped together. These extra caches are called aggregation caches. The combinations of fields that make up an aggregation cache are referred to as schemes. As flows expire from the main cache, they are added to each enabled aggregation cache.

You can configure each aggregation cache with its individual cache size, cache ager timeout parameter, export destination IP address, and export destination UDP port. As data flows expire in the main cache (depending on the aggregation scheme configured), relevant information is extracted from the expired flow and the corresponding flow entry in the aggregation cache is updated. The normal flow ager process runs on each active aggregation cache the same way it runs on the main cache. On-demand aging is also supported. Each aggregation cache contains different field combinations that determine which data flows are grouped. The default aggregation cache size is 4096 bytes.

You configure a cache aggregation scheme through the use of arguments to the **ip flow-aggregation cache** command. NetFlow supports the following five non-ToS based cache aggregation schemes:

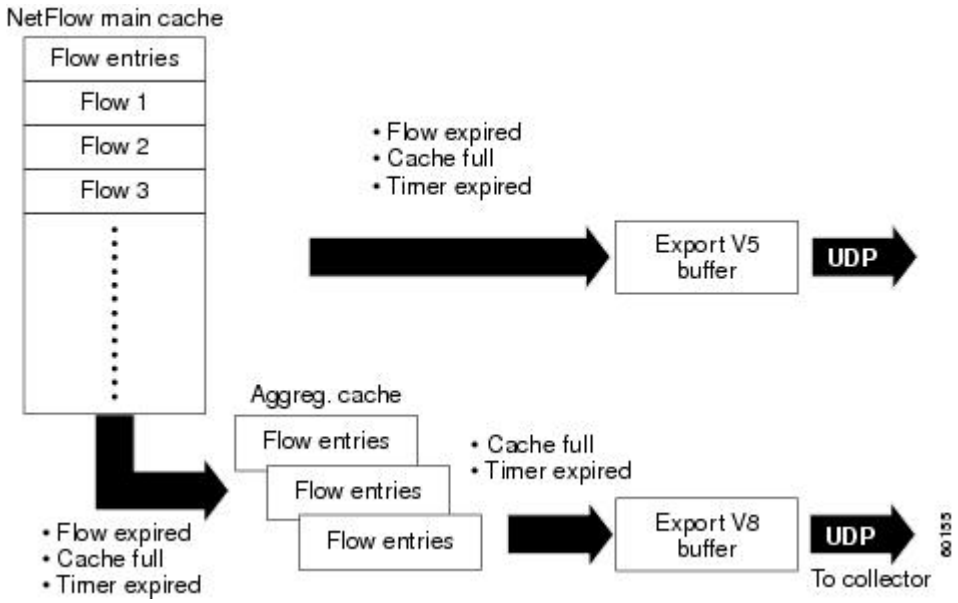
- Autonomous system (AS) aggregation scheme
- Destination prefix aggregation scheme
- Prefix aggregation scheme
- Protocol port aggregation scheme
- Source prefix aggregation scheme

The NetFlow Type of Service (ToS)-Based Router Aggregation feature introduced support for additional cache aggregation schemes, all of which include the ToS byte as one of the fields in the aggregation cache. The following are the six ToS-based aggregation schemes:

- AS-ToS aggregation scheme
- Destination prefix-ToS aggregation scheme
- Prefix-port aggregation scheme
- Prefix-ToS aggregation scheme
- Protocol-port-ToS aggregation scheme
- Source prefix-ToS aggregation scheme

The figure below shows an example of how the main NetFlow cache can be aggregated into multiple aggregation caches based upon user-configured aggregation schemes.

Figure 1: Building a NetFlow Aggregation Cache



Note NetFlow Aggregation Scheme Fields, on page 5 through NetFlow Cache Aggregation Schemes, on page 3 illustrate the Version 8 export formats of the aggregation schemes listed above. Additional export formats (for instance, Version 9) are also supported. If you are using Version 9, the formats will be different from those shown in the figures. For more information about Version 9 export formats, see Configuring NetFlow and NetFlow Data Export.

NetFlow Aggregation Scheme Fields

Each cache aggregation scheme contains field combinations that differ from any other cache aggregation scheme. The combination of fields determines which data flows are grouped and collected when a flow expires from the main cache. A flow is a set of packets that has common fields, such as the source IP address, destination IP address, protocol, source and destination ports, type-of-service, and the same interface on which the flow is monitored. To manage flow aggregation on your router, you need to configure the aggregation cache scheme that groups and collects the fields from which you want to examine data. The tables below show the NetFlow fields that are grouped and collected for non-ToS and ToS based cache aggregation schemes.

The table below shows the NetFlow fields used in the non-TOS based aggregation schemes.

Table 1: NetFlow Fields Used in the Non-ToS Based Aggregations Schemes

Field	AS	Protocol Port	Source Prefix	Destination Prefix	Prefix
Source prefix			X		X
Source prefix mask			X		X
Destination prefix				X	X
Destination prefix mask				X	X
Source app port		X			
Destination app port		X			
Input interface	X		X		X
Output interface	X			X	X
IP protocol		X			
Source AS	X		X		X
Destination AS	X			X	X

Field	AS	Protocol Port	Source Prefix	Destination Prefix	Prefix
First time stamp	X	X	X	X	X
Last time stamp	X	X	X	X	X
Number of flows	X	X	X	X	X
Number of packets	X	X	X	X	X
Number of bytes	X	X	X	X	X

The table below shows the NetFlow fields used in the TOS based aggregation schemes.

Table 2: NetFlow Fields Used in the ToS Based Aggregation Schemes

Field	AS-ToS	Protocol Port-ToS	Source Prefix-ToS	Destination Prefix-ToS	Prefix-ToS	Prefix-Port
Source prefix			X		X	X
Source prefix mask			X		X	X
Destination prefix				X	X	X
Destination prefix mask				X	X	X
Source app port		X				X
Destination app port		X				X
Input interface	X	X	X		X	X
Output interface	X	X		X	X	X
IP protocol		X				X
Source AS	X		X		X	

Field	AS-ToS	Protocol Port-ToS	Source Prefix-ToS	Destination Prefix-ToS	Prefix-ToS	Prefix-Port
Destination AS	X			X	X	
ToS	X	X	X	X	X	X
First time stamp	X	X	X	X		X
Last time stamp	X	X	X	X		X
Number of flows	X	X	X	X		X
Number of packets	X	X	X	X		X
Number of bytes	X	X	X	X		X

NetFlow AS Aggregation Scheme

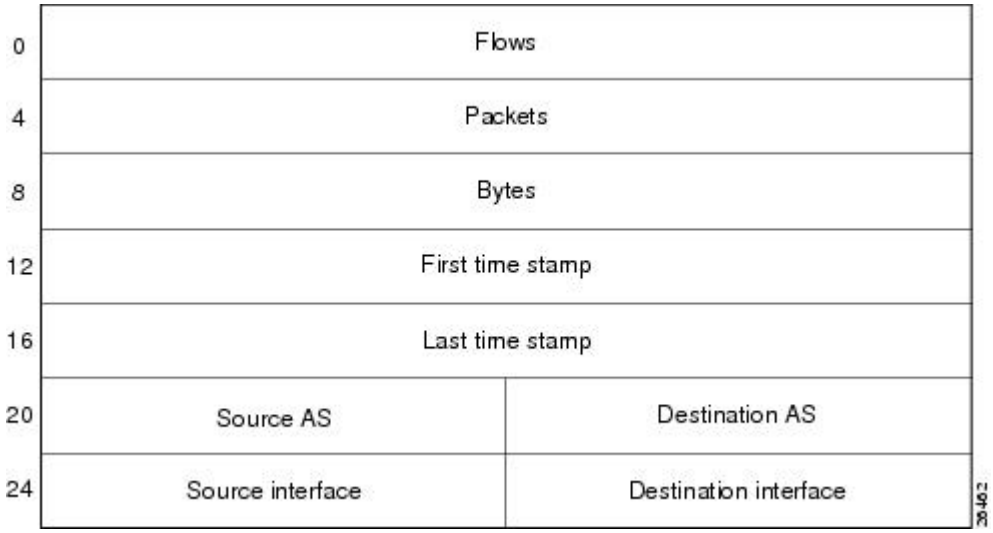
The NetFlow AS aggregation scheme reduces NetFlow export data volume substantially and generates AS-to-AS traffic flow data. The scheme groups data flows that have the same source BGP AS, destination BGP AS, input interface, and output interface.

