JUNIPER NETWORKS

Junos® OS

Flow Monitoring Feature Guide

Release
11.4

Published: 2011-11-14

Juniper Networks, Inc.
1194 North Mathilda Avenue
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

Junos® OS Flow Monitoring Feature Guide,
Release 11.4

Revision History
November 2011—R1 Junos OS 11.4

The information in this document is current as of the date listed in the revision history.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

The Juniper Networks product that is the subject of this technical documentation consists of (or is intended for use with) Juniper Networks software. Use of such software is subject to the terms and conditions of the End User License Agreement ("EULA") posted at http://www.juniper.net/support/eula.html. By downloading, installing or using such software, you agree to the terms and conditions of that EULA.

Table of Contents

List of Figures

List of Tables

PART 1

Flow Monitoring

CHAPTER 1

Flow Monitoring Concepts and Reference Material

This section contains the following topics:

Flow Monitoring Overview

The flow monitoring application performs traffic flow monitoring and enables lawful interception of packets transiting between two routers. Traffic flows can either be passively monitored by an offline router or actively monitored by a router participating in the network.

Using a Juniper Networks router, a selection of PICs for M Series and T Series routers—including the Monitoring Services PIC, Monitoring Services II PIC, Adaptive Services PIC, and MultiServices PICs—and other networking hardware, you can monitor traffic flow and export the monitored traffic. Monitoring traffic allows you to do the following:

- Gather and export detailed information about traffic flows between source and destination routers in your network.
- Sample all incoming traffic on the monitoring interface and present the data in record format.
- Encrypt or tunnel outgoing records, intercepted traffic, or both.

- Direct filtered traffic to different packet analyzers and present the data in its original format.
- Intercept unwanted traffic, discard it, and perform accounting on the discarded packets.

There are two main types of flow monitoring:

- Active Flow Monitoring
- Passive Flow Monitoring

Related Documentation

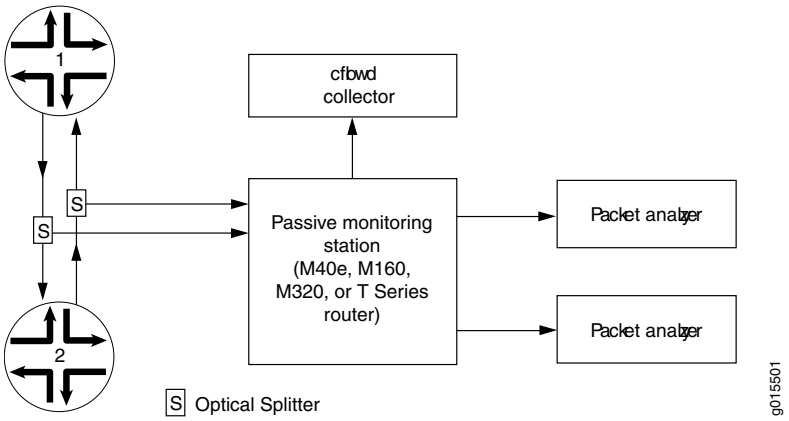
- Active Flow Monitoring Overview on page 5
- Passive Flow Monitoring Overview on page 4

Passive Flow Monitoring Overview

Flow monitoring version 5 supports passive flow monitoring. Versions 8 and 9 do not support passive flow monitoring.

The M40e, M160, M320, MX Series, or T Series router that is used for passive flow monitoring does not route packets from monitored interfaces, nor does it run any routing protocols related to those interfaces; it only passes along intercepted traffic and receives traffic flows. Figure 1 on page 4 shows a typical topology for the passive flow monitoring application.

Figure 1: Passive Flow Monitoring Application Topology



Traffic travels normally between Router 1 and Router 2. To redirect IPv4 traffic, you insert an optical splitter on the interface between these two routers. The optical splitter copies and redirects the traffic to the monitoring station. The optical cable connects only the receive port on the monitoring station, never the transmit port. This configuration allows the monitoring station to receive traffic only from the router being monitored but never to transmit it back.

If you are monitoring traffic flow, the Internet Processor II ASIC in the router forwards a copy of the traffic to the Monitoring Services or Monitoring Services II PIC in the monitoring station. If there is more than one Monitoring Services PIC installed, the monitoring station

distributes the load of the incoming traffic across the multiple PICs. The Monitoring Services PICs generate flow records in version 5 format, and the records are exported to the flow collector.

When you are performing lawful interception of packets, the Internet Processor II ASIC filters the incoming traffic and forwards it to the Tunnel Services PIC. Filter-based forwarding is then applied to direct the traffic to the packet analyzers. Optionally, the intercepted traffic or the flow records can be encrypted by the ES PIC and then sent to their destination. With additional configuration, flow records can be processed by a flow collector and flows can be captured dynamically.

With MPLS passive monitoring, the router can process MPLS packets with label values that do not have corresponding entries in the **mpls.0** routing table. You can divert these unrecognized MPLS packets, remove the MPLS labels, and redirect the underlying IPv4 packets. This is equivalent to a default route for MPLS packets or a promiscuous label. Because this application does not use a Monitoring Services PIC, see the *Junos MPLS Applications Configuration Guide* for more information about MPLS passive monitoring.

Related Documentation

- Flow Monitoring Overview on page 3
- Active Flow Monitoring Overview on page 5

Active Flow Monitoring Overview

Flow monitoring versions 5, 8, and 9 support active flow monitoring. For active flow monitoring, the monitoring station participates in the network as an active router. The major actions the router can perform during active flow monitoring are as follows:

- Sampling—The router selects and analyzes only a portion of the traffic.
- Sampling with templates—The router selects, analyzes, and arranges a portion of the traffic into templates.
- Sampling per sampling instance—The router selects, analyzes, and arranges a portion of the traffic according to the configuration and binding of a sampling instance.
- Port mirroring—The router copies entire packets and sends the copies to another interface.
- Multiple port mirroring—The router sends multiple copies of monitored packets to multiple export interfaces with the **next-hop-group** statement at the **[edit forwarding-options]** hierarchy level.
- Discard accounting—The router accounts for selected traffic before discarding it. Such traffic is not forwarded out of the router. Instead, the traffic is quarantined and deleted.
- Flow-tap processing—The router processes requests for active flow monitoring dynamically by using the Dynamic Tasking Control Protocol (DTCP).

Related Documentation

- Flow Monitoring Overview on page 3
- Passive Flow Monitoring Overview on page 4

System Requirements

This section describes the system requirements for flow monitoring and contains the following sections:

Passive Flow Monitoring System Requirements

To perform passive flow monitoring, your system must meet these minimum requirements:

- Junos OS Release 8.5 or later for passive flow monitoring support on the MX Series MultiServices routers
- Junos OS Release 8.4 or later for passive flow monitoring support on the MultiServices 400 PIC (Type 2)
- Junos OS Release 7.6 or later to clear error and flow statistics with the **clear passive-monitoring statistics** command
- Junos OS Release 7.5 or later for support of the dynamic flow capture (DFC) Management Information Base (MIB)
- Junos OS Release 7.4 or later for dynamic flow capture on Monitoring Services III PICs installed in T Series and M320 routers, and port mirroring of IPv6 packets
- Junos OS Release 7.3 or later for passive flow monitoring on selected Ethernet-based interfaces and filter-based forwarding on output interfaces
- Junos OS Release 7.1 or later for passive flow monitoring and flow collection services on Monitoring Services II PICs installed in T Series and M320 routers
- Junos OS Release 6.4 or later for support of the next-hop IP address field in flow monitoring version 5 records
- Junos OS Release 6.2 or later for ATM2 intelligent queuing (IQ) interface passive monitoring, flow collection services, and MPLS label stripping
- Junos OS Release 6.1 or later for MPLS passive monitoring
- Junos OS Release 6.0 or later for the Monitoring Services II PIC
- Junos OS Release 5.7 or later for the automatic insertion of autonomous system (AS) numbers and SNMP index values for interfaces into flow records
- Junos OS Release 5.4 or later for the Monitoring Services PIC
- M40e, M160, M320, MX Series, or T Series router with an Internet Processor II ASIC or later
- Type 1 enhanced FPCs
- Two optical splitters

- A Tunnel Services PIC (required if you wish to send traffic to more than one analyzer)
- An input interface from the following list:
  - SONET/SDH PIC—OC3, OC12, or OC48
  - ATM2 IQ PIC—OC3 or OC12
  - 4-port Fast Ethernet PIC
  - Gigabit Ethernet PIC—4-port with small form-factor pluggable transceiver (SFP) or 10-port with SFP
  - 1-port 10-Gigabit Ethernet PIC with XENPAK
- Outgoing PICs to connect to the flow collector or packet analyzer
- Flow monitoring version 5 collector
- ES PIC and packet analyzers (optional)

Related Documentation

- Active Flow Monitoring System Requirements on page 7
- Active Flow Monitoring PIC Specifications on page 8

Active Flow Monitoring System Requirements

To implement active flow monitoring, your system must meet these minimum requirements:

- Junos 10.4 or later for peer AS billing support on flow monitoring version 9
- Junos 9.3R2 or later for IPv6 support on flow monitoring version 9
- Junos 9.3R2 or later for multiple flows for flow monitoring version 9
- Junos OS Release 9.0 or later for version 9 flow aggregation to multiple flow servers
- Junos OS Release 8.5 or later for active flow monitoring support on MultiServices 500 PICs
- Junos OS Release 8.3 or later for flow monitoring version 9 support, MPLS support, and active flow monitoring support on MultiServices 100 and 400 PICs
- Junos OS Release 8.2 or later for M120 router support and for flow monitoring version 5 and 8 support on MultiServices 100 and 400 PICs
- Junos OS Release 8.1 or later for the flow-tap services application on Adaptive Services II PICs installed in M7i, M10i, M20, M40e, M320, and T Series routers
- Junos OS Release 7.4 or later for port mirroring of IPv6 packets
- Junos OS Release 7.3 or later for active flow monitoring on Adaptive Services II PICs installed in TX Matrix platforms
- Junos OS Release 7.0 or later for active flow monitoring on Adaptive Services II PICs installed in T Series and M320 routers

- Junos OS Release 7.0 or later for active flow monitoring on J Series Services Routers
- Junos OS Release 6.0 or later for the Adaptive Services PIC
- Junos OS Release 5.7 or later for the automatic insertion of AS numbers and SNMP index values for input and output interfaces into records, port mirroring to multiple ports, and discard accounting
- Junos OS Release 5.6 or later for the Monitoring Services PIC
- M5, M7i, M10, M10i, M20, M40e, M120, M160, M320, or T Series router with an Internet Processor II ASIC or later; or a J Series Services Router
- Type 1 enhanced FPCs
- Two M Series or T Series PICs or J Series Physical Interface Modules (PIMs) of your choice: One to receive incoming traffic and one to forward outgoing traffic (the second PIC or PIM is not necessary for discard accounting)
- Export PICs to connect to the collector or packet analyzer
- Tunnel Services PIC (required for multiple port mirroring or **mo-** interface load balancing)
- Flow collector version 5, 8, or 9
- ES PIC and packet analyzers (optional)

Related Documentation

- Passive Flow Monitoring System Requirements on page 6
- Active Flow Monitoring PIC Specifications on page 8

Active Flow Monitoring PIC Specifications

For Monitoring Services PIC specifications, see Table 1 on page 8 and Table 2 on page 9. For Adaptive Services PIC specifications, see Table 3 on page 9. For MultiServices PIC specifications, see Table 4 on page 10 and Table 5 on page 10.

Table 1: Monitoring Services PIC Specifications

Specification	Description
Physical dimensions	Single-wide PIC that occupies one PIC slot
Connectors	DB-9 diagnostic serial console port
Status LED	One tricolor: • Off—The PIC is offline; it is safe to remove it from the chassis. • Green—The PIC is operating normally. • Amber—The PIC is initializing. • Red—The PIC has an error or failure; no further harm can be done by removing it from the chassis.

Table 1: Monitoring Services PIC Specifications *(continued)*

Specification	Description
Application LED	One tricolor: • Off—The service is not running. • Green—The service is running under acceptable load. • Amber—The service is overloaded.

Table 2: Monitoring Services II PIC Specifications

Specification	Description
Physical dimensions	Single-wide PIC that occupies one PIC slot
Connectors	N/A
Status LED	One tricolor: • Off—The PIC is offline; it is safe to remove it from the chassis. • Green—The PIC is operating normally. • Amber—The PIC is initializing. • Red—The PIC has an error or failure; no further harm can be done by removing it from the chassis.
Application LED	One tricolor: • Off—The flow collector is not running. • Green—The flow collector is running under acceptable load. • Amber—The flow collector is overloaded.