The aggregated NetFlow data export records report the following:

- Source and destination BGP AS
- Number of packets summarized by the aggregated record
- Number of flows summarized by the aggregated record
- Number of bytes summarized by the aggregated record
- Source interface
- Destination interface
- Time stamp when the first packet was switched and time stamp when the last packet was switched

The figure below shows the data export format for the AS aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 2: Data Export Format for AS Aggregation Scheme



The table below lists definitions for the data export record fields used in the AS aggregation scheme.

Table 3: Data Export Record Field Definitions for AS Aggregation Scheme

Field	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Source AS	Autonomous system of the source IP address (peer or origin)
Destination AS	Autonomous system of the destination IP address (peer or origin)
Source interface	SNMP index of the input interface
Destination interface	SNMP index of the output interface

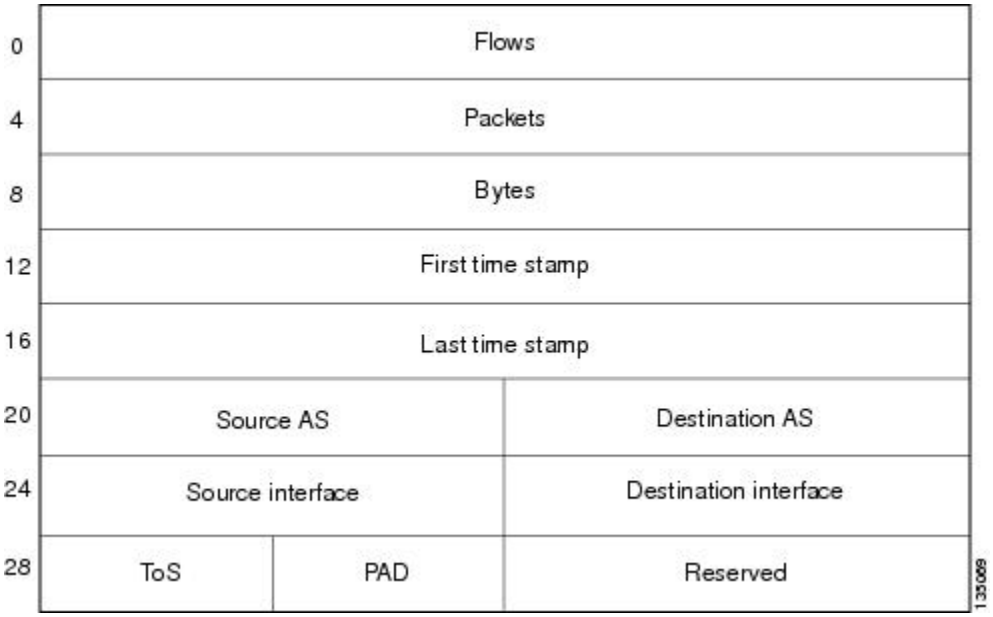
NetFlow AS-ToS Aggregation Scheme

The NetFlow AS-ToS aggregation scheme groups flows that have the same source BGP AS, destination BGP AS, source and destination interfaces, and ToS byte. The aggregated NetFlow export record based on the AS-ToS aggregation scheme reports the following:

- Source BGP AS
- Destination BGP AS
- ToS byte
- Number of flows summarized by the aggregated record
- Number of bytes summarized by this aggregated record
- Number of packets summarized by this aggregation record
- Source and destination interface
- Time stamp when the first packet was switched and time stamp when the last packet was switched

This aggregation scheme is particularly useful for generating AS-to-AS traffic flow data, and for reducing NetFlow export data volume substantially. The figure below shows the data export format for the AS-ToS aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 3: Data Export Format for AS-ToS Aggregation Scheme



The table below lists definitions for the data export record terms used in the AS-ToS aggregation scheme.

Table 4: Data Export Record Term Definitions for AS-ToS Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Source AS	Autonomous system of the source IP address (peer or origin)
Destination AS	Autonomous system of the destination IP address (peer or origin)
Source interface	SNMP index of the input interface
Destination interface	SNMP index of the output interface
ToS	Type of service byte
PAD	Zero field
Reserved	Zero field

NetFlow Destination Prefix Aggregation Scheme

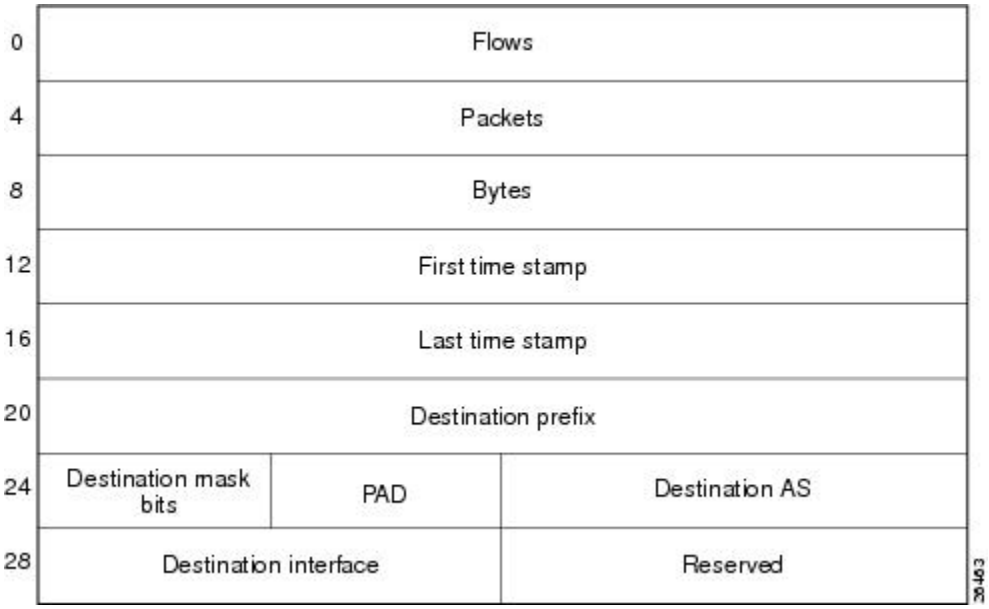
The destination prefix aggregation scheme generates data so that you can examine the destinations of network traffic passing through a NetFlow-enabled device. The scheme groups data flows that have the same destination prefix, destination prefix mask, destination BGP AS, and output interface.

The aggregated NetFlow data export records report the following:

- Destination prefix
- Destination prefix mask
- Destination BGP AS
- Number of flows summarized by the aggregated record
- Number of bytes summarized by the aggregated record
- Number of packets summarized by the aggregated record
- Output interface
- Time stamp when the first packet was switched and time stamp when the last packet was switched

The figure below shows the data export format for the destination prefix aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 4: Destination Prefix Aggregation Data Export Record Format



The table below lists definitions for the data export record terms used in the destination prefix aggregation scheme.