Table 3: Adaptive Services PIC Specifications

Specification	Description
Physical dimensions	Single-wide PIC that occupies one PIC slot
Connectors	N/A
Status LED	One tricolor: • Off—The PIC is offline; it is safe to remove it from the chassis. • Green—The PIC is operating normally. • Amber—The PIC is initializing. • Red—The PIC has an error or failure; no further harm can be done by removing it from the chassis.
Application LED	One tricolor: • Off—The flow collector is not running. • Green—The flow collector is running under acceptable load. • Amber—The flow collector is overloaded.

Table 4: MultiServices 100 PIC

Specification	Description
Physical dimensions	Single-wide PIC that occupies one PIC slot
Connectors	N/A
Status LED	One tricolor: • Off—The PIC is offline; it is safe to remove it from the chassis. • Green—The PIC is operating normally. • Amber—The PIC is initializing. • Red—The PIC has an error or failure; no further harm can be done by removing it from the chassis.
Application LED	One tricolor: • Off—The service is not running. • Green—The service is running under acceptable load. • Amber—The service is overloaded.

Table 5: MultiServices 400 PIC

Specification	Description
Physical dimensions	Single-wide PIC that occupies one PIC slot
Connectors	N/A
Status LED	One tricolor: • Off—The PIC is offline; it is safe to remove it from the chassis. • Green—The PIC is operating normally. • Amber—The PIC is initializing. • Red—The PIC has an error or failure; no further harm can be done by removing it from the chassis.
Application LED	One tricolor: • Off—The service is not running. • Green—The service is running under acceptable load. • Amber—The service is overloaded.

Table 6: MultiServices 500 PIC

Specification	Description
Physical dimensions	Single-wide PIC that occupies one PIC slot
Connectors	N/A

Table 6: MultiServices 500 PIC *(continued)*

Specification	Description
Status LED	One tricolor: • Off—The PIC is offline; it is safe to remove it from the chassis. • Green—The PIC is operating normally. • Amber—The PIC is initializing. • Red—The PIC has an error or failure; no further harm can be done by removing it from the chassis.
Application LED	One tricolor: • Off—The service is not running. • Green—The service is running under acceptable load. • Amber—The service is overloaded.

Related Documentation

- Passive Flow Monitoring System Requirements on page 6
- Active Flow Monitoring System Requirements on page 7

Terms and Acronyms

A

active flow monitoring — Technique to lawfully intercept and observe specified data network traffic on an active router participating in the network.

Adaptive Services PIC — Advanced PIC that handles active flow monitoring, Network Address Translation (NAT), stateful firewall, and intrusion detection functions. For more information on the Adaptive Services PIC, see the *Junos Services Interfaces Configuration Guide*.

C

cflowd — Version 5 and version 8 flow monitoring process that captures flow information from network traffic and exports this data into summary tables. Once captured, flow data can be analyzed as needed. For more information about cflowd, see **http://www.caida.org**.

content destination — A recipient of monitored packets sent by a DTCP or dynamic flow capture-enabled monitoring station.

control source — A dynamic flow capture client that wants to monitor electronic data or voice transfer over the network. The control source sends filter requests to the dynamic flow capture-enabled monitoring station by using DTCP.

D

DTCP (Dynamic Tasking Control Protocol) — Protocol used to specify filtering criteria in a dynamic flow capture environment.

dynamic flow capture	Technique that allows DTCP-enabled control sources to send specified filtering criteria in real time to a monitoring station. The monitoring station passively monitors the specified traffic flows on demand and sends the captured packets to content destinations.

E

ES PIC	PIC that handles encryption and security services (such as IP Security [IPSec]).

F

flow collector interface	Converted Monitoring Services II PIC that processes multiple flow records into compressed ASCII data files and exports these files to an FTP server.

M

Monitoring Services II PIC	Advanced PIC that handles passive flow monitoring functions.
Monitoring Services III PIC	Advanced PIC that handles dynamic flow capture functions.
Monitoring Services PIC	Original PIC that handles passive and active flow monitoring functions.
MultiServices 100 PIC	Also referred to as MultiServices PIC Type 1. Advanced PIC that handles active flow capture functions.
MultiServices 400 PIC	Also referred to as MultiServices PIC Type 2. Advanced PIC that handles active flow capture functions.
MultiServices 500 PIC	Also referred to as MultiServices PIC Type 3. Advanced PIC that handles active flow capture functions.

P

passive flow monitoring	Technique to lawfully intercept and observe specified data network traffic on a passive flow monitoring station not participating in the network.

CHAPTER 2

Passive Flow Monitoring

This section contains the following topics:

Configuring Passive Flow Monitoring

Table 7 on page 13 shows which Juniper Networks PICs and routers support passive flow monitoring. The PICs receive passively monitored network traffic from an input interface (SONET/SDH, ATM2 IQ, Fast Ethernet, Gigabit Ethernet, or 10-Gigabit Ethernet), convert the received packets into flow records, and export them to a flow server for further analysis.

Table 7: Passive Flow Monitoring PIC Support

PIC Type	M40e	M160	T Series/ M320
Monitoring Services PIC	Yes	Yes	No
Monitoring Services II PIC	Yes	Yes	Yes
Monitoring Services III PIC	Yes	Yes	Yes
MultiServices 400 PIC (Type 2)	Yes	No	Yes

The key configuration hierarchy statement for passive flow monitoring is the **monitoring** statement found at the **[edit forwarding-options]** hierarchy level. At minimum, you must configure a VRF routing instance to direct the traffic to a monitoring services interface for flow processing.

However, there are several options you can use that add complexity to passive flow monitoring. For example, you can configure the router to direct traffic into a routing instance and deliver the traffic into a monitoring group. You can also use port mirroring and filter-based forwarding to copy and redirect traffic. Optionally, you can configure the monitoring station to encrypt flow output before it is sent to a flow server for processing, to send flow records to a flow collector, or to process on-demand monitoring requests with dynamic flow capture.

Related Documentation

- Copying and Redirecting Traffic with Port Mirroring and Filter-Based Forwarding on page 22
- Using a Flow Collector Interface to Process and Export Multiple Flow Records on page 28
- Using a Dynamic Flow Capture Interface to Monitor Traffic On Demand on page 34
- Hardware and Software Considerations on page 39

Monitoring Traffic with a VRF Instance and a Monitoring Group

The first way you can implement passive flow monitoring is to direct traffic into a VRF routing instance and use a monitoring group to export this traffic to a flow server for analysis. Complete the following tasks:

- Specifying a Firewall Filter to Select Traffic to Monitor on page 14
- Configuring Input Interfaces, Monitoring Services Interfaces, and Export Interfaces on page 15
- Establishing a VRF Instance for the Monitored Traffic on page 18
- Configuring a Monitoring Group to Send Traffic to the Flow Server on page 19
- Configuring Policy Options on page 20
- Option: Stripping MPLS Labels on ATM, Ethernet-Based, and SONET/SDH Interfaces on page 21

Specifying a Firewall Filter to Select Traffic to Monitor

When you define a firewall filter, you select the initial traffic to be monitored. To configure a firewall filter, include the **filter** statement at the **[edit firewall family inet]** hierarchy level. All filtered traffic to be monitored must be accepted.

```
[edit]
firewall {
   family inet {
      filter input-monitoring-filter {
         term 1 {
            from {
               destination-address {
                  10.7.0.0/16;
               }
            }
            then {
               count counter1;
```

```
            accept;
          }
        }
        term 2 {
          from {
            destination-address {
              10.6.0.0/16;
            }
          }
          then {
            count counter2;
            accept;
          }
        }
      }
    }
  }
```

Configuring Input Interfaces, Monitoring Services Interfaces, and Export Interfaces

After creating the input filter, you need to configure the interfaces where traffic will enter the router. To enable passive flow monitoring for SONET/SDH input interfaces, include the **passive-monitor-mode** statement at the **[edit interfaces so-*fpc/pic/port* unit *unit-number*]** hierarchy level. This mode disables the router from participating in the network as an active device. On SONET/SDH interfaces, passive monitor mode suppresses SONET keepalives.

For ATM2 IQ interfaces, passive monitor mode suppresses the sending and receiving of ATM Operations, Administration, and Maintenance (OAM) and Integrated Local Management Interface (ILMI) control messages. To enable passive flow monitoring for ATM2 IQ input interfaces, include the **passive-monitor-mode** statement at the **[edit interfaces at-*fpc/pic/port*]** hierarchy level. ATM passive monitoring supports the following interface encapsulation types: Cisco-compatible ATM Network Layer Protocol ID (NLPID) (**atm-cisco-nlpid**), ATM NLPID (**atm-nlpid**), ATM Point-to-Point Protocol (PPP) over ATM Adaptation Layer 5 (AAL5)/ logical link control (LLC) (**atm-ppp-llc**), ATM PPP over raw AAL5 (**atm-ppp-vc-mux**), ATM LLC/ subnetwork attachment point (SNAP) (**atm-snap**), and ATM virtual circuit (VC) multiplexing (**atm-vc-mux**).

Ethernet-based interfaces support both per-port passive monitoring and per-VLAN passive monitoring. For Fast Ethernet interfaces, include the **passive-monitor-mode** statement at the **[edit interfaces fe-*fpc/pic/port*]** hierarchy level. For Gigabit Ethernet interfaces, include the **passive-monitor-mode** statement at the **[edit interfaces ge-*fpc/pic/port*]** hierarchy level. On Ethernet-based interfaces, passive monitor mode disables the Routing Engine from receiving packets and prevents the routing table from transmitting packets. You can verify this by the presence of the **No-receive** and **No-transmit** interface flags in the output of the **show interfaces (fe | ge)-*fpc/pic/port*** command.

NOTE: The following restrictions apply to passive flow monitoring on Ethernet-based interfaces:

- No special encapsulation types are allowed, so you must configure Ethernet encapsulations only.
- When you configure the **passive-monitor-mode** statement, destination MAC address filters applied to incoming interfaces are disabled by default.
- The **flow-control** statement at the **[edit interfaces ge-*fpc/pic/port* gigether-options]** or **[edit interfaces fe-*fpc/pic/port* fastether-options]** hierarchy level does not work when passive flow monitoring is enabled.

In addition to passive monitor mode, apply the previously defined firewall filter to the interface with the **filter** statement at the **[edit interfaces *interface-name-fpc/pic/port* unit *unit-number* family inet]** hierarchy level:

```
[edit]
interfaces {
   so-0/0/0 {
      description “SONET/SDH input interface”;
      encapsulation ppp;
      unit 0 {
         passive-monitor-mode;
         family inet {
            filter {
               input  input-monitoring-filter;
            }
         }
      }
   }
   at-1/0/0 {
      description “ATM2 IQ input interface”;
      passive-monitor-mode;
      atm-options {
         pic-type atm2;
         vpi 0 {
            maximum-vcs 255;
         }
      }
      unit 0 {
         encapsulation atm-snap;
         vci 0.100;
         family inet {
            filter {
               input input-monitoring-filter;
            }
         }
      }
   }
   ge-2/0/0 {
      description “Gigabit Ethernet input interface”;
      passive-monitor-mode;
```

```
      unit 0 {
        family inet {
          filter {
            input input-monitoring-filter;
          }
        }
      }
    }
  }
```

Configure the interfaces on the Monitoring Services PIC or Monitoring Services II PIC with the **family inet** statement at the **[edit interfaces mo-*fpc/pic/port* unit *unit-number*]** hierarchy level. The statement allows the interfaces to process IPv4 traffic received from the input interfaces.

When you use VRF instances, you need to configure two logical interfaces. The first (**unit 0**) is part of the inet.0 routing table and sources the flow packets. The second (**unit 1**) is configured as part of the VRF instance so the monitoring services interface can serve as a valid next hop for packets received in the instance.

You can also capture options packets and time-to-live (TTL) exceeded information when the monitoring services interface processes flow records. To configure, include the **receive-options-packets** and **receive-ttl-exceeded** statements at the **[edit interfaces mo-*fpc/pic/port* unit *unit-number* family inet]** hierarchy level:

```
[edit]
interfaces {
  mo-4/0/0 {
    unit 0 {
      family inet {
        receive-options-packets;
        receive-ttl-exceeded;
      }
    }
    unit 1 {
      family inet;
    }
  }
  mo-4/1/0 {
    unit 0 {
      family inet;
    }
    unit 1 {
      family inet;
    }
  }
  mo-4/2/0 {
    unit 0 {
      family inet;
    }
    unit 1 {
      family inet;
    }
  }
  mo-4/3/0 {
```

```
        unit 0 {
            family inet;
        }
        unit 1 {
            family inet;
        }
    }
}
```

You must also configure the export interface where flow packets exit the monitoring station and are sent to the flow server.

On output interfaces, you can apply a firewall filter that leads to a filter-based forwarding routing instance. This is useful if you want to port-mirror traffic to multiple Monitoring Services PICs or flow collection services interfaces. To configure, include the **output** statement at the **[edit interfaces *interface-name* unit *logical-unit-number* family inet filter]** hierarchy level. For more information, see "Using Filter-Based Forwarding to Export Monitored Traffic to Multiple Destinations" on page 25.

```
[edit]
interfaces
fe-3/0/0 {
    description "export interface to flow server";
    unit 0 {
        family inet;
        address ip-address;
        filter {
            output output-filter-name;
        }
    }
}
```

Establishing a VRF Instance for the Monitored Traffic

After the firewall filter and interfaces are ready, create a VPN routing and forwarding (VRF) instance. The filtered traffic enters the VRF instance and is shared only between the input interfaces and the monitoring services output interfaces. In this case, a group of four monitoring services interfaces is used as the next hop.

```
[edit]
routing-instances {
    monitoring-vrf {
        instance-type vrf;
        interface so-0/0/0.0;
        interface so-0/1/0.0;
        interface mo-4/0/0.1;
        interface mo-4/1/0.1;
        interface mo-4/2/0.1;
        route-distinguisher 69:1;
        vrf-import monitoring-vrf-import;
        vrf-export monitoring-vrf-export;
        routing-options {
            static {
                route 0.0.0.0/0 next-hop [mo-4/0/0.1 mo-4/1/0.1 mo-4/2/0.1];
            }
```

```
        }
    }
}
```

Configuring a Monitoring Group to Send Traffic to the Flow Server

You collect flow records by specifying output interfaces in a monitoring group. In general, the monitoring services interfaces are the output interfaces. The logical unit number on the output interfaces when used in conjunction with a VRF instance must be 1. To configure, include the **output** statement at the **[edit forwarding-options monitoring *group-name* family inet]** hierarchy level.

NOTE: Because routing instances determine the input interface, the **input** statement at the **[edit forwarding-options monitoring *group-name* family inet]** hierarchy level has been removed in Junos OS Release 6.0 and later. If you have a configuration that contains this old statement, we recommend that you update your configuration and remove the statement.

As part of the **mo-*fpc/pic/port*** statement at the **[edit forwarding-options monitoring *group-name* family inet output interface]** hierarchy level, you must specify a source address for transmission of flow information. You can use the router ID IP address, the IP address of the input interface, or any local IP address of your choice as the source address. If you provide a different **source-address** statement for each monitoring services output interface, you can track which interface processes a particular flow record.

All other statements at this level (**engine-id, engine-type, input-interface-index,** and **output-interface-index**) are dynamically generated, but can be configured manually. To reset outgoing interface or incoming interface indexes that were once configured manually, configure the **input-interface-index** or **outgoing-interface-index** statements with a value of 0 at the **[edit forwarding-options monitoring *group-name* family inet output interface *interface-name*]** hierarchy level.

To specify the flow server IP address and port number, include the **flow-server *ip-address* port *port-number*** statement at the **[edit forwarding-options monitoring *group-name* family inet output]** hierarchy level. You can specify up to eight flow servers in a monitoring group and the IP address for each server must be unique. Flow records are exported and load-balanced between all active flow servers.

Once you configure the VRF and monitoring group statements, traffic enters the input interfaces, passes to the monitoring services interfaces for processing, and is discarded. The resulting flow description packets exit the monitoring station through the export interface. If you want traffic to travel to destinations other than the monitoring services interfaces, or need to establish additional analysis, see the section "Copying and Redirecting Traffic with Port Mirroring and Filter-Based Forwarding" on page 22.

NOTE: You must complete interface configuration on the Monitoring Services or Monitoring Services II PIC before an interface can be added into a monitoring group. For more information, see "Configuring Input Interfaces, Monitoring Services Interfaces, and Export Interfaces" on page 15.

```
[edit]
forwarding-options {
  monitoring group1 {
    family inet {
      output {
        export-format cflowd-version-5;
        flow-active-timeout 60;
        flow-inactive-timeout 30;
        flow-server 192.168.245.1 port 2055;
        flow-server 192.168.245.2 port 2055;
        interface mo-4/0/0.1 {
          engine-id 1;
          engine-type 1;
          input-interface-index 44;
          output-interface-index 54;
          source-address 192.168.245.1;
        }
        interface mo-4/1/0.1 {
          engine-id 2;
          engine-type 1;
          input-interface-index 45;
          output-interface-index 55;
          source-address 192.168.245.1;
        }
        interface mo-4/2/0.1 {
          engine-id 3;
          engine-type 1;
          input-interface-index 46;
          output-interface-index 56;
          source-address 192.168.245.1;
        }
      }
    }
  }
}
```

Configuring Policy Options

When you use a group of next hops in your monitoring group, you can load-balance traffic and distribute it to the export interfaces if you configure policy options. To configure, include the **load-balance per-packet** statement at the **[edit policy-options policy-statement *policy-name* then]** hierarchy level. You can also reject import and export of VRF routes by including the **reject** statement at the **[edit policy-options policy-statement *policy-name* then]** hierarchy level.

```
[edit]
routing-options {
  forwarding-table {
```



```
      export pplb;
    }
  }
  policy-options {
    policy-statement monitoring-vrf-import {
      then {
        reject;
      }
    }
    policy-statement monitoring-vrf-export {
      then {
        reject;
      }
    }
    policy-statement pplb {
      then {
        load-balance per-packet;
      }
    }
  }
```

Option: Stripping MPLS Labels on ATM, Ethernet-Based, and SONET/SDH Interfaces

Because flow monitoring can be performed only on IPv4 packets, any packets containing MPLS labels must have the labels removed before monitoring can occur. To remove MPLS labels from packets as they enter an ATM2 IQ, Ethernet-based, or SONET/SDH interface, include the **pop-all-labels** statement at the **[edit interfaces** *interface-name-fpc/pic/port* **(atm | fastether | gigether | sonet)-options mpls]** hierarchy level. If you use static MPLS labels, we recommend you assign label values from **10000** through **99999** to avoid using the label ranges reserved by the Junos OS.

To remove a specified number of labels from selected packets with MPLS labels, include the **required-depth** statement at the **[edit interfaces** *interface-name-fpc/pic/port* **(atm | fastether | gigether | sonet)-options mpls pop-all-labels]** hierarchy level. A **required-depth** value of **1** removes labels from all packets containing only one MPLS label, a value of **2** removes labels from all packets containing only two MPLS labels, and a value of **[1 2]** removes labels from all packets containing either one or two MPLS labels. The **required-depth** value of **[1 2]** is the default setting. When you configure the **required-depth** statement, you must configure the same value for all ports on the same PIC.

The labels are removed and discarded as soon as they arrive at the interface. As a result, no MPLS filters can be applied to the stripped labels, no statistics are generated for the labels, and you cannot apply an IP filter to the incoming packets. No Tunnel Services PIC is required to perform MPLS label stripping.

```
[edit]
interfaces {
  at-/fpc/pic/port  {
    atm-options {
      mpls {
        pop-all-labels {
          required-depth 1;
        }
```

```
        }
      }
    }
    (fe | ge)-fpc/pic/port {
      (fastether | gigether)-options {
        mpls {
          pop-all-labels {
            required-depth [1 2];
          }
        }
      }
    }
    so-fpc/pic/port {
      sonet-options {
        mpls {
          pop-all-labels {
            required-depth 2;
          }
        }
      }
    }
  }
```

Using Port Mirroring and Filter-Based Forwarding to Copy and Redirect Traffic

This section discusses additional techniques you can use with the passive flow monitoring application.

Copying and Redirecting Traffic with Port Mirroring and Filter-Based Forwarding

This section discusses additional techniques you can use with the passive flow monitoring application:

- In addition to flow analysis, you can analyze a copy of the original traffic with a single packet analyzer. To implement this technique, divert traffic with a filter-based forwarding routing instance and send the monitored traffic through a physical interface to the packet analyzer.

- You can cluster the traffic into different groups and redirect this traffic to multiple packet analyzers. For example, you can break traffic flows into TCP groups and UDP groups and send these groups of packets to different analyzers. To accomplish this, you use port mirroring and send a copy of the original traffic to a Tunnel PIC. Then you can apply a firewall filter, split the traffic into your desired groups, and send these groups toward different exit interfaces leading to the packet analyzers. This technique provides maximum flexibility for traffic analysis.
- For secure transmission of the copied or grouped traffic, you can encrypt the diverted traffic with an ES PIC and send this traffic to a packet analyzer over an IP Security (IPSec) tunnel.

To implement the filter-based forwarding enhancement methods, see the following sections:

Specifying Port Mirroring Input and Output

This step works in conjunction with the action specified by the **port-mirror** statement configured at the **[edit firewall family (inet | inet6) filter *filter-name* term *term-name* then]** hierarchy level. At this point, you select input and output statements to determine where the copies of the IPv4 or IPv6 packets are sent. To configure, include the **input** and **output** statements at the **[edit forwarding-options port-mirroring family *family-name*]** hierarchy level. The traffic to be monitored is copied, port-mirrored, and sent to the packet analyzer for analysis. On M Series routers, you can port-mirror either IPv4 or IPv6 packets at one time. On M120, M320, and T Series routers, you can port-mirror both IPv4 and IPv6 packets simultaneously.

NOTE: On an M320 or T Series router using an Adaptive Services (AS) II PIC or a MultiServies PIC, corrupted IP packets might be sent to the port mirror when traffic passes through an IPSec tunnel. The inbound IP traffic passes through the IPSec tunnel and the sp interface is decoded and forwarded to the port mirror correctly, but the return outbound traffic is corrupted and unreadable through the router configured with the port mirror.

The port-mirrored copy of the traffic can travel only to a single next hop. As a result, only one type of analysis can be performed if the packets are sent to a packet analyzer through a physical next hop. If more than one type of analysis is desired, a tunnel interface must be used as the next hop for port mirroring. When the mirrored copy of the traffic arrives at the virtual tunnel interface, it can be filtered, split into groups, and redirected to multiple exit interfaces and packet analyzers.

For your input requirements, include the **rate** and **run-length** statements at the **[edit forwarding-options port-mirroring family *family-name* input]** hierarchy level. For your output requirements, specify the target interface with the **interface** statement at the **[edit forwarding-options port-mirroring family *family-name* output]** hierarchy level.

By default, a filter cannot be applied to an interface where port-mirrored traffic is received. To allow the tunnel services interface to be used as a filtered next hop, include the **no-filter-check** statement at the **[edit forwarding-options port-mirroring family *family-name* output]** hierarchy level.

```
[edit]
forwarding-options {
   port-mirroring {
      family (inet | inet6) {
         input {
            rate 1;
            run-length 5;
         }
         output {
            interface vt-0/2/0.0;
            no-filter-check;
         }
      }
   }
}
```

NOTE: Before Junos OS Release 7.4, you could configure the input and output statements at the **[edit forwarding-options port-mirroring]** hierarchy level. However, this older syntax has been revised to extend port-mirroring support to IPv6 packets. If you have a configuration that contains the older syntax, we recommend that you update your configuration to the new syntax listed above.

Creating a Firewall Filter to Split the Port-Mirrored Traffic into Different Instances

If you need to split the copy of the monitored traffic into separate groups and send these filtered packets to different analyzers, devise a firewall filter that selects some traffic for sampling and some traffic for discarding. In this case, UDP traffic is sent into one routing instance, TCP traffic is diverted into a second routing instance, and all other traffic is discarded. In a later step, you will define the filter-based forwarding routing instances specified in the **then** statements shown in this filter.

```
[edit]
```

```
firewall {
  family inet {
    filter tunnel-interface-filter {
      term tcp {
        from {
          protocol tcp;
        }
        then {
          count tcp;
          routing-instance tcp-routing-table;
        }
      }
      term udp {
        from {
          protocol udp;
        }
        then {
          count udp;
          routing-instance udp-routing-table;
        }
      }
      term rest {
        then {
          count rest;
          discard;
        }
      }
    }
  }
}
```

Applying the Firewall Filter to a Tunnel PIC Interface

Once the firewall filter is defined, apply it as an input filter on a tunnel interface. This is required if the firewall filter defines two or more types of traffic or export interfaces. However, if the firewall filter only specifies one type of traffic and one export interface, you can apply the filter directly to the export interface.

```
[edit]
interfaces {
  vt-0/2/0 {
    unit 0 {
      family inet {
        filter {
          input tunnel-interface-filter;
        }
      }
    }
  }
}
```

Using Filter-Based Forwarding to Export Monitored Traffic

to Multiple Destinations

The firewall filter called **tunnel-interface-filter** that you made earlier sends UDP traffic into one filter-based forwarding routing instance called **udp-routing-table**, sends TCP traffic into a second filter-based forwarding routing instance called **tcp-routing-table**, and discards all other packets. Here you will configure the filter-based forwarding instances.