Table 5: Data Export Record Term Definitions for Destination Prefix Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Destination prefix	Destination IP address ANDed with the destination prefix mask
Destination mask bits	Number of bits in the destination prefix
PAD	Zero field
Destination AS	Autonomous system of the destination IP address (peer or origin)

Term	Definition
Destination interface	SNMP index of the output interface
Reserved	Zero field

NetFlow Destination Prefix-ToS Aggregation Scheme

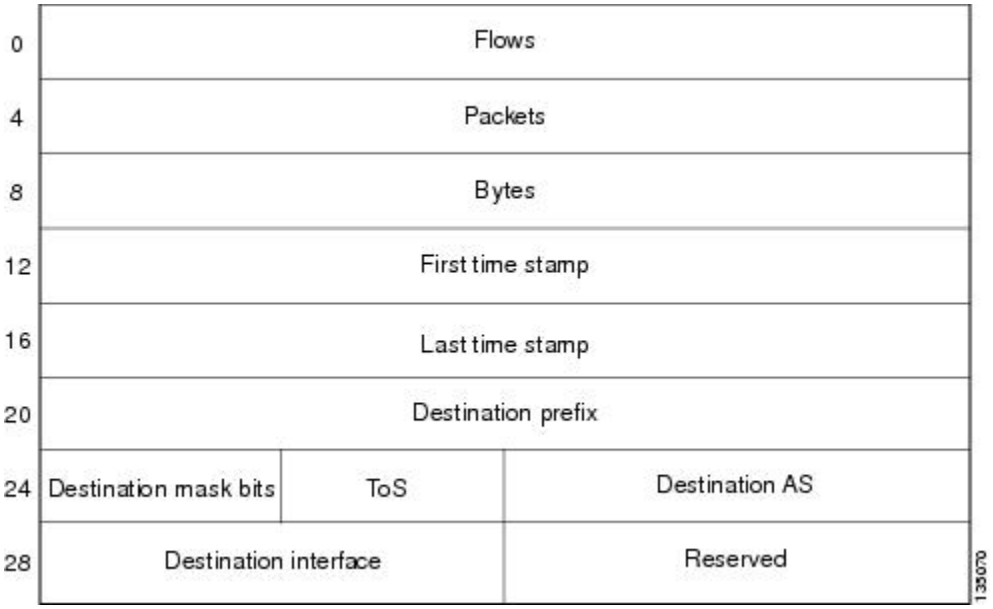
The NetFlow destination prefix-ToS aggregation scheme groups flows that have the same destination prefix, destination prefix mask, destination BGP AS, ToS byte, and output interface. The aggregated NetFlow export record reports the following:

- Destination IP address
- Destination prefix mask
- Destination AS
- ToS byte
- Number of flows summarized by the aggregated record
- Number of bytes summarized by the aggregated record
- Number of packets summarized by the aggregated record
- Output interface
- Time stamp when the first packet was switched and time stamp when the last packet was switched

This aggregation scheme is particularly useful for capturing data with which you can examine the destinations of network traffic passing through a NetFlow-enabled device. The figure below shows the data export format

for the Destination prefix-ToS aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 5: Data Export Format for Destination Prefix-ToS Aggregation Scheme



The table below lists definitions for the data export record terms used in the destination prefix-ToS aggregation scheme.

Table 6: Data Export Record Term Definitions for Destination Prefix-ToS Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Destination prefix	Destination IP address ANDed with the destination prefix mask
Dest mask bits	Number of bits in the destination prefix
ToS	Type of service byte
Destination AS	Autonomous system of the destination IP address (peer or origin)

Term	Definition
Destination interface	SNMP index of the output interface
Reserved	Zero field

NetFlow Prefix Aggregation Scheme

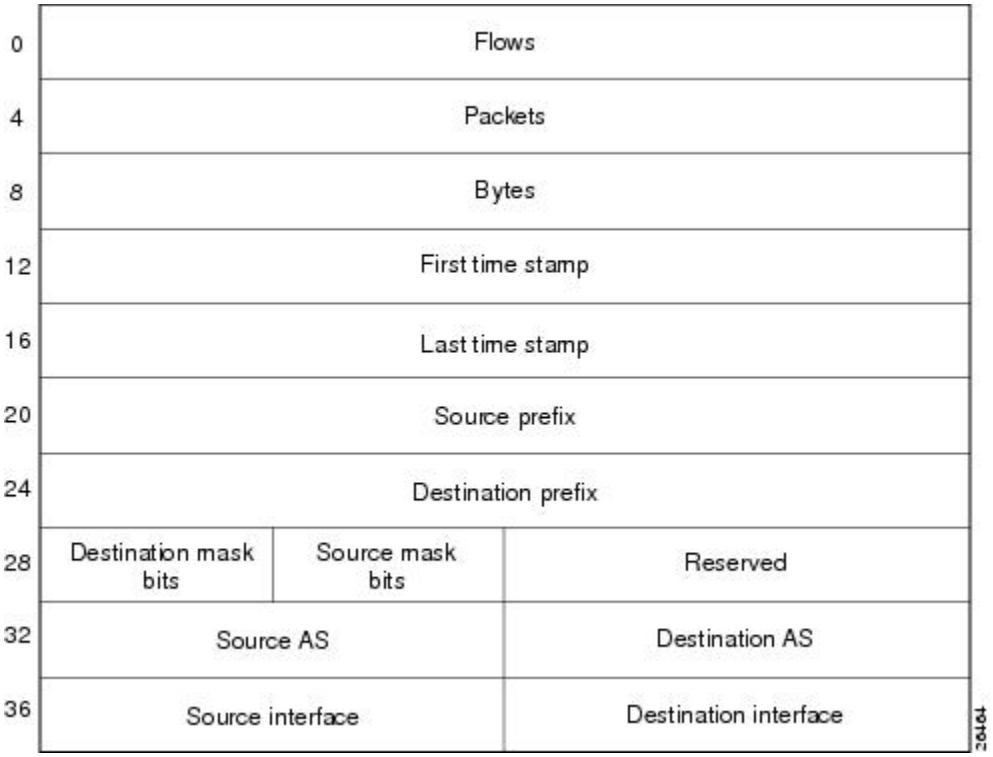
The NetFlow prefix aggregation scheme generates data so that you can examine the sources and destinations of network traffic passing through a NetFlow-enabled device. The scheme groups data flows that have the same source prefix, destination prefix, source prefix mask, destination prefix mask, source BGP AS, destination BGP AS, input interface, and output interface.

The aggregated NetFlow data export records report the following:

- Source and destination prefix
- Source and destination prefix mask
- Source and destination BGP AS
- Number of flows summarized by the aggregated record
- Number of bytes summarized by the aggregated record
- Number of packets summarized by the aggregated record
- Input and output interfaces
- Time stamp when the first packet is switched and time stamp when the last packet is switched

The figure below shows the data export format for the prefix aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 6: Data Export Format for Prefix Aggregation Scheme



The table below lists definitions for the data export record terms used in the prefix aggregation scheme.

Table 7: Data Export Record Terms and Definitions for Prefix Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Source prefix	Source IP address ANDed with the source prefix mask, or the prefix to which the source IP address of the aggregated flows belongs
Destination prefix	Destination IP address ANDed with the destination prefix mask

Term	Definition
Destination mask bits	Number of bits in the destination prefix
Source mask bits	Number of bits in the source prefix
Reserved	Zero field
Source AS	Autonomous system of the source IP address (peer or origin)
Destination AS	Autonomous system of the destination IP address (peer or origin)
Source interface	SNMP index of the input interface
Destination interface	SNMP index of the output interface

NetFlow Prefix-Port Aggregation Scheme

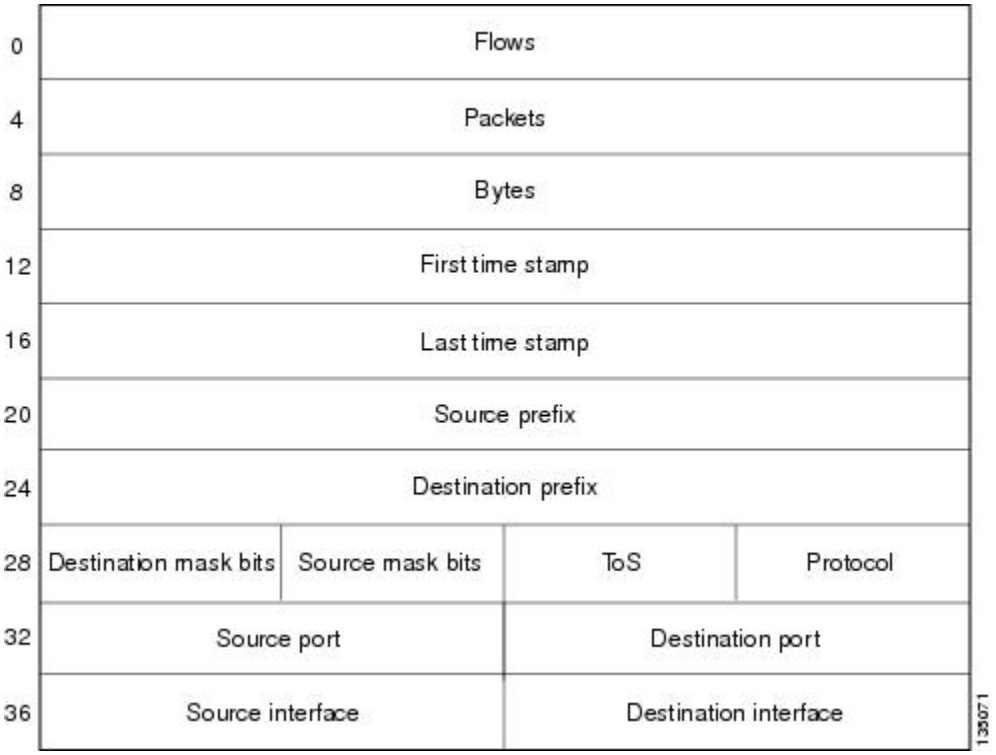
The NetFlow prefix-port aggregation scheme groups flows that have a common source prefix, source mask, destination prefix, destination mask, source port and destination port when applicable, input interface, output interface, protocol, and ToS byte. The aggregated NetFlow export record reports the following:

- Source prefix
- Source prefix mask
- Destination prefix
- Destination prefix mask
- Source port
- Destination port
- Source interface
- Destination interface
- Protocol
- ToS byte
- Number of flows summarized by the aggregated record
- Number of bytes summarized by the aggregated record
- Number of packets summarized by the aggregation record
- Time stamp when the first packet was switched and time stamp when the last packet was switched

This aggregation scheme is particularly useful for capturing data with which you can examine the sources and destinations of network traffic passing through a NetFlow-enabled device. The figure below shows the

data export record for the prefix-port aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 7: Data Export Record for Prefix-Port Aggregation Scheme



The table below lists definitions for the data export record terms used in the prefix-port aggregation scheme.

Table 8: Data Export Record Term Definitions for Prefix-Port Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Source prefix	Source IP address ANDed with the source prefix mask, or the prefix to which the source IP address of the aggregated flows belongs
Destination prefix	Destination IP address ANDed with the destination prefix mask

Term	Definition
Destination mask bits	Number of bits in the destination prefix
Source mask bits	Number of bits in the source prefix
ToS	Type of service byte
Protocol	IP protocol byte
Source port	Source UDP or TCP port number if applicable
Destination port	Destination User Datagram Protocol (UDP) or TCP port number
Source interface	SNMP index of the input interface
Destination interface	SNMP index of the output interface

NetFlow Prefix-ToS Aggregation Scheme

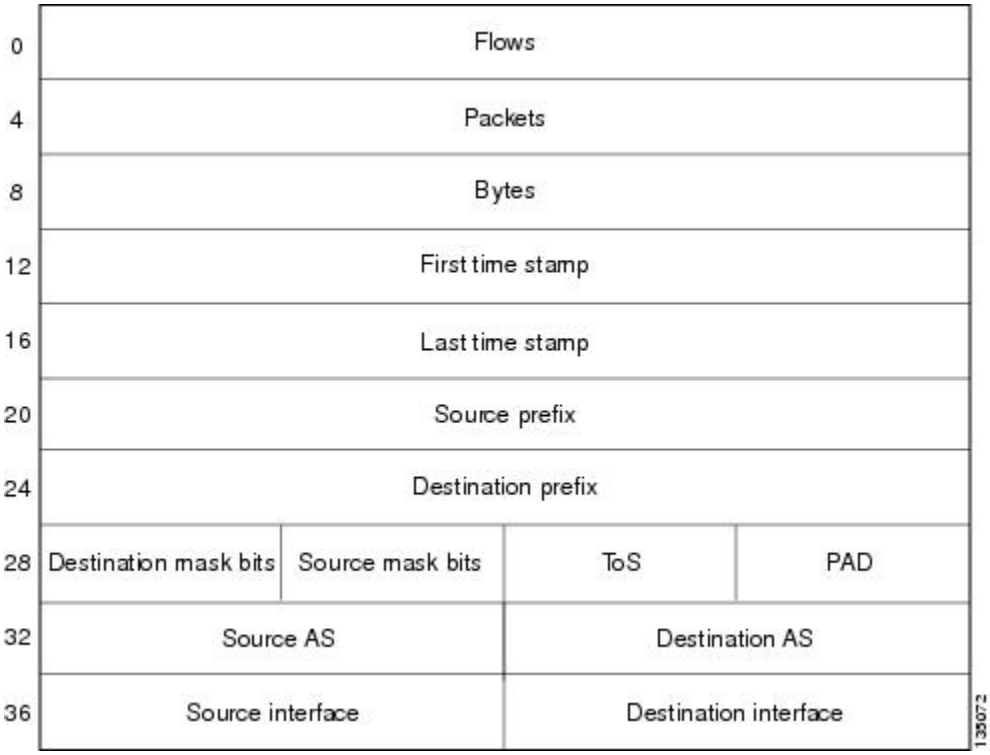
The NetFlow prefix-tos aggregation scheme groups together flows that have a common source prefix, source mask, destination prefix, destination mask, source BGP AS, destination BGP AS, input interface, output interface, and ToS byte. The aggregated NetFlow export record reports the following:

- Source prefix
- Source prefix mask
- Destination prefix
- Destination prefix mask
- Source AS
- Destination AS
- Source interface
- Destination interface
- ToS byte
- Number of flows summarized by the aggregated record
- Number of bytes summarized by the aggregated record
- Number of packets summarized by the aggregated record
- Time stamp when the first packet was switched and time stamp when the last packet was switched

This aggregation scheme is particularly useful for capturing data so that you can examine the sources and destinations of network traffic passing through a NetFlow-enabled device. The figure below displays the data

export format for the prefix-tos aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 8: Data Export Format for Prefix-ToS Aggregation Scheme



The table below lists definitions for the data export record terms used in the prefix-ToS aggregation scheme.

Table 9: Data Export Record Term Definitions for Prefix-ToS Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Source prefix	Source IP address ANDed with the source prefix mask, or the prefix to which the source IP address of the aggregated flows belongs
Destination prefix	Destination IP address ANDed with the destination prefix mask

Term	Definition
Destination mask bits	Number of bits in the destination prefix
Source mask bits	Number of bits in the source prefix
ToS	Type of service byte
Pad	Zero field
Source AS	Autonomous system of the source IP address (peer or origin)
Destination AS	Autonomous system of the destination IP address (peer or origin)
Source interface	SNMP index of the input interface
Destination interface	SNMP index of the output interface

NetFlow Protocol Port Aggregation Scheme

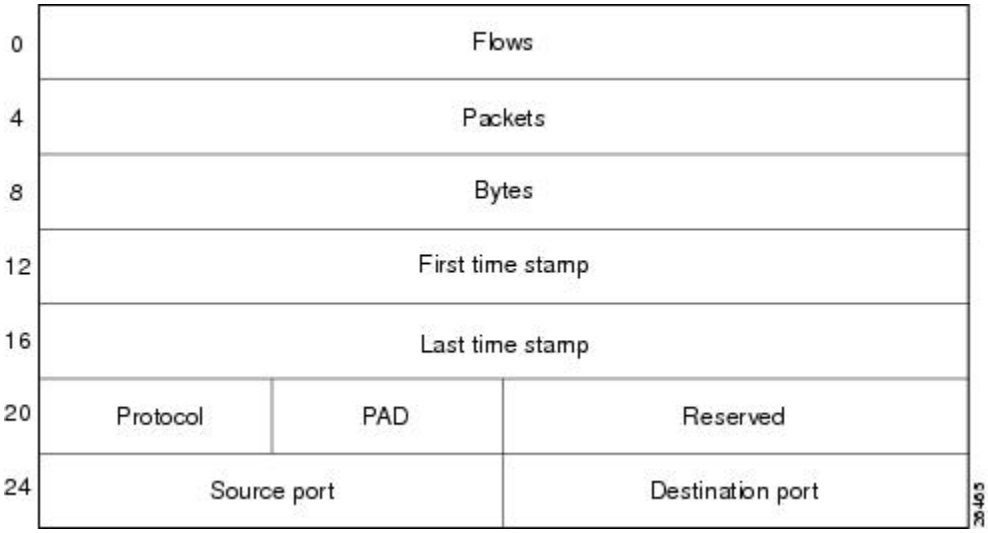
The NetFlow protocol port aggregation scheme captures data so that you can examine network usage by traffic type. The scheme groups data flows with the same IP protocol, source port number, and (when applicable) destination port number.