Configure an export interface for each of your routing instances by including a static next hop. To configure, include the **route** statement at the **[edit routing-instances *instance-name* routing-options static]** hierarchy level and specify a next-hop address or interface.

```
[edit]
routing-instances {
   tcp-routing-table {
      instance-type forwarding;
      routing-options {
         static {
            route 0.0.0.0/0 next-hop es-3/1/0.0;
         }
      }
   }
   udp-routing-table {
      instance-type forwarding;
      routing-options {
         static {
            route 0.0.0.0/0 next-hop 10.9.1.2;
         }
      }
   }
}
```

Configuring a Routing Table Group to Add Interface Routes into the Forwarding Instance

Next, import the interface routes into the forwarding instance. This step is necessary because the next hops specified in the forwarding instances must be installed in the forwarding instances themselves. To configure, include the **import-rib** statement at the **[edit routing-options rib-groups *group-name*]** hierarchy level. The **export** statement at the **[edit routing-options forwarding-table]** hierarchy level and the **pplb** policy enable load balancing.

```
[edit]
routing-options {
   interface-routes {
      rib-group inet bc-vrf;
   }
   rib-groups {
      bc-vrf {
         import-rib [inet.0 tcp-routing-table.inet.0 udp-routing-table.inet.0];
      }
   }
   forwarding-table {
      export pplb;
```

```
    }
  }
  policy-options {
    policy-statement pplb {
      then {
        load-balance per-packet;
      }
    }
  }
```

Option: Using an ES PIC to Send Traffic to a Packet Analyzer

You can send some or all of the traffic securely to the packet analyzer using IPSec and an ES PIC. In this case, the TCP traffic is encrypted, sent over an IPSec tunnel, and received by the packet analyzer. For more information on configuring IPSec on the ES PIC, see the *IPsec Feature Guide* or the *Junos System Basics Configuration Guide*.

```
[edit]
interfaces {
  es-3/1/0 {
    unit 0 {
      tunnel {
        source 10.8.8.1;
        destination 10.8.8.2;
      }
      family inet {
        ipsec-sa sa-esp;
        address 3.3.3.1/32 {
          destination 3.3.3.2;
        }
      }
    }
  }
  fe-3/2/1 {
    unit 0 {
      family inet {
        address 10.8.8.1/30;
      }
    }
  }
}
security {
  ipsec {
    proposal esp-sha1-3des {
      protocol esp;
      authentication-algorithm hmac-sha1-96;
      encryption-algorithm 3des-cbc;
      lifetime-seconds 180;
    }
    policy esp-group2 {
      perfect-forward-secrecy {
        keys group2;
      }
      proposals esp-sha1-3des;
    }
    security-association sa-esp {
```

```
        mode tunnel;
        dynamic {
          ipsec-policy esp-group2;
        }
      }
    }
    ike {
      proposal ike-esp {
        authentication-method pre-shared-keys;
        dh-group group2;
        authentication-algorithm sha1;
        encryption-algorithm 3des-cbc;
        lifetime-seconds 180;
      }
      policy 10.8.8.2 {
        mode aggressive;
        proposals ike-esp;
        pre-shared-key ascii-text "$9$qmQnuORrlMBIds2oiH0BIESe";
      }
    }
  }
```

Option: Applying a Firewall Filter to an Output Interface

On output interfaces, you can apply a firewall filter that leads to a filter-based forwarding routing instance. This is useful if you want to port-mirror traffic to multiple Monitoring Services PICs or flow collection services interfaces. To configure, include the **output** statement at the **[edit interfaces *interface-name* unit *logical-unit-number* family inet filter]** hierarchy level.

```
[edit]
interfaces
fe-3/1/0 {
  description “export interface to flow collection services interfaces”;
  unit 0 {
    family inet;
    address ip-address;
    filter {
      output output-filter-name;
    }
  }
}
```

Using a Flow Collector Interface to Process and Export Multiple Flow Records

Basic passive monitoring can sometimes create a large number of flow records. However, you can manage multiple flow records with a flow collector interface. You can create a flow collector interface from a Monitoring Services II PIC. The flow collector interface combines multiple flow records received from a monitoring services interface into a compressed ASCII data file and exports the file to an FTP server.

To convert a Monitoring Services II PIC into a flow collector interface, include the **flow-collector** statement at the **[edit chassis fpc *fpc-slot* pic *pic-slot* monitoring-services application]** hierarchy level. To restore the monitoring functions of a Monitoring Services

II PIC, include the **monitor** statement at the **[edit chassis fpc *fpc-slot* pic *pic-slot* monitoring-services application]** hierarchy level.

After you commit the configuration to convert the PIC between the **monitor** and **flow-collector** service types, you must take the PIC offline and then bring the PIC back online. Rebooting the router does not enable the new service type. You can use the Monitoring Services II PIC for either flow collection or monitoring, but not both types of service simultaneously.

A flow collector interface, designated by the **cp-*fpc/pic/port*** interface name, requires three logical interfaces for correct operation. Units 0 and 1 are used respectively as export channels 0 and 1 to send the compressed ASCII data files to an FTP server. You must include a class-of-service (CoS) configuration for these two export channels to provide adequate bandwidth for file transmission. Unit 2 is used as a flow receive channel to receive flow records from a monitoring services interface.

NOTE: Unlike conventional interfaces, IP addresses for flow collector logical interfaces set up a point-to-point connection between the Routing Engine and the flow collector. The **address** statement at the **[edit interfaces cp-*fpc/pic/port* unit *unit-number* family inet]** hierarchy level corresponds to the IP address of the Routing Engine. Likewise, the **destination** statement at the **[edit interfaces cp-*fpc/pic/port* unit *unit-number* family inet address *ip-address*]** hierarchy level corresponds to the IP address of the flow collector interface. As a result, you must configure the **destination** statement for Units 0 and 1 (export channels 0 and 1) with *local* addresses that can reach the FTP server. Similarly, configure the **destination** statement for Unit 2 (flow receive channel) with a *local* IP address so it can reach the monitoring services interface that sends flow records.

To activate flow collector services after the Monitoring Services II PIC is converted into a flow collector, include the **flow-collector** statement at the **[edit services]** hierarchy level. You also need to configure several additional components:

- Destination of the FTP server—Determines where the compressed ASCII data files are sent after the flow records are collected and processed. To specify the destination FTP server, include the **destinations** statement at the **[edit services flow-collector]** hierarchy level. You can specify up to two FTP server destinations and include the password for each configured server. If two FTP servers are configured, the first server in the configuration is the primary server and the second is a backup server.
- File specifications—Preset data file formats, name formats, and transfer characteristics. Files are sent by FTP to the destination FTP server when the timer expires or when a preset number of records are received, whichever comes first. To set the data file format, include the **data-format** statement at the **[edit services flow-collector file-specification *file-name*]** hierarchy level. The default data format is **flow-compressed**. To set the export timer and file size thresholds, include the **transfer** statement at the **[edit services flow-collector file-specification *file-name*]** hierarchy level and specify values for the **timeout** and **record-level** options. The default values are 600 seconds for **timeout** and 500,000 records for **record-level**.

To set the filename format, include the **name-format** statement at the **[edit services flow-collector file-specification *file-name*]** hierarchy level. Common name format macros that you can use in your configuration are included in Table 8 on page 30.

Table 8: Name Format Macros

Field	Expansion
{*am_pm*}	**AM** or **PM**
{*date*}	Expands to the current date, using the **{month}**, **{day}, and {year}** macros.
{*day*}	**01** to **31**
{*day_abbr*}	**Sun** through **Sat**
{*day_full*}	**Sunday** through **Saturday**
{*generation_number*}	Expands to a unique, sequential number for each new file created.
{*hour_12*}	**01** to **12**
{*hour_24*}	**00** to **23**
{*ifalias*}	Expands to a description string for the logical interface.
{*minute*}	**00** to **59**
{*month*}	**01** to **12**
{*month_abbr*}	**Jan** through **Dec**
{*month_full*}	**January** through **December**
{*num_zone*}	**-2359** to **+2359**
{*second*}	**00** to **60**
{*time*}	Expands to the time the file is created, using the **{hour_24}**, **{minute}**, and **{second}** macros.
{*time_zone*}	Time zone code name of the locale (**gmt, pst**, and so on).
{*year*}	**1970, 2008**, and so on.
{*year_abbr*}	**00** to **99**

- Input interface-to-flow collector interface mappings—Match an input interface with a flow collector interface and apply the preset file specifications to the input interface. To configure the default flow collector and file specifications for all input interfaces, include the **file-specification** and **collector** statements at the **[edit services flow-collector**

interface-map] hierarchy level. To override the default settings and apply flow collector and file specifications to a specific input interface, include the **file-specification** and **collector** statements at the **[edit services flow-collector interface-map *interface-name*]** hierarchy level.

- Transfer log settings—Allow you to configure the destination FTP server where log files containing the transfer activity history for a flow collector interface are to be archived, the name for the log file, and the amount of time the router waits before sending the log file to the FTP server. To configure, include the **archive-sites**, **filename-prefix**, and **maximum-age** statements at the **[edit services flow-collector transfer-log-archive]** hierarchy level. The default value for the **maximum-age** statement is 120 minutes, with a range of 1 to 360 minutes. Also, you can configure up to five FTP archive site servers to receive log files.
- Miscellaneous settings—Allow you to configure values for the IP address of the analyzer, an identifier for the analyzer, the maximum number of times the flow collector interface attempts to send transfer log files to the FTP server, and the amount of time the flow collector interface waits between retry attempts. To configure, include the **analyzer-address**, **analyzer-id**, **retry**, and **retry-delay** statements at the **[edit services flow-collector]** hierarchy level. The range for the **retry** statement is 0 through 10 retry attempts. The default for the **retry-delay** statement is 30 seconds and the range is 0 through 60 seconds.

To specify a flow collector interface as the destination for flow records coming from a Monitoring Services or Monitoring Services II PIC, include the **collector-pic** statement at the **[edit forwarding-options monitoring *group-name* family inet output flow-export-destination]** hierarchy level. You can select either the flow collector interface or a flow server as the destination for flow records, but you cannot select both destination types simultaneously.

There is also a Juniper Networks enterprise Management Information Base (MIB) for the flow collector interface. The Flow Collector Services MIB allows you to use SNMP to monitor the flow collector interface. The MIB provides statistics on files, records, memory, FTP, and error states of a flow collector interface. It also provides SNMP traps for unavailable destinations, unsuccessful file transfers, flow overloading, and memory overloading. For more information, see the *Junos Network Management Configuration Guide* or view the enterprise-specific Juniper Networks MIBs at **http://www.juniper.net/techpubs/software/junos/mibs.html**.

In summary, to implement the flow collector service, include statements at the **[edit chassis]**, **[edit interfaces]**, **[edit forwarding-options]**, and **[edit services]** hierarchy levels. The excerpt on the following pages shows the flow collector service configuration hierarchy. For a full configuration example, see "Example: Flow Collector Interface Configuration" on page 55.

```
[edit]
chassis {
   fpc fpc-slot {
      pic pic-slot {
         monitoring-services {
            application flow-collector;
         }
```

```
        }
      }
    }
    interfaces {
      cp-fpc/pic/port {
        description ”flow_collector_interface”;
        unit 0 {
          family inet {
            address ip-address {
              destination  ip-address;
            }
          }
        }
        unit 1 {
          family inet {
            address ip-address {
              destination ip-address;
            }
          }
        }
        unit 2 {
          family inet {
            address ip-address {
              destination ip-address;
            }
          }
        }
      }
      interface-fpc/pic/port {
        description “export_interface”;
        unit 0 {
          family inet {
            address ip-address;
          }
        }
      }
      mo-fpc/pic/port  {
        description “monitoring_services_interface”;
        unit 0 {
          family inet;
        }
      }
      SONET/SDH, ATM2 IQ, or Ethernet-based-interface-fpc/pic/port {
        description “ input_interface”;
        encapsulation encapsulation-type;
        passive-monitor-mode; # Apply to the logical interface for SONET/SDH
      }
    }
    forwarding-options {
      monitoring group1 {
        family inet {
          output {
            export-format cflowd-version-5;
            flow-active-timeout value;
            flow-inactive-timeout value;
            flow-export-destination collector-pic;
```

```
            interface mo-fpc/pic/port {
              source-address ip-address;
            }
          }
        }
      }
    }
    services {
      flow-collector {
        analyzer-address ip-address;
        analyzer-id name;
        retry value;
        retry-delay seconds;
        destinations {
          "ftp://username@ftp-server-address-1//directory/" {
            password "encrypted-password";
          }
          "ftp://username@ftp-server-address-2//directory/" {
            password "encrypted-password";
          }
        }
        file-specification {
          file-specification-name {
          }
          data-format flow-compressed;
          transfer timeout value record-level size;
        }
      }
      interface-map {
        file-specification file-specification-name;
        collector cp-fpc/pic/port;
        interface-name {
          file-specification file-specification-name;
          collector cp-fpc/pic/port;
        }
      }
      transfer-log-archive {
        filename-prefix filename;
        maximum-age timeout-value;
        archive-sites {
          "ftp://username@ip-address//directory/" {
            password "encrypted-password";
          }
        }
      }
    }
```

Monitoring Traffic Using a Dynamic Flow Capture Interface

Dynamic flow capture enables you to capture packet flows based on filtering criteria that you specify in real time.

Using a Dynamic Flow Capture Interface to Monitor Traffic On Demand

Dynamic flow capture enables you to capture packet flows based on filtering criteria that you specify in real time. Unlike traditional flow monitoring that requires filtering criteria to be established before operation, dynamic flow capture uses an on demand control protocol that allows you to modify the filtering criteria as network conditions change.

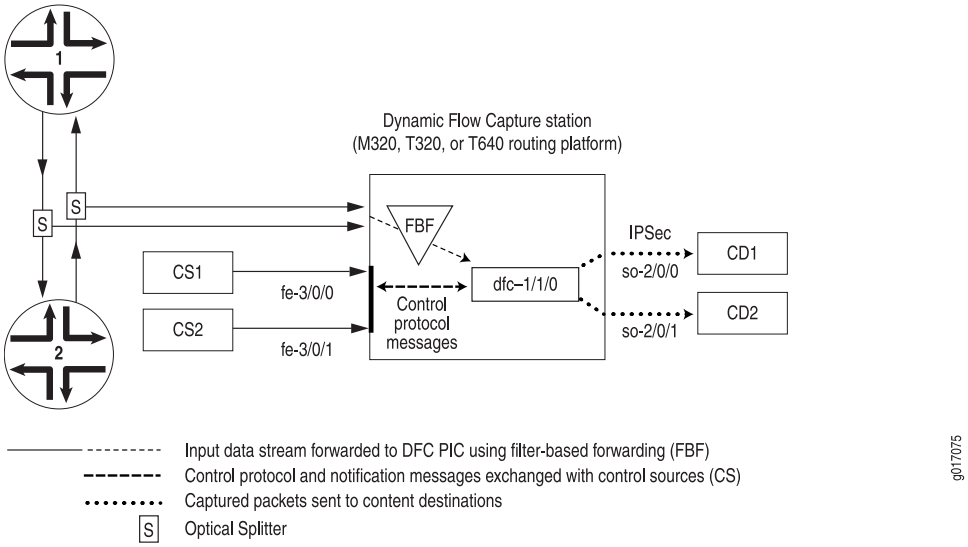
The dynamic flow capture architecture consists of one or more *control sources* that send Dynamic Tasking Control Protocol (DTCP) requests to a *monitoring station*. The requests contain filtering criteria that specify which incoming traffic should be monitored, and the monitoring station forwards any packets that match the filter criteria to a set of one or more *content destinations*.

- Control source—A client that wants to monitor electronic data or voice transfer over the network. The control source sends filter requests to the Juniper Networks router using DTCP. The control source is identified by a unique identifier and an optional list of IP addresses.
- Monitoring station—A Juniper Networks T Series or M320 router configured with one or more Monitoring Services III PICs which support dynamic flow capture processing. The monitoring station processes the requests from the control sources, creates the filters, monitors incoming data flows, and sends the matched packets to the appropriate content destinations.
- Content destination—Recipient of the matched packets from the monitoring station. Typically the matched packets are sent using an IPSec tunnel from the monitoring station to another router connected to the content destination. The content destination and the control source can be located on the same host.

NOTE: **The DFC PIC forwards the entire packet content to the content destination, rather than just a content record.**

Figure 2 on page 35 shows a sample topology that contains control sources, a monitoring station, and content destinations.

Figure 2: Dynamic Flow Capture Topology



To configure dynamic flow capture, perform the following tasks:

- Configuring the Capture Group on page 35
- Configuring the Content Destination on page 36
- Configuring the Control Source on page 36
- Configuring the Dynamic Flow Capture Interface on page 37
- Option: Configuring Thresholds on page 38
- Option: Configuring System Logging on page 38
- Option: Monitoring Dynamic Flow Capture by Using SNMP on page 39

Configuring the Capture Group

A dynamic flow capture capture group defines a profile of dynamic flow capture configuration information. The static configuration includes information about control sources, content destinations, and notification destinations. Dynamic configuration is added through interaction with control sources using a control protocol.

To configure a capture group, include the **capture-group** statement at the [**edit services dynamic-flow-capture**] hierarchy level:

```
[edit services dynamic-flow-capture]
capture-group client-name {
  content-destination identifier {
    address address;
    ttl hops;
  }
  control-source identifier {
    allowed-destinations [ destination ];
    no-syslog;
    notification-targets [ address address port  port-number ];
```

```
    service-port port-number;
    shared-key value;
    source-addresses [ address ];
  }
  input-packet-rate-threshold rate;
  interfaces interface-name;
  pic-memory-threshold percentage percentage;
}
```

To specify the **capture-group**, assign it a unique ***client-name*** that associates the information with the requesting control sources.

Configuring the Content Destination

You must specify a destination for the packets that match dynamic flow capture filter criteria. To configure, include the **content-destination** statement at the [**edit services dynamic-flow-capture capture-group** ***client-name***] hierarchy level:

```
[edit services dynamic-flow-capture capture-group client-name]
content-destination  identifier {
  address address;
  ttl hops;
}
```

Assign the **content-destination** a unique ***identifier***. In addition, you must specify its IP address, and you can optionally set a time-to-live (TTL) value for the IP-IP header:

- **address**—The dynamic flow capture interface appends an IP header with this destination address on the matched packet (with its own IP header and contents intact) and sends it out to the content destination.
- **ttl**—By default, the TTL value is 255, with a range from 0 through 255.

Configuring the Control Source

You configure information about the control source, including allowed source addresses, destinations, and authentication key values. To configure the control source information, include the **control-source** statement at the [**edit services dynamic-flow-capture**] hierarchy level:

```
[edit services dynamic-flow-capture capture-group client-name]
control-source identifier {
  allowed-destinations [ destination-identifier ];
  no-syslog;
  notification-targets [ address address port port-number ];
  service-port port-number;
  shared-key value;
  source-addresses [ address ];
}
```

Assign the **control-source** statement with a unique ***identifier***. You can also include values for the following statements:

- **allowed-destinations**—One or more content destination identifiers to which this control source can request matched data to be sent in its control protocol requests. If you do not specify any content destinations, all available destinations are allowed.
- **notification-targets**—One or more destinations to which the dynamic flow capture interface can log information about control protocol-related events and other events such as PIC startup messages. You configure each **notification-target** entry with an IP **address** value and a User Datagram Protocol (UDP) **port** number.
- **service-port**—UDP port number to which the control protocol requests are directed. Control protocol requests that are not directed to this port are discarded by dynamic flow capture interfaces.
- **shared-key**—A 20-byte authentication key value shared between the control source and the dynamic flow capture monitoring station.
- **source-addresses**—One or more allowed IP addresses from which the control source can send control protocol requests to the dynamic flow capture monitoring station. These are /32 addresses.

Configuring the Dynamic Flow Capture Interface

You specify the interface that interacts with the control sources configured in the same dynamic flow capture group. A Monitoring Services III PIC can belong to only one capture group, and you can configure only one PIC for each group.

To configure a dynamic flow capture interface, include the **interfaces** statement at the [**edit services dynamic-flow-capture**] hierarchy level:

```
[edit services dynamic-flow-capture capture-group client-name]
interfaces interface-name;
```

You specify dynamic flow capture interfaces using the **dfc-** identifier at the **[edit interfaces]** hierarchy level. Three logical units are required on each dynamic flow capture interface, numbered **0**, **1**, and **2**. You cannot configure any other logical interfaces.

- **unit 0** processes control protocol requests and responses.
- **unit 1** receives monitored data.
- **unit 2** transmits the matched packets to the destination address.

The following example shows the configuration necessary to set up a dynamic flow capture interface:

```
[edit interfaces dfc-0/0/0]
unit 0 {
   family inet {
      address 10.1.0.0/32 { # Address of the Routing Engine for the DFC PIC.
         destination 10.36.100.1; # Address of DFC PIC; used by the
            # control source to correspond with the monitoring station.
      }
```

```
    }
  }
  unit 1 { # Receives data packets on this logical interface.
    family inet;
  }
  unit 2 { # Sends copies of matched packets from this logical interface.
    family inet;
  }
```

In addition, you must configure the dynamic flow capture application to run on the DFC PIC in the correct chassis location. The following example shows this configuration at the **[edit chassis]** hierarchy level:

```
[edit chassis]
fpc 0 {
  pic 0 {
    monitoring-services application dynamic-flow-capture;
  }
}
```

For more information on configuring chassis properties, see the *Junos System Basics Configuration Guide*.

Option: Configuring Thresholds

You can optionally specify threshold values for situations in which warning messages will be recorded in the system log:

- Input packet rate to the dynamic flow capture interfaces
- Memory usage on the dynamic flow capture interfaces

To configure, include the **input-packet-rate-threshold** or **pic memory-threshold** statements at the [**edit services dynamic-flow-capture capture-group *client-name***] hierarchy level:

```
[edit services dynamic-flow-capture capture-group  client-name]
input-packet-rate-threshold rate;
pic-memory-threshold percentage percentage;
```

If these statements are not configured, no threshold messages are logged. The threshold settings are configured for the capture group as a whole.

Option: Configuring System Logging

By default, control protocol activity is logged as a separate system log facility, **dfc**. To modify the filename or level at which control protocol activity is recorded, include the following statements at the **[edit syslog]** hierarchy level:

```
[edit syslog]
file dfc.log {
  dfc any;
}
```

To cancel logging, include the **no-syslog** statement at the [**edit services dynamic-flow-capture *capture-group client-name* control-source *identifier***] hierarchy level:

```
[edit services dynamic-flow-capture capture-group client-name control-source identifier]
```

```
no-syslog;
```

Option: Monitoring Dynamic Flow Capture by Using SNMP

In Junos OS Release 7.5 and later, the Dynamic Flow Capture MIB provides a way to monitor dynamic flow capture information by using Simple Network Management Protocol (SNMP). The MIB provides the same information that you can view with the **show services dynamic-flow-capture content-destination**, **show services dynamic-flow-capture control-source**, and **show services dynamic-flow-capture statistics** commands. For more information, see the *Junos Network Management Configuration Guide*.

Hardware and Software Considerations

There are several hardware and software considerations when you implement passive flow monitoring. When defining the hardware requirements of the monitoring station, keep in mind the following:

- The input interfaces on the monitoring station must be SONET/SDH interfaces (OC3, OC12, or OC48), ATM2 IQ interfaces (OC3 or OC12), 4-port Fast Ethernet interfaces, Gigabit Ethernet interfaces with SFP (4-port or 10-port), or 1-port 10-Gigabit Ethernet interfaces with XENPAK.
- To monitor the flows in both directions for a single interface, the monitoring station must have two SONET/SDH, ATM2 IQ, or Ethernet-based receive ports, one for each direction of flow. In Figure 1 on page 4, the monitoring station needs one port to monitor the traffic flowing from Router 1 to Router 2, and a second port to monitor the traffic flowing from Router 2 to Router 1.
- The Monitoring Services PICs must be installed in a Type 1 enhanced FPC slot.
- Type 1 and Type 2 Tunnel Services PICs are supported.
- Use an ES PIC to encrypt the flow export.

When defining a traffic monitoring strategy, keep in mind the following:

- The monitoring station collects only IPv4 packets. All other packet formats are discarded and not counted.
- You can set the amount of time a data flow can be inactive before the monitoring station terminates the flow and exports the flow data. To set the timer, include the **flow-inactive-timeout** statement at the **[edit forwarding-options monitoring *group-name* family inet output]** hierarchy level. The timer value can be from 15 seconds through 1800 seconds, with a default value of 60 seconds.