The aggregated NetFlow data export records report the following:

- Source and destination port numbers
- IP protocol (where 6 = TCP, 17 = UDP, and so on)
- Number of flows summarized by the aggregated record
- Number of bytes summarized by the aggregated record
- Number of packets summarized by the aggregated record
- Time stamp when the first packet was switched and time stamp when the last packet was switched

The figure below shows the data export format for the protocol port aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 9: Data Export Format for Protocol Port Aggregation Scheme



The table below lists definitions for the data export record terms used in the protocol port aggregation scheme.

Table 10: Data Export Record Term Definitions for Protocol Port Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Protocol	IP protocol byte
PAD	Zero field
Reserved	Zero field
Source port	Source UDP or TCP port number if applicable
Destination port	Destination User Datagram Protocol (UDP) or TCP port number

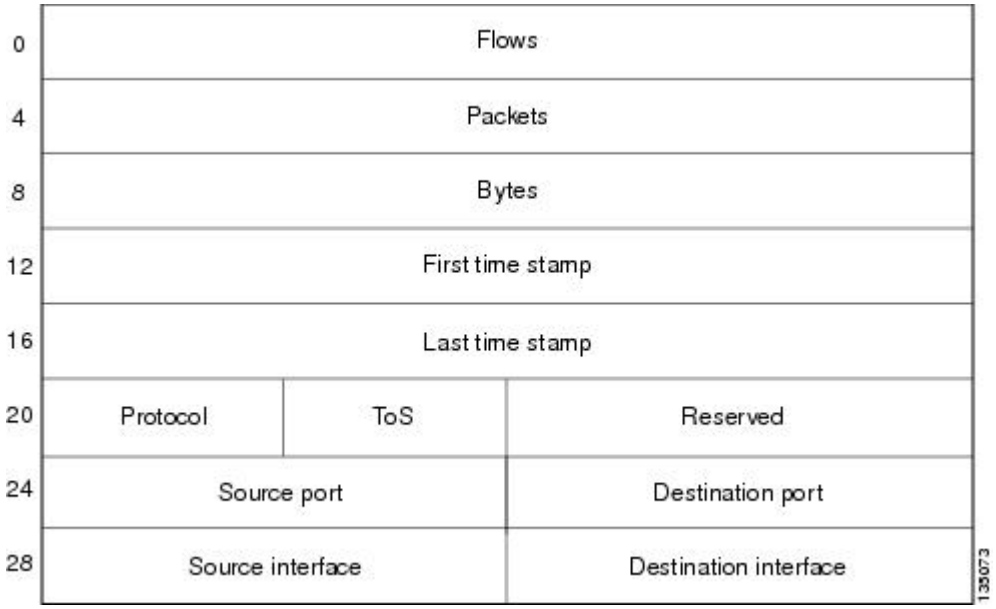
NetFlow Protocol-Port-ToS Aggregation Scheme

The NetFlow protocol-port-tos aggregation scheme groups flows that have a common IP protocol, ToS byte, source and (when applicable) destination port numbers, and source and destination interfaces. The aggregated NetFlow Export record reports the following:

- Source application port number
- Destination port number
- Source and destination interface
- IP protocol
- ToS byte
- Number of flows summarized by the aggregated record
- Number of bytes summarized by the aggregated record
- Number of packets summarized by the aggregation record
- Time stamp when the first packet was switched and time stamp when the last packet was switched

This aggregation scheme is particularly useful for capturing data so that you can examine network usage by type of traffic. The figure below shows the data export format for the protocol-port-tos aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 10: Data Export Format for Protocol-Port-ToS Aggregation Scheme



The table below lists definitions for the data export record terms used in the protocol-port-ToS aggregation scheme.

Table 11: Data Export Record Term Definitions for Protocol-Port-ToS Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Protocol	IP protocol byte
ToS	Type of service byte
Reserved	Zero field
Source port	Source UDP or TCP port number if applicable
Destination port	Destination User Datagram Protocol (UDP) or TCP port number
Source interface	SNMP index of the input interface
Destination interface	SNMP index of the output interface

NetFlow Source Prefix Aggregation Scheme

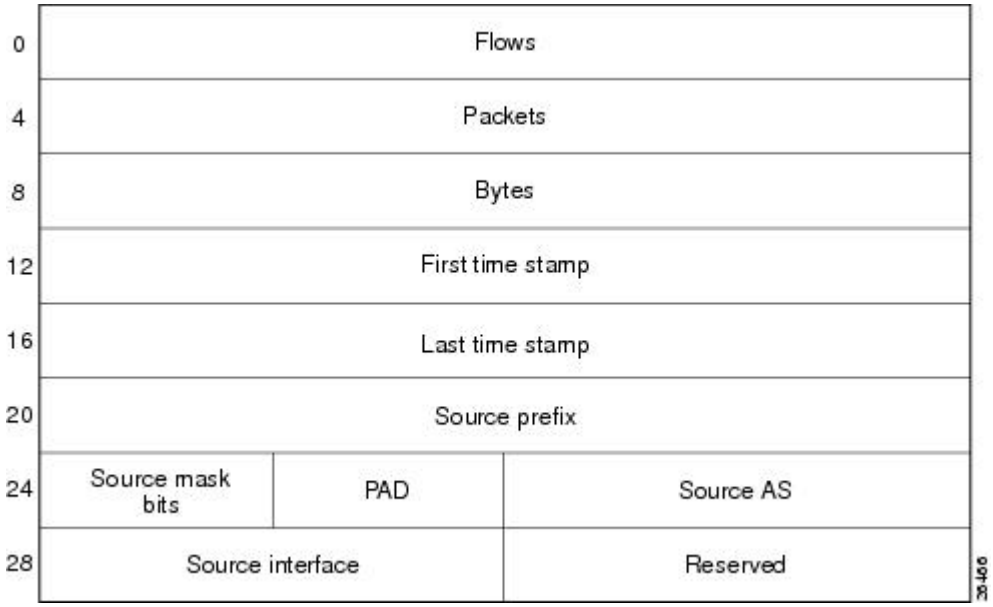
The NetFlow source prefix aggregation scheme captures data so that you can examine the sources of network traffic passing through a NetFlow-enabled device. The scheme groups data flows that have the same source prefix, source prefix mask, source BGP AS, and input interface.

The aggregated NetFlow data export records report the following:

- Source prefix
- Source prefix mask
- Source BGP AS
- Number of bytes summarized by the aggregated record
- Number of packets summarized by the aggregated record
- Input interface
- Time stamp when the first packet was switched and time stamp when the last packet was switched

The figure below show the data export format for the source prefix aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Figure 11: Data Export Format for Source Prefix Aggregation Scheme



The table below lists definitions for the data export record terms used in the source prefix aggregation scheme.

Table 12: Data Export Record Term Definitions for Source Prefix Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Source prefix	Source IP address ANDed with the source prefix mask, or the prefix to which the source IP address of the aggregated flows belongs
Source mask bits	Number of bits in the source prefix
PAD	Zero field
Source AS	Autonomous system of the source IP address (peer or origin)

Term	Definition
Source interface	SNMP index of the input interface
Reserved	Zero field