You can also configure the monitoring station to collect periodic flow reports for flows that last longer than the configured active timeout. To set this activity timer, include the **flow-active-timeout** statement at the **[edit forwarding-options monitoring *group-name* family inet output]** hierarchy level. The timer value can be from 60 seconds through 1800 seconds, with a default value of 180 seconds.

- Multiple expired flows are exported together, if possible. A UDP packet is sent when one of the following conditions is met:

  - When 30 flows are contained in the current packet, the flows are exported.
  - If there are fewer than 30 flows but the export timer expires, the flows are exported one second after the timer expires.
- TCP and UDP flows are considered differently:
  - TCP flows watch for a segment containing the **FIN** bit and a subsequent acknowledgement (**ACK**) to detect the end of a flow. Alternately, a TCP reset (**RST**) can also indicate the end of a flow. When these TCP combinations are detected, the flow expires. The **FIN+ACK** and **RST** cases cover most TCP stream closures. For all other flows, an inactive timeout is needed.
  - All non-TCP flows, such as UDP, depend on timeout mechanisms for export.
- The default MTU value for SONET/SDH interfaces is 4474 bytes; for Gigabit Ethernet and Fast Ethernet interfaces, it is 1500 bytes. If the monitoring station receives packets exceeding 4474 bytes, they are discarded; no fragmentation is performed. Note that the supported MTU size on the Gigabit Ethernet or Fast Ethernet PICs might exceed 1500 bytes, depending on the type of PIC.
- Any incoming traffic that is discarded is not forwarded to packet analyzers.
- The interfaces on the monitoring station that collect intercepted traffic must be configured with Cisco HDLC or PPP encapsulation.
- You must always use a standard interface (for example, one that follows the usual ***interface-name-fpc/pic/slot*** format) to send flow records to a flow server. Flow data generated by the Monitoring Services or Monitoring Services II PICs will not be delivered to the server across the **fxp0** interface.
- You can send version 5 records to multiple flow servers. You can configure up to eight servers and flow traffic is load-balanced between the servers in a round-robin fashion. If one of the servers ceases operation, flow traffic load-balances automatically between the remaining active servers. To configure, include up to eight **flow-server** statements at the **[edit forwarding-options monitoring *group-name* output]** hierarchy level.

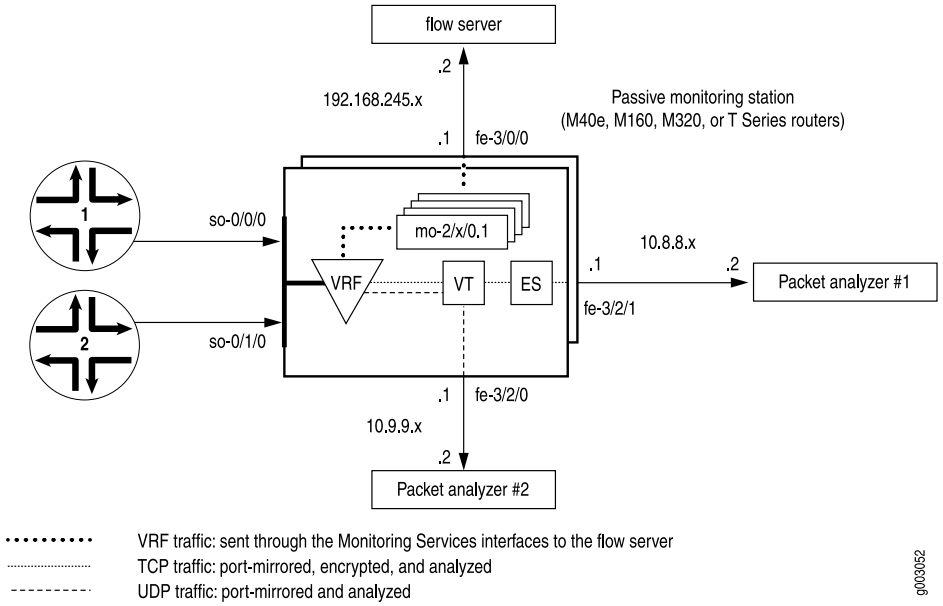
CHAPTER 3

Passive Flow Monitoring Configuration Examples

This section contains configuration examples and commands you can issue to verify a passive flow monitoring configuration:

Example: Passive Flow Monitoring Configuration

Figure 3: Passive Flow Monitoring—Topology Diagram



In Figure 3 on page 41, traffic enters the monitoring station through interfaces **so-0/0/0** and **so-0/1/0**. After the firewall filter accepts the traffic to be monitored, the packets enter a VRF instance.

The original packets travel within the VRF instance to the Monitoring Services PIC for flow processing. The final flow packets are sent from the monitoring services interfaces out the **fe-3/0/0** interface to a flow server.

A copy of the accepted traffic is port-mirrored to the Tunnel PIC. As the copied packets enter the tunnel interface, a second firewall filter separates TCP and UDP packets and places them into two filter-based forwarding instances. The UDP instance directs the UDP packets to a packet analyzer attached to **fe-3/2/0**. The TCP instance sends the TCP packets to the ES PIC for encryption and the ES PIC sends the packets to a second packet analyzer connected to **fe-3/2/1**.

Your first step is to define a firewall filter to select packets for monitoring. All filtered traffic must be accepted, and the **port-mirror** statement at the **[edit firewall family inet filter *filter-name* term *term-name* then]** hierarchy level facilitates port mirroring.

Next, configure the input SONET/SDH interfaces and apply the firewall filter that you just defined. The **passive-monitor-mode** statement disables SONET keepalives on the SONET/SDH interfaces and enables passive flow monitoring.

Configure all other interfaces that you will use with the monitoring application, including the monitoring services interfaces, the export interfaces, the tunnel interface, and the ES interface. Once the interfaces are in place, configure a VRF instance and monitoring group to direct the original packets from the input interfaces to the monitoring services interfaces for processing. The resulting flow description packets exit **fe-3/0/0** to reach the flow server.

Next, configure statements to port-mirror the monitored traffic to a tunnel interface. Design a firewall filter that selects some of this copied traffic for further analysis and some of the traffic for discarding. In this case, isolate TCP and UDP traffic and direct these two flows into separate filter-based forwarding routing instances. Remember to apply the filter to the tunnel interface to enable the separation of TCP traffic from UDP traffic. Also, import the interface routes into the forwarding instances with a routing table group.

In the filter-based forwarding instances, define static route next hops. The next hop for the TCP instance is the ES interface and the next hop for the UDP instance is the packet analyzer connected to **fe-3/2/0**. Finally, configure IPSec so that the next hop for the TCP traffic is the second packet analyzer attached to **fe-3/2/1**.

```
[edit]
interfaces {
   so-0/0/0 { # Traffic enters the router on this interface.
      description " input interface";
      encapsulation ppp;
      unit 0 {
         passive-monitor-mode; # Disables SONET keepalives.
         family inet {
            filter {
               input input-monitoring-filter; # The firewall filter is applied here.
            }
         }
      }
```

```
}
so-0/1/0 { # Traffic enters the router on this interface.
  description " input interface";
  encapsulation ppp;
  unit 0 {
    passive-monitor-mode; # Disables SONET keepalives.
    family inet {
      filter {
        input input-monitoring-filter; # The firewall filter is applied here.
      }
    }
  }
}
es-3/1/0 { # This is where the TCP traffic enters the ES PIC.
  unit 0 {
    tunnel {
      source 10.8.8.1;
      destination 10.8.8.2;
    }
    family inet {
      ipsec-sa sa-esp;
      address 3.3.3.1/32 {
        destination 3.3.3.2;
      }
    }
  }
}
fe-3/0/0 { # Flow records exit here and travel to the flow server.
  description " export interface to the flow server";
  unit 0 {
    family inet;
    address 192.168.245.1/30;
  }
}
fe-3/2/0 { # This export interface for UDP traffic leads to a packet analyzer.
  description " export interface to the packet analyzer";
  unit 0 {
    family inet {
      address 10.9.9.1/30;
    }
  }
}
fe-3/2/1 { # This IPSec tunnel source exports TCP traffic to a packet analyzer.
  unit 0 {
    family inet {
      address 10.8.8.1/30;
    }
  }
}
mo-4/0/0 { # This marks the beginning of the monitoring services interfaces.
  unit 0 { # Unit 0 is part of the inet.0 routing table and generates flow records.
    family inet;
  }
  unit 1 { # Unit 1 receives monitored traffic and is part of the VRF instance.
    family inet;
  }
```

```
    }
    mo-4/1/0 {
      unit 0 { # Unit 0 is part of the inet.0 routing table and generates flow records.
        family inet;
      }
      unit 1 { # Unit 1 receives monitored traffic and is part of the VRF instance.
        family inet;
      }
    }
    mo-4/2/0 {
      unit 0 { # Unit 0 is part of the inet.0 routing table and generates flow records.
        family inet;
      }
      unit 1 { # Unit 1 receives monitored traffic and is part of the VRF instance.
        family inet;
      }
    }
    mo-4/3/0 {
      unit 0 { # Unit 0 is part of the inet.0 routing table and generates flow records.
        family inet;
      }
      unit 1 { # Unit 1 receives monitored traffic and is part of the VRF instance.
        family inet;
      }
    }
    vt-0/2/0 {  # The tunnel services interface receives the port-mirrored traffic.
      unit 0 {
        family inet {
          filter {
            input tunnel-interface-filter;  # The filter splits traffic into TCP and UDP
          }
        }
      }
    }
  }
  forwarding-options {
    monitoring group1 {  # Monitored traffic is processed by the monitoring services
      family inet { # interfaces and flow records are sent to the flow server.
        output {
          export-format cflowd-version-5;
          flow-active-timeout 60;
          flow-inactive-timeout 30;
          flow-server 192.168.245.2 port 2055; # IP address and port for server.
          interface mo-4/0/0.1 {  # Use monitoring services interfaces for output.
            engine-id 1; # engine and interface-index statements are optional.
            engine-type 1;
            input-interface-index 44;
            output-interface-index 54;
            source-address 192.168.245.1; # This is the IP address of fe-3/0/0.
          }
          interface mo-4/1/0.1 {
            engine-id 2; # engine and interface-index statements are optional.
            engine-type 1;
            input-interface-index 45;
            output-interface-index 55;
            source-address 192.168.245.1; # This is the IP address of fe-3/0/0.
```

```
            }
            interface mo-4/2/0.1 {
              engine-id 3; # engine and interface-index statements are optional.
              engine-type 1;
              input-interface-index 46;
              output-interface-index 56;
              source-address 192.168.245.1; # This is the IP address of fe-3/0/0.
            }
            interface mo-4/3/0.1 {
              engine-id 4; # engine and interface-index statements are optional.
              engine-type 1;
              input-interface-index 47;
              output-interface-index 57;
              source-address 192.168.245.1; # This is the IP address of fe-3/0/0.
            }
          }
        }
      }
      port-mirroring {  # Copies the traffic and sends it to the Tunnel Services PIC.
        family inet {
          input {
            rate 1;
            run-length 1;
          }
          output {
            interface vt-0/2/0.0;
            no-filter-check;
          }
        }
      }
    }
    routing-options { # This installs the interface routes into the forwarding instances.
      interface-routes {
        rib-group inet bc-vrf;
      }
      rib-groups {
        bc-vrf {
          import-rib [inet.0 tcp-routing-table.inet.0 udp-routing-table.inet.0];
        }
      }
      forwarding-table {
        export pplb; # Applies per-packet load balancing to the forwarding table.
      }
    }
    policy-options {
      policy-statement monitoring-vrf-import {
        then reject;
      }
      policy-statement monitoring-vrf-export {
        then reject;
      }
      policy-statement pplb {
        then {
          load-balance per-packet;
        }
      }
```

```
}
security { # This sets IPSec options for the ES PIC.
  ipsec {
    proposal esp-sha1-3des {
      protocol esp;
      authentication-algorithm hmac-sha1-96;
      encryption-algorithm 3des-cbc;
      lifetime-seconds 180;
    }
    policy esp-group2 {
      perfect-forward-secrecy {
        keys group2;
      }
      proposals esp-sha1-3des;
    }
    security-association sa-esp {
      mode tunnel;
      dynamic {
        ipsec-policy esp-group2;
      }
    }
  }
  ike {
    proposal ike-esp {
      authentication-method pre-shared-keys;
      dh-group group2;
      authentication-algorithm sha1;
      encryption-algorithm 3des-cbc;
      lifetime-seconds 180;
    }
    policy 10.8.8.2 {
      mode aggressive;
      proposals ike-esp;
      pre-shared-key ascii-text "$9$qmQnuORrlMBIds2oiH0BIESe";
    }
  }
}
firewall {
  family inet {
    filter input-monitoring-filter { # This filter selects traffic to send into the VRF
      term 1 { # instance and prepares the traffic for port mirroring.
        from {
          destination-address {
            10.7.0.0/16;
          }
        }
        then {
          port-mirror;
          accept;
        }
      }
      term 2 {
        from {
          destination-address {
            10.6.0.0/16;
          }
```

```
            }
            then accept;
          }
        }
        filter tunnel-interface-filter {  # This filter breaks the port-mirrored traffic into two
          term tcp { # filter-based forwarding instances: TCP packets and UDP packets.
            from {
              protocol tcp;
            }
            then { # This counts TCP packets and sends them into a TCP instance.
              count tcp;
              routing-instance tcp-routing-table;
            }
          }
          term udp {
            from {
              protocol udp;
            }
            then { # This counts UDP packets and sends them into a UDP instance.
              count udp;
              routing-instance udp-routing-table;
            }
          }
          term rest {
            then {
              count rest;
              discard;
            }
          }
        }
      }
    }
    routing-instances {
      monitoring-vrf { # This is the VRF instance where you send the traffic. It contains
        instance-type vrf; # the input interface and the monitoring services interfaces.
        interface so-0/0/0.0; # Traffic enters the router on these input interfaces.
        interface so-0/1/0.0;
        interface mo-4/0/0.1;
        interface mo-4/1/0.1; # These are output interfaces (use them as
        interface mo-4/2/0.1; # output interfaces in your monitoring group).
        interface mo-4/3/0.1;
        route-distinguisher 69:1;
        vrf-import monitoring-vrf-import;
        vrf-export monitoring-vrf-export;
        routing-options { # Sends traffic to a group of monitoring services interfaces.
          static {
            route 0.0.0.0/0 next-hop [mo-4/0/0.1 mo-4/1/0.1
              mo-4/2/0.1 mo-4/3/0.1];
          }
        }
      }
      tcp-routing-table {  # This is the filter-based forwarding instance for TCP traffic.
        instance-type forwarding;
        routing-options {  # The next hop is the ES PIC.
          static {
            route 0.0.0.0/0 next-hop es-3/1/0.0;
```

```
        }
      }
    }
    udp-routing-table { # This is the filter-based forwarding instance for UDP traffic.
      instance-type forwarding;
      routing-options { # The next hop is the second packet analyzer.
        static {
          route 0.0.0.0/0 next-hop 10.9.1.2;
        }
      }
    }
  }
```

Verifying Your Work

To verify that your configuration is correct, use the following commands on the monitoring station that is configured for passive flow monitoring:

- **show route 0/0**
- **show passive-monitoring error**
- **show passive-monitoring flow**
- **show passive-monitoring memory**
- **show passive-monitoring status**
- **show passive-monitoring usage**

To clear statistics for the **show passive-monitoring error** and **show passive-monitoring flow** commands, issue the **clear passive-monitoring (all | *interface-name*)** command.

You can also view passive flow monitoring status with the Simple Network Management Protocol (SNMP). The following Management Information Base (MIB) tables are supported:

- **jnxPMonErrorTable**—Corresponds to the **show passive-monitoring error** command.
- **jnxPMonFlowTable**—Corresponds to the **show passive-monitoring flow** command.
- **jnxPMonMemoryTable**—Corresponds to the **show passive-monitoring memory** command.

The following section shows the output of the **show** commands used with the configuration example:

```
user@mon-station> show route 0/0
 <skip inet.0>
```

We are only concerned with the routing-instance route.

```
bc-vrf.inet.0:  1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
bc-vrf.inet.0:+ = Active Route, - = Last Active, * = Both
0.0.0.0/0       *[Static/5] 5d 17:34:57
                 via mo-4/0/0.1
                > via mo-4/1/0.1
                 via mo-4/2/0.1
                 via mo-4/3/0.1
tcp-rt.inet.0: 13 destinations, 13 routes (12 active, 0 holddown, 1
```

```
hidden)
+ = Active Route, - = Last Active, * = Both
0.0.0.0/0          *[Static/5] 19:24:39
                    > via es-3/1/0.0
  : <other interface routes>
udp-rt.inet.0: 13 destinations, 13 routes (12 active, 0 holddown, 1
hidden)
+ = Active Route, - = Last Active, * = Both
0.0.0.0/0          *[Static/5] 19:24:39
                    > to 10.9.1.2 via fe-3/2/0.0
  : <other interface routes>
```

NOTE: For all **show passive-monitoring** commands, the output obtained when using a wildcard (such as *) or the **all** option is based on the configured interfaces listed at the **[edit forwarding-options monitoring *group-name*]** hierarchy level. In the output from the configuration example, you see information only for the configured interfaces **mo-4/0/0**, **mo-4/1/0**, **mo-4/2/0**, and **mo-4/3/0**.

Many of the statements you can configure in a monitoring group, such as **engine-id** and **engine-type**, are visible in the output of the **show passive-monitoring** commands.

Table 9: Output Fields for the show passive-monitoring error Command

Field	Explanation
Packets dropped (no memory)	Number of packets dropped because of memory.
Packets dropped (not IP)	Number of non-IP packets dropped.
Packets dropped (not IPv4)	Number of packets dropped because they failed the IPv4 check.
Packets dropped (header too small)	Number of packets dropped because the packet length or IP header length was too small.
Memory allocation failures	Number of flow record memory allocation failures. A small number reflects failures to replenish the free list. A large number indicates the monitoring station is almost out of memory space.
Memory free failures	Number of flow record memory frees.
Memory free list failures	Number of flow records received from free list that failed. Memory is nearly exhausted or too many new flows greater than 128K are being created in one second.
Memory warning	The flows have exceeded 1 million packets per second (Mpps) on a Monitoring Services PIC or 2 Mpps on a Monitoring Services II PIC. The response can be **Yes** or **No**.

Table 9: Output Fields for the show passive-monitoring error Command *(continued)*

Field	Explanation
Memory overload	The memory has been overloaded. The response is **Yes** or **No**.
PPS overload	In packets per second, whether the PIC is receiving more traffic than the configured threshold. The response can be **Yes** or **No**.
BPS overload	In bytes per second, whether the PIC is receiving more traffic than the configured threshold. The response can be **Yes** or **No**.

```
user@mon-station> show passive-monitoring error all
Passive monitoring interface: mo-4/0/0, Local interface index: 44
  Error information
    Packets dropped (no memory): 0, Packets dropped (not IP): 0
    Packets dropped (not IPv4): 0, Packets dropped (header too small): 0
    Memory allocation failures: 0, Memory free failures: 0
    Memory free list failures: 0
    Memory warning: No, Memory overload: No, PPS overload: No, BPS overload: No

Passive monitoring interface: mo-4/1/0, Local interface index: 45
  Error information
    Packets dropped (no memory): 0, Packets dropped (not IP): 0
    Packets dropped (not IPv4): 0, Packets dropped (header too small): 0
    Memory allocation failures: 0, Memory free failures: 0
    Memory free list failures: 0
    Memory warning: No, Memory overload: No, PPS overload: No, BPS overload: No

Passive monitoring interface: mo-4/2/0, Local interface index: 46
  Error information
    Packets dropped (no memory): 0, Packets dropped (not IP): 0
    Packets dropped (not IPv4): 0, Packets dropped (header too small): 0
    Memory allocation failures: 0, Memory free failures: 0
    Memory free list failures: 0
    Memory warning: No, Memory overload: No, PPS overload: No, BPS overload: No

Passive monitoring interface: mo-4/3/0, Local interface index: 47
  Error information
    Packets dropped (no memory): 0, Packets dropped (not IP): 0
    Packets dropped (not IPv4): 0, Packets dropped (header too small): 0
    Memory allocation failures: 0, Memory free failures: 0
    Memory free list failures: 0
    Memory warning: No, Memory overload: No, PPS overload: No, BPS overload: No
```

Table 10: Output Fields for the show passive-monitoring flow Command

Field	Explanation
Flow packets	Number of packets received by an operational PIC.
Flow bytes	Number of bytes received by an operational PIC.

Table 10: Output Fields for the show passive-monitoring flow Command *(continued)*

Field	Explanation
Flow packets 10-second rate	Number of packets per second handled by the PIC and displayed as a 10-second average.
Flow bytes 10-second rate	Number of bytes per second handled by the PIC and displayed as a 10-second average.
Active flows	Number of currently active flows tracked by the PIC.
Total flows	Total number of flows received by an operational PIC.
Flows exported	Total number of flows exported by an operational PIC.
Flows packets exported	Total number of flow packets exported by an operational PIC.
Flows inactive timed out	Total number of flows that are exported because of inactivity.
Flows active timed out	Total number of long-lived flows that are exported because of an active timeout.

```
user@mon-station> show passive-monitoring flow all
Passive monitoring interface: mo-4/0/0, Local interface index: 44
  Flow information
    Flow packets: 6533434, Flow bytes: 653343400
    Flow packets 10-second rate: 0, Flow bytes 10-second rate: 0
    Active flows: 0, Total flows: 1599
    Flows exported: 1599, Flows packets exported: 55
    Flows inactive timed out: 1599, Flows active timed out: 0

Passive monitoring interface: mo-4/1/0, Local interface index: 45
  Flow information
    Flow packets: 6537780, Flow bytes: 653778000
    Flow packets 10-second rate: 0, Flow bytes 10-second rate: 0
    Active flows: 0, Total flows: 1601
    Flows exported: 1601, Flows packets exported: 55
    Flows inactive timed out: 1601, Flows active timed out: 0

Passive monitoring interface: mo-4/2/0, Local interface index: 46
  Flow information
    Flow packets: 6529259, Flow bytes: 652925900
    Flow packets 10-second rate: 0, Flow bytes 10-second rate: 0
    Active flows: 0, Total flows: 1599
    Flows exported: 1599, Flows packets exported: 55
    Flows inactive timed out: 1599, Flows active timed out: 0

Passive monitoring interface: mo-4/3/0, Local interface index: 47
  Flow information
    Flow packets: 6560741, Flow bytes: 656074100
```

```
    Flow packets 10-second rate: 0, Flow bytes 10-second rate: 0
    Active flows: 0, Total flows: 1598
    Flows exported: 1598, Flows packets exported: 55
    Flows inactive timed out: 1598, Flows active timed out: 0
```

Table 11: Output Fields for the show passive-monitoring memory Command

Field	Explanation
Allocation count	Number of flow records allocated.
Free count	Number of flow records freed.
Maximum allocated	Maximum number of flow records allocated since the monitoring station booted. This number represents the peak number of flow records allocated at a time.
Allocations per second	Flow records allocated per second during the last statistics interval on the PIC.
Frees per second	Flow records freed per second during the last statistics interval on the PIC.
Total memory used	Total amount of memory currently used (in bytes).
Total memory free	Total amount of memory currently free (in bytes).

```
user@mon-station> show passive-monitoring memory all

Passive monitoring interface: mo-4/0/0, Local interface index: 44
  Memory utilization
    Allocation count: 1600, Free count: 1599, Maximum allocated: 1600
    Allocations per second: 3200, Frees per second: 1438
    Total memory used (in bytes): 103579176, Total memory free (in bytes): 163914184

Passive monitoring interface: mo-4/1/0, Local interface index: 45
  Memory utilization
    Allocation count: 1602, Free count: 1601, Maximum allocated: 1602
    Allocations per second: 3204, Frees per second: 1472
    Total memory used (in bytes): 103579176, Total memory free (in bytes): 163914184

Passive monitoring interface: mo-4/2/0, Local interface index: 46
  Memory utilization
    Allocation count: 1600, Free count: 1599, Maximum allocated: 1600
    Allocations per second: 3200, Frees per second: 1440
    Total memory used (in bytes): 103579176, Total memory free (in bytes): 163914184

Passive monitoring interface: mo-4/3/0, Local interface index: 47
  Memory utilization
    Allocation count: 1599, Free count: 1598, Maximum allocated: 1599
    Allocations per second: 3198, Frees per second: 1468
    Total memory used (in bytes): 103579176, Total memory free (in bytes): 163914184
```