NetFlow Source Prefix-ToS Aggregation Scheme

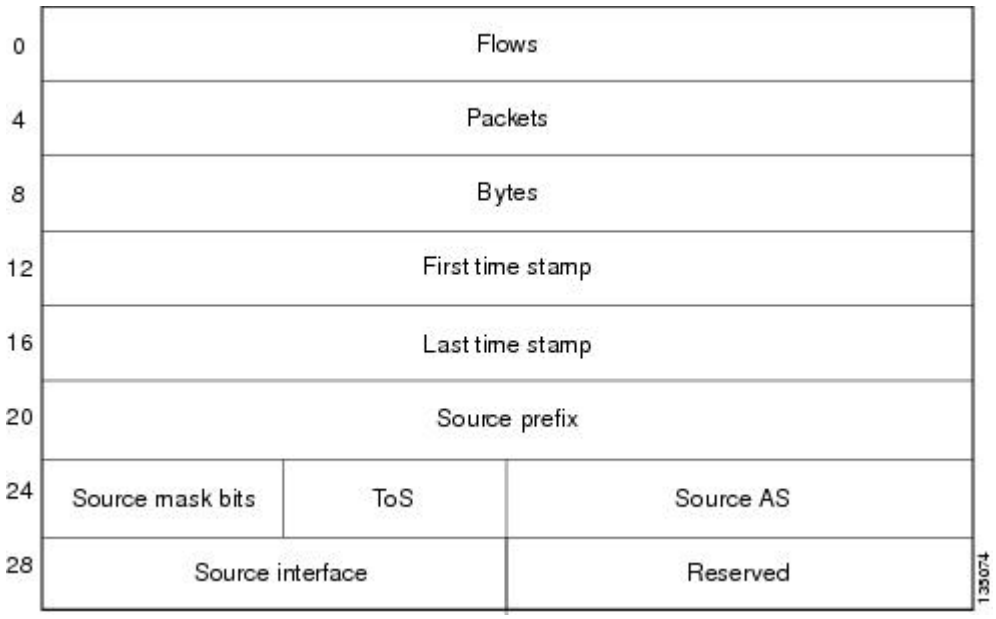
The NetFlow source prefix-ToS aggregation scheme groups flows that have a common source prefix, source prefix mask, source BGP AS, ToS byte, and input interface. The aggregated NetFlow export record reports the following:

- Source prefix
- Source prefix mask
- Source AS
- ToS byte
- Number of bytes summarized by the aggregated record
- Number of packets summarized by the aggregation record
- Input interface
- Time stamp when the first packet was switched and time stamp when the last packet was switched

This aggregation scheme is particularly useful for capturing data so that you can examine the sources of network traffic passing through a NetFlow-enabled device. The figure below show the data export format for the source prefix-ToS aggregation scheme. For a definition of the data export terms used in the aggregation scheme, see the table below.

Note When a router does not have a prefix for the source IP address in the flow, NetFlow uses 0.0.0.0 with 0 mask bits rather than making /32 entries. This prevents DOS attacks that use random source addresses from thrashing the aggregation caches. This is also done for the destination in the destination prefix-ToS, the prefix-ToS, and prefix-port aggregation schemes.

Figure 12: Data Export Format for Source Prefix-ToS Aggregation Scheme



The table below lists definitions for the data export record terms used in the source prefix-ToS aggregation scheme.

Table 13: Data Export Record Term Definitions for Source Prefix-ToS Aggregation Scheme

Term	Definition
Flows	Number of main cache flows that were aggregated
Packets	Number of packets in the aggregated flows
Bytes	Number of bytes in the aggregated flows
First time stamp	System uptime when the first packet was switched
Last time stamp	System uptime when the last packet was switched
Source prefix	Source IP address ANDed with the source prefix mask, or the prefix to which the source IP address of the aggregated flows belongs

Term	Definition
Source mask bits	Number of bits in the source prefix
ToS	Type of service byte
Source AS	Autonomous system of the source IP address (peer or origin)
Source interface	SNMP index of the input interface
Reserved	Zero field

NetFlow Data Export Format Versions 9 and 8 for NetFlow Aggregation Caches Overview

Export formats available for NetFlow aggregation caches are the Version 9 export format and the Version 8 export format.

- Version 9--A flexible and extensible format, which provides the versatility needed for support of new fields and record types. This format accommodates new NetFlow-supported technologies such as Multicast, Multiprotocol Label Switching (MPLS), and Border Gateway Protocol (BGP) next hop. Version 9 export format enables you to use the same version for main and aggregation caches, and the format is extendable, so you can use the same export format with future features.
- Version 8--A format added to support data export from aggregation caches. Export datagrams contain a subset of the usual Version 5 export data, which is valid for the particular aggregation cache scheme. Version 8 is the default export version for aggregation caches when data export is configured.

The Version 9 export format is flexible and extensible, which provides the versatility needed for the support of new fields and record types. You can use the Version 9 export format for both main and aggregation caches.

The Version 8 export format was added to support data export from aggregation caches. This format allows export datagrams to contain a subset of the Version 5 export data that is valid for the cache aggregation scheme.

Refer to the NetFlow Data Export, on page 2 section for more details.

How to Configure NetFlow Aggregation Caches

Configuring NetFlow Aggregation Caches

Perform the steps in this required to enable NetFlow and configure a NetFlow aggregation cache.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip flow-aggregation cache** {**as** | **as-tos** | **bgp-nexthop-tos** | **destination-prefix** | **destination-prefix-tos** | **prefix** | **prefix-port** | **prefix-tos** | **protocol-port** | **protocol-port-tos** | **source-prefix** | **source-prefix-tos**}
4. **cache entries** *number*
5. **cache timeout active** *minutes*
6. **cache timeout inactive** *seconds*
7. **export destination** {{*ip-address* | *hostname*} *udp-port*}
8. Repeat Step 7 once to configure a second export destination.
9. **export version** [**9** | **8**]
10. **enabled**
11. **exit**
12. **interface** *interface-type interface-number*
13. **ip flow** {**ingress** | **egress**}
14. **exit**
15. Repeat Steps 12 through 14 to enable NetFlow on other interfaces
16. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	(Required) Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	(Required) Enters global configuration mode.
Step 3	**ip flow-aggregation cache** {**as**	**as-tos**	**bgp-nexthop-tos**	**destination-prefix**	**destination-prefix-tos**	**prefix**	**prefix-port**	**prefix-tos**	**protocol-port**	**protocol-port-tos**	**source-prefix**	**source-prefix-tos**} **Example:**	(Required) Specifies the aggregation cache scheme and enables aggregation cache configuration mode. • The **as** keyword configures the AS aggregation cache. • The **as-tos**keyword configures the AS ToS aggregation cache. • The **bgp-nexthop-tos** keyword configures the BGP nexthop aggregation cache. • The **destination-prefix** keyword configures the destination prefix aggregation cache.

	Command or Action	Purpose
	Example: `Router(config)# ip flow-aggregation cache destination-prefix`	• The **destination-prefix-tos** keyword configures the destination prefix ToS aggregation cache. • The **prefix** keyword configures the prefix aggregation cache. • The **prefix-port** keyword configures the prefix port aggregation cache. • The **prefix-tos** keyword configures the prefix ToS aggregation cache. • The **protocol-port** keyword configures the protocol port aggregation cache. • The **protocol-port-tos** keyword configures the protocol port ToS aggregation cache. • The **source-prefix** keyword configures the source prefix aggregation cache. • The **source-prefix-tos** keyword configures the source prefix ToS aggregation cache.
Step 4	**cache entries** *number* **Example:** `Router(config-flow-cache)# cache entries 2048`	(Optional) Configures aggregation cache operational parameters. • The **entries** *number* keyword-argument pair is the number of cached entries allowed in the aggregation cache. The range is from 1024 to 524288. The default is 4096.
Step 5	**cache timeout active** *minutes* **Example:** `Router(config-flow-cache)# cache timeout active 15`	(Optional) Configures aggregation cache operational parameters. • The **timeout** keyword dissolves the session in the aggregation cache. • The **active** *minutes* keyword-argument pair specifies the number of minutes that an entry is active. The range is from 1 to 60 minutes. The default is 30 minutes.
Step 6	**cache timeout inactive** *seconds* **Example:** `Router(config-flow-cache)# cache timeout inactive 300`	(Optional) Configures aggregation cache operational parameters. • The **timeout** keyword dissolves the session in the aggregation cache. • The **inactive** *seconds*keyword-argument pair specifies the number of seconds that an inactive entry stays in the aggregation cache before the entry times out. The range is from 10 to 600 seconds. The default is 15 seconds.
Step 7	**export destination** {{*ip-address* | *hostname*} *udp-port*} **Example:** `Router(config-flow-cache)# export destination 172.30.0.1 991`	(Optional) Enables the exporting of information from NetFlow aggregation caches. • The *ip-address* | *hostname*argument is the destination IP address or hostname. • The *port* argument is the destination UDP port.

	Command or Action	Purpose
Step 8	Repeat Step 7 once to configure a second export destination.	(Optional) You can configure a maximum of two export destinations for each NetFlow aggregation cache.
Step 9	**export version** [**9** | **8**] **Example:** `Router(config-flow-cache)# export version 9`	(Optional) Specifies data export format Version. • The **version 9** keyword specifies that the export packet uses the Version 9 format.
Step 10	**enabled** **Example:** `Router(config-flow-cache)# enabled`	(Required) Enables the aggregation cache.
Step 11	**exit** **Example:** `Router(config-if)# exit`	(Required) Exits NetFlow aggregation cache configuration mode and returns to global configuration mode.
Step 12	**interface** *interface-type interface-number* **Example:** `Router(config)# interface ethernet 0/0`	(Required) Specifies the interface that you want to enable NetFlow on and enters interface configuration mode.
Step 13	**ip flow** {**ingress** | **egress**} **Example:** `Router(config-if)# ip flow ingress`	(Required) Enables NetFlow on the interface. • **ingress** --captures traffic that is being received by the interface • **egress** --captures traffic that is being transmitted by the interface.
Step 14	**exit** **Example:** `Router(config-if)# exit`	(Optional) Exits interface configuration mode and returns to global configuration mode. **Note** You only need to use this command if you want to enable NetFlow on another interface.
Step 15	Repeat Steps 12 through 14 to enable NetFlow on other interfaces	(Optional) --
Step 16	**end** **Example:** `Router(config-if)# end`	Exits the current configuration mode and returns to privileged EXEC mode.

Verifying the Aggregation Cache Configuration

Perform the steps in this optional task to verify that:

- The NetFlow aggregation cache is operational
- NetFlow Data Export for the aggregation cache is operational
- To view the aggregation cache statistics.

SUMMARY STEPS

1. **show ip cache flow aggregation** {**as** | **as-tos** | **bgp-nexthop-tos** | **destination-prefix** | **destination-prefix-tos** | **prefix** | **prefix-port** | **prefix-tos** | **protocol-port** | **protocol-port-tos** | **source-prefix** | **source-prefix-tos**}
2. **show ip flow export**

DETAILED STEPS

Step 1 **show ip cache flow aggregation** {**as** | **as-tos** | **bgp-nexthop-tos** | **destination-prefix** | **destination-prefix-tos** | **prefix** | **prefix-port** | **prefix-tos** | **protocol-port** | **protocol-port-tos** | **source-prefix** | **source-prefix-tos**}

Use the **show ip cache flow aggregation destination-prefix** command to verify the configuration of an destination-prefix aggregation cache. For example:

Example:

```
Router# show ip cache flow aggregation destination-prefix
IP Flow Switching Cache, 139272 bytes
  5 active, 2043 inactive, 9 added
  841 ager polls, 0 flow alloc failures
  Active flows timeout in 15 minutes
  Inactive flows timeout in 300 seconds
IP Sub Flow Cache, 11144 bytes
  5 active, 507 inactive, 9 added, 9 added to flow
  0 alloc failures, 0 force free
  1 chunk, 2 chunks added
Dst If         Dst Prefix      Msk  AS    Flows  Pkts B/Pk  Active
Null           0.0.0.0         /0   0         5    13    52   138.9
Et0/0.1        172.16.6.0      /24  0         1     1    56     0.0
Et1/0.1        172.16.7.0      /24  0         3    31K 1314   187.3
Et0/0.1        172.16.1.0      /24  0        16   104K 1398   188.4
Et1/0.1        172.16.10.0     /24  0         9    99K 1412   183.3
Router#
```

Use the **show ip cache verbose flow aggregation source-prefix**command to verify the configuration of a source-prefix aggregation cache. For example:

Example:

```
Router# show ip cache verbose flow aggregation source-prefix
IP Flow Switching Cache, 278544 bytes
  4 active, 4092 inactive, 4 added
  51 ager polls, 0 flow alloc failures
  Active flows timeout in 30 minutes
  Inactive flows timeout in 15 seconds
IP Sub Flow Cache, 21640 bytes
```

```
  4 active, 1020 inactive, 4 added, 4 added to flow
  0 alloc failures, 0 force free
  1 chunk, 1 chunk added
Src If         Src Prefix      Msk  AS    Flows  Pkts B/Pk  Active
Et1/0.1        172.16.10.0     /24  0         4    35K 1391    67.9
Et0/0.1        172.16.6.0      /24  0         2     5    88    60.6
Et1/0.1        172.16.7.0      /24  0         2  3515  1423    58.6
Et0/0.1        172.16.1.0      /24  0         2    20K 1416    71.9
Router#
```

Use the **show ip cache verbose flow aggregation protocol-port** command to verify the configuration of a protocol-port aggregation cache. For example:

Example:

```
Router# show ip cache verbose flow aggregation protocol-port
IP Flow Switching Cache, 278544 bytes
  4 active, 4092 inactive, 4 added
  158 ager polls, 0 flow alloc failures
  Active flows timeout in 30 minutes
  Inactive flows timeout in 15 seconds
IP Sub Flow Cache, 21640 bytes
  0 active, 1024 inactive, 0 added, 0 added to flow
  0 alloc failures, 0 force free
  1 chunk, 1 chunk added
Protocol  Source Port  Dest Port  Flows  Packets  Bytes/Packet  Active
  0x01       0x0000      0x0000      6       52K     1405        104.3
  0x11       0x0208      0x0208      1        3        52         56.9
  0x01       0x0000      0x0800      2      846      1500         59.8
  0x01       0x0000      0x0B01      2       10        56         63.0
Router#
```

Step 2 **show ip flow export**

Use the **show ip flow export** command to verify that NetFlow Data Export is operational for the aggregation cache. For example:

Example:

```
Router# show ip flow export
Flow export v1 is disabled for main cache
  Version 1 flow records
  Cache for protocol-port aggregation:
    Exporting flows to 172.16.20.4 (991) 172.30.0.1 (991)
    Exporting using source IP address 172.16.6.2
  Cache for source-prefix aggregation:
    Exporting flows to 172.16.20.4 (991) 172.30.0.1 (991)
    Exporting using source IP address 172.16.6.2
  Cache for destination-prefix aggregation:
    Exporting flows to 172.16.20.4 (991) 172.30.0.1 (991)
    Exporting using source IP address 172.16.6.2
  40 flows exported in 20 udp datagrams
  0 flows failed due to lack of export packet
  20 export packets were sent up to process level
  0 export packets were dropped due to no fib
  0 export packets were dropped due to adjacency issues
  0 export packets were dropped due to fragmentation failures
  0 export packets were dropped due to encapsulation fixup failures
Router#
```

Configuration Examples for Configuring NetFlow Aggregation Caches

Configuring an AS Aggregation Cache Example

The following example shows how to configure an AS aggregation cache with a cache size of 2046, an inactive timeout of 200 seconds, a cache active timeout of 45 minutes, an export destination IP address of 10.42.42.1, and a destination port of 9992:

```
configure terminal
!
ip flow-aggregation cache as
 cache entries 2046
 cache timeout inactive 200
 cache timeout active 45
 export destination 10.42.42.1 9992
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring a Destination Prefix Aggregation Cache Example

The following example shows how to configure a destination prefix aggregation cache with a cache size of 2046, an inactive timeout of 200 seconds, a cache active timeout of 45 minutes, an export destination IP address of 10.42.42.1, and a destination port of 9992:

```
configure terminal

!

ip flow-aggregation cache destination-prefix
 cache entries 2046
 cache timeout inactive 200
 cache timeout active 45
 export destination 10.42.42.1 9992
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring a Prefix Aggregation Cache Example

The following example shows how to configure a prefix aggregation cache with a cache size of 2046, an inactive timeout of 200 seconds, a cache active timeout of 45 minutes, an export destination IP address of 10.42.42.1, and a destination port of 9992:

```
configure terminal

!

ip flow-aggregation cache prefix
 cache entries 2046
 cache timeout inactive 200
 cache timeout active 45
 export destination 10.42.42.1 9992
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring a Protocol Port Aggregation Cache Example

The following example shows how to configure a protocol port aggregation cache with a cache size of 2046, an inactive timeout of 200 seconds, a cache active timeout of 45 minutes, an export destination IP address of 10.42.42.1, and a destination port of 9992:

```
configure terminal

!

ip flow-aggregation cache protocol-port
 cache entries 2046
 cache timeout inactive 200
 cache timeout active 45
 export destination 10.42.42.1 9992
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring a Source Prefix Aggregation Cache Example

The following example shows how to configure a source prefix aggregation cache with a cache size of 2046, an inactive timeout of 200 seconds, a cache active timeout of 45 minutes, an export destination IP address of 10.42.42.1, and a destination port of 9992:

```
configure terminal

!

ip flow-aggregation cache source-prefix
 cache entries 2046
 cache timeout inactive 200
 cache timeout active 45
 export destination 10.42.42.1 9992
```

```
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring an AS-ToS Aggregation Cache Example

The following example shows how to configure an AS-ToS aggregation cache with a cache active timeout of 20 minutes, an export destination IP address of 10.2.2.2, and a destination port of 9991:

```
configure terminal

!

ip flow-aggregation cache as-tos
 cache timeout active 20
 export destination 10.2.2.2 9991
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring a Prefix-ToS Aggregation Cache Example

The following example shows how to configure a prefix-ToS aggregation cache with an export destination IP address of 10.4.4.4 and a destination port of 9995:

```
configure terminal

!

ip flow-aggregation cache prefix-tos
 export destination 10.4.4.4 9995
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring the Minimum Mask of a Prefix Aggregation Scheme Example

The following example shows how to configure the minimum mask for a prefix aggregation scheme:

```
configure terminal

!

ip flow-aggregation cache prefix
 mask source minimum 24
 mask destination minimum 28
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring the Minimum Mask of a Destination Prefix Aggregation Scheme Example

The following example shows how to configure the minimum mask for a destination prefix aggregation scheme:

```
configure terminal

!

ip flow-aggregation cache destination-prefix
 mask destination minimum 32
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring the Minimum Mask of a Source Prefix Aggregation Scheme Example

The following example shows how to configure the minimum mask for a source prefix aggregation scheme:

```
configure terminal

!

ip flow-aggregation cache source-prefix
 mask source minimum 30
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring NetFlow Version 9 Data Export for Aggregation Caches Example

The following example shows how to configure NetFlow Version 9 data export for an AS aggregation cache scheme:

```
configure terminal
!
ip flow-aggregation cache as
 export destination 10.42.42.2 9991
 export template refresh-rate 10
 export version 9
 export template timeout-rate 60
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Configuring NetFlow Version 8 Data Export for Aggregation Caches Example

The following example shows how to configure NetFlow Version 8 data export for an AS aggregation cache scheme:

```
configure terminal
!
ip flow-aggregation cache as
 export destination 10.42.42.2 9991
 export destination 10.42.41.1 9991
 export version 8
 enabled
!
interface Ethernet0/0
 ip flow ingress
!
 end
```

Additional References

Related Documents

Related Topic	Document Title
Overview of Cisco IOS NetFlow	Cisco IOS NetFlow Overview
The minimum information about and tasks required for configuring NetFlow and NetFlow Data Export	Getting Started with Configuring NetFlow and NetFlow Data Export
Tasks for configuring NetFlow to capture and export network traffic data	Configuring NetFlow and NetFlow Data Export
Tasks for configuring Configuring MPLS Aware NetFlow	Configuring MPLS Aware NetFlow
Tasks for configuring MPLS egress NetFlow accounting	Configuring MPLS Egress NetFlow Accounting and Analysis
Tasks for configuring NetFlow input filters	Using NetFlow Filtering or Sampling to Select the Network Traffic to Track
Tasks for configuring Random Sampled NetFlow	Using NetFlow Filtering or Sampling to Select the Network Traffic to Track
Tasks for configuring NetFlow BGP next hop support	Configuring NetFlow BGP Next Hop Support for Accounting and Analysis
Tasks for configuring NetFlow multicast support	Configuring NetFlow Multicast Accounting
Tasks for detecting and analyzing network threats with NetFlow	Detecting and Analyzing Network Threats With NetFlow

Related Topic	Document Title
Tasks for configuring NetFlow Reliable Export With SCTP	NetFlow Reliable Export With SCTP
Tasks for configuring NetFlow Layer 2 and Security Monitoring Exports	NetFlow Layer 2 and Security Monitoring Exports
Tasks for configuring the SNMP NetFlow MIB	Configuring SNMP and using the NetFlow MIB to Monitor NetFlow Data
Tasks for configuring the NetFlow MIB and Top Talkers feature	Configuring NetFlow Top Talkers using Cisco IOS CLI Commands or SNMP Commands
Information for installing, starting, and configuring the CNS NetFlow Collection Engine	Cisco CNS NetFlow Collection Engine Documentation

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIBs	MIBs Link
No new or modified MIBS are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

Description	Link
The Cisco Technical Support website contains thousands of pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/techsupport

Feature Information for Configuring NetFlow Aggregation Caches

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 14: Feature Information for Configuring NetFlow Aggregation Caches

Feature Name	Releases	Feature Configuration Information
NetFlow ToS-Based Router Aggregation	12.0(15)S 12.2(4)T 12.2(14)S 15.0(1)S	The NetFlow ToS-Based Router Aggregation feature enables you to limit router-based type of service (ToS) aggregation of NetFlow export data. The aggregation of export data provides a summarized NetFlow export data that can be exported to a collection device. The result is lower bandwidth requirements for NetFlow export data and reduced platform requirements for NetFlow data collection devices. The following commands were modified by this feature: **ip flow-aggregation cache**, **show ip cache verbose flow aggregation**, and **show ip flow export**.

Feature Name	Releases	Feature Configuration Information
NetFlow Minimum Prefix Mask for Router-Based Aggregation	12.0(11)S 12.1(2)T	The NetFlow Minimum Prefix Mask for Router-Based Aggregation feature allows you to set a minimum mask size for prefix aggregation, destination prefix aggregation, and source prefix aggregation schemes. The following commands were modified by this feature: **ip flow-aggregation cache**, **mask destination**, **mask source**, and **show ip cache flow aggregation**.

Glossary

AS --autonomous system. A collection of networks under a common administration sharing a common routing strategy. Autonomous systems are subdivided by areas. An autonomous system must be assigned a unique 16-bit number by the Internet Assigned Numbers Authority (IANA).

CEF --Cisco Express Forwarding. A Layer 3 IP switching technology that optimizes network performance and scalability for networks with large and dynamic traffic patterns.

dCEF --Distributed Cisco Express Forwarding. Type of CEF switching in which line cards maintain an identical copy of the forwarding information base (FIB) and adjacency tables. The line cards perform the express forwarding between port adapters; this relieves the Route Switch Processor of involvement in the switching operation.

export packet --Type of packet built by a device (for example, a router) with NetFlow services enabled. The packet contains NetFlow statistics and is addressed to another device (for example, the NetFlow Collection Engine). The other device processes the packet (parses, aggregates, and stores information on IP flows).

flow --A set of packets with the same source IP address, destination IP address, protocol, source/destination ports, and type-of-service, and the same interface on which flow is monitored. Ingress flows are associated with the input interface, and egress flows are associated with the output interface.

flowset --Collection of flow records that follow the packet header in an export packet. A flowset contains information that must be parsed and interpreted by the NetFlow Collection Engine. There are two different types of flowsets: template flowsets and data flowsets. An export packet contains one or more flowsets, and both template and data flowsets can be mixed in the same export packet.

NetFlow --Cisco IOS accounting feature that maintains per-flow information.

NetFlow Aggregation --A NetFlow feature that lets you summarize NetFlow export data on an IOS router before the data is exported to a NetFlow data collection system such as the NetFlow Collection Engine. This feature lowers bandwidth requirements for NetFlow export data and reduces platform requirements for NetFlow data collection devices.

NetFlow Collection Engine (formerly NetFlow FlowCollector)--Cisco application that is used with NetFlow on Cisco routers and Catalyst series switches. The NetFlow Collection Engine collects packets from the router

that is running NetFlow and decodes, aggregates, and stores them. You can generate reports on various aggregations that can be set up on the NetFlow Collection Engine.

NetFlow v9 --NetFlow export format Version 9. A flexible and extensible means for carrying NetFlow records from a network node to a collector. NetFlow Version 9 has definable record types and is self-describing for easier NetFlow Collection Engine configuration.

QoS --quality of service. A measure of performance for a transmission system that reflects its transmission quality and service availability.

template flowset --One or more template records that are grouped in an export packet.

ToS --type of service. The second byte in the IP header. It indicates the desired quality of service (QoS) for a particular datagram.