Table 12: Output Fields for the show passive-monitoring status Command

Field	Explanation
Interface state	Indicates whether the interface is monitoring (operating properly), disabled (administratively disabled), or not monitoring (not configured).
Group index	Integer that represents the monitoring group of which the PIC is a member. (This does not indicate the number of monitoring groups.)
Export interval	Configured export interval for flow records, in seconds.
Export format	Configured export format (only v5 is currently supported).
Protocol	Protocol the PIC is configured to monitor (only IPv4 is currently supported).
Engine type	Configured engine type that is inserted in output flow packets.
Engine ID	Configured engine ID that is inserted in output flow packets.
Route record count	Number of routes recorded.
IFL to SNMP index count	Number of logical interfaces mapped to an SNMP index.
AS count	Number of AS boundaries that the flow has crossed.
Time set	Indicates whether the time stamp is in place.
Configuration set	Indicates whether the monitoring configuration is set.
Route record set	Indicates whether routes are being recorded.
IFL SNMP map set	Indicates whether logical interfaces are being mapped to an SNMP index.

```
user@mon-station> show passive-monitoring status all
Passive monitoring interface: mo-4/0/0, Local interface index: 44
  Interface state: Monitoring
  Group index: 0
  Export interval: 15 secs, Export format: cflowd v5
  Protocol: IPv4, Engine type: 1, Engine ID: 1
  Route record count: 13, IFL to SNMP index count: 30, AS count: 1
  Time set: Yes, Configuration set: Yes
  Route record set: Yes, IFL SNMP map set: Yes

Passive monitoring interface: mo-4/1/0, Local interface index: 45
  Interface state: Monitoring
  Group index: 0
  Export interval: 15 secs, Export format: cflowd v5
  Protocol: IPv4, Engine type: 1, Engine ID: 2
  Route record count: 13, IFL to SNMP index count: 30, AS count: 1
  Time set: Yes, Configuration set: Yes
  Route record set: Yes, IFL SNMP map set: Yes

Passive monitoring interface: mo-4/2/0, Local interface index: 46
  Interface state: Monitoring
```

```
  Group index: 0
  Export interval: 15 secs, Export format: cflowd v5
  Protocol: IPv4, Engine type: 1, Engine ID: 3
  Route record count: 13, IFL to SNMP index count: 30, AS count: 1
  Time set: Yes, Configuration set: Yes
  Route record set: Yes, IFL SNMP map set: Yes

Passive monitoring interface: mo-4/3/0, Local interface index: 47
  Interface state: Monitoring
  Group index: 0
  Export interval: 15 secs, Export format: cflowd v5
  Protocol: IPv4, Engine type: 1, Engine ID: 4
  Route record count: 13, IFL to SNMP index count: 30, AS count: 1
  Time set: Yes, Configuration set: Yes
  Route record set: Yes, IFL SNMP map set: Yes
```

Table 13: Output Fields for the show passive-monitoring usage Command

Field	Explanation
Uptime	Time, in milliseconds, that the PIC has been operational.
Interrupt time	Cumulative time that the PIC spent in processing packets since the last PIC reset.
Load (5 second)	CPU load on the PIC averaged over 5 seconds. The number is a percentage obtained by dividing the time spent on active tasks by the total elapsed time.
Load (1 minute)	CPU load on the PIC averaged over 1 minute. The number is a percentage obtained by dividing the time spent on active tasks by the total elapsed time.

```
user@mon-station> show passive-monitoring usage *
Passive monitoring interface: mo-4/0/0, Local interface index: 44
  CPU utilization
    Uptime: 653155 milliseconds, Interrupt time: 40213754 microseconds
    Load (5 second): 20%, Load (1 minute): 17%

Passive monitoring interface: mo-4/1/0, Local interface index: 45
  CPU utilization
    Uptime: 652292 milliseconds, Interrupt time: 40223178 microseconds
    Load (5 second): 22%, Load (1 minute): 15%

Passive monitoring interface: mo-4/2/0, Local interface index: 46
  CPU utilization
    Uptime: 649491 milliseconds, Interrupt time: 40173645 microseconds
    Load (5 second): 22%, Load (1 minute): 10098862%

Passive monitoring interface: mo-4/3/0, Local interface index: 47
  CPU utilization
    Uptime: 657328 milliseconds, Interrupt time: 40368704 microseconds
    Load (5 second): 1%, Load (1 minute): 15%
```

Example: Flow Collector Interface Configuration

Figure 4: Flow Collector Interface Topology Diagram

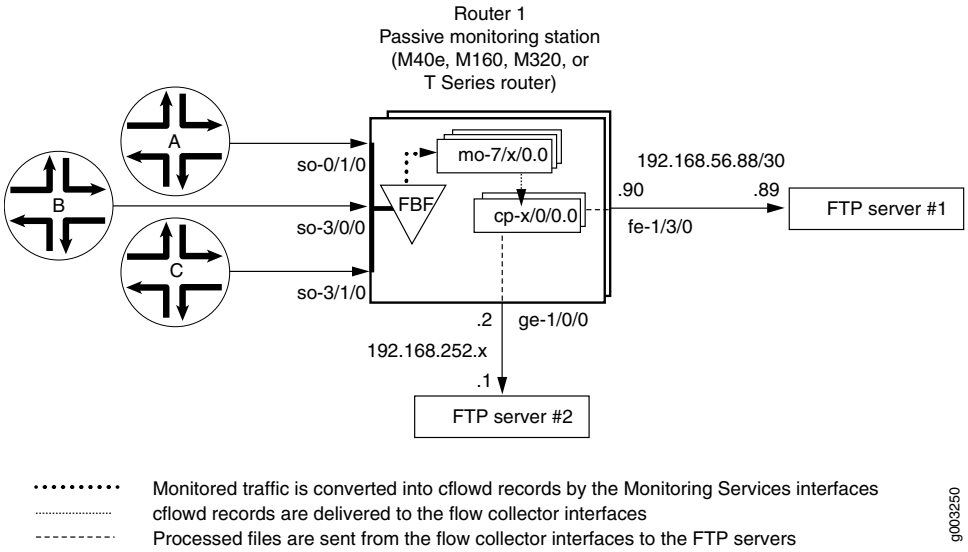


Figure 4 on page 55 shows the path traveled by monitored traffic as it passes through the router. Packets arrive at input interfaces **so-0/1/0**, **so-3/0/0**, and **so-3/1/0**. The raw packets are directed into a filter-based forwarding routing instance and processed into flow records by the monitoring services interfaces **mo-7/1/0**, **mo-7/2/0**, and **mo-7/3/0**. The flow records are compressed into files at the flow collector interfaces **cp-6/0/0** and **cp-7/0/0** and sent to the FTP server for analysis. Finally, a mandatory class-of-service (CoS) configuration is applied to export channels 0 and 1 on the flow collector interfaces to manage the outgoing processed files.

Router 1

```
[edit]
chassis {
   fpc 6 {
      pic 0 {
         monitoring-services {
            application flow-collector; # This converts a Monitoring Services II PIC
         }       # into a flow collector interface.
      }
   }
   fpc 7 {
      pic 0 {
         monitoring-services {
            application flow-collector; # This converts a Monitoring Services II PIC
         }         # into a flow collector interface.
      }
   }
}
interfaces {
   cp-6/0/0 {
      unit 0 {# Logical interface .0 on a flow collector interface is export
         family inet { # channel 0 and sends records to the FTP server.
            filter {
```

```
            output cp-ftp; # Apply the CoS filter here.
          }
          address 10.0.0.1/32 {
            destination 10.0.0.2;
          }
        }
      }
      unit 1 { # Logical interface .1 on a flow collector interface is export
        family inet { # channel 1 and sends records to the FTP server.
          filter {
            output cp-ftp; # Apply the CoS filter here.
          }
          address 10.1.1.1/32 {
            destination 10.1.1.2;
          }
        }
      }
      unit 2 { # Logical interface .2 on a flow collector interface is the flow
        family inet { # receive channel that communicates with the Routing Engine.
          address 10.2.2.1/32 { # Do not apply a CoS filter on logical interface .2.
            destination 10.2.2.2;
          }
        }
      }
    }
    cp-7/0/0 {
      unit 0 { # Logical interface .0 on a flow collector interface is export
        family inet { # channel 0 and sends records to the FTP server.
          filter {
            output cp-ftp; # Apply the CoS filter here.
          }
          address 10.3.3.1/32 {
            destination 10.3.3.2;
          }
        }
      }
      unit 1 { # Logical interface .1 on a flow collector interface is export
        family inet { # channel 1 and sends records to the FTP server.
          filter {
            output cp-ftp; # Apply the CoS filter here.
          }
          address 10.4.4.1/32 {
            destination 10.4.4.2;
          }
        }
      }
      unit 2 { # Logical interface .2 on a flow collector interface is the flow
        family inet { # receive channel that communicates with the Routing Engine.
          address 10.5.5.1/32 { # Do not apply a CoS filter on logical interface .2.
            destination 10.5.5.2;
          }
        }
      }
    }
    fe-1/3/0 { # This is the exit interface leading to the first FTP server.
      unit 0 {
```

```
    family inet {
      address 192.168.56.90/30;
    }
  }
}
ge-1/0/0 { # This is the exit interface leading to the second FTP server.
  unit 0 {
    family inet {
      address 192.168.252.2/24;
    }
  }
}
mo-7/1/0 {  # This is the first interface that creates flow records.
  unit 0 {
    family inet;
  }
}
mo-7/2/0 { # This is the second interface that creates flow records.
  unit 0 {
    family inet;
  }
}
mo-7/3/0 { # This is the third interface that creates flow records.
  unit 0 {
    family inet;
  }
}
so-0/1/0 { # This is the first input interface that receives traffic to be monitored.
  encapsulation ppp;
  unit 0 {
    passive-monitor-mode; # This allows the interface to be passively monitored.
    family inet {
      filter {
        input catch; # The filter-based forwarding filter is applied here.
      }
    }
  }
}
so-3/0/0 { # This is the second interface that receives traffic to be monitored.
  encapsulation ppp;
  unit 0 {
    passive-monitor-mode; # This allows the interface to be passively monitored.
    family inet {
      filter {
        input catch; # The filter-based forwarding filter is applied here.
      }
    }
  }
}
so-3/1/0 { # This is the third interface that receives traffic to be monitored.
  encapsulation ppp;
  unit 0 {
    passive-monitor-mode; # This allows the interface to be passively monitored.
    family inet {
      filter {
        input catch; # The filter-based forwarding filter is applied here.
```

```
            }
          }
        }
      }
    }
    forwarding-options {
      monitoring group1 { # Always define your monitoring group here.
        family inet {
          output {
            export-format cflowd-version-5;
            flow-active-timeout 60;
            flow-inactive-timeout 15;
            flow-export-destination collector-pic; # Sends records to the flow collector.
            interface mo-7/1/0.0 {
              source-address 192.168.252.2;
            }
            interface mo-7/2/0.0 {
              source-address 192.168.252.2;
            }
            interface mo-7/3/0.0 {
              source-address 192.168.252.2;
            }
          }
        }
      }
    }
    routing-options {
      interface-routes {
        rib-group inet common;
      }
      rib-groups {
        common {
          import-rib [ inet.0 fbf_instance.inet.0 ];
        }
      }
      forwarding-table {
        export pplb;
      }
    }
    policy-options {
      policy-statement pplb {
        then {
          load-balance per-packet;
        }
      }
    }
    class-of-service { # A class-of-service configuration for the flow collector interface
      interfaces { # is mandatory when implementing flow collector services.
        cp-6/0/0 {
          scheduler-map cp-map;
        }
        cp-7/0/0 {
          scheduler-map cp-map;
        }
      }
      scheduler-maps {
```

```
      cp-map {
        forwarding-class best-effort scheduler Q0;
        forwarding-class expedited-forwarding scheduler Q1;
        forwarding-class network-control scheduler Q3;
      }
    }
    schedulers {
      Q0 {
        transmit-rate remainder;
        buffer-size percent 90;
      }
      Q1 {
        transmit-rate percent 5;
        buffer-size percent 5;
        priority strict-high;
      }
      Q3 {
        transmit-rate percent 5;
        buffer-size percent 5;
      }
    }
}
firewall {
    family inet {
      filter cp-ftp { # This filter provides CoS for flow collector interface traffic.
        term t1 {
          then forwarding-class expedited-forwarding;
        }
      }
    }
    filter catch { # This firewall filter sends incoming traffic into the
      interface-specific; # filter-based forwarding routing instance.
      term def {
        then {
          count counter;
          routing-instance fbf_instance;
        }
      }
    }
}
routing-instances {
    fbf_instance { # This instance sends traffic to the monitoring services interface.
      instance-type forwarding;
      routing-options {
        static {
          route 0.0.0.0/0 next-hop mo-7/1/0.0;
        }
      }
    }
}
services {
    flow-collector { # Define properties for flow collector interfaces here.
      analyzer-address 10.10.10.1; # This is the IP address of the analyzer.
      analyzer-id server1; # This helps to identify the analyzer.
      retry 3; # Maximum number of attempts by the PIC to send a file transfer log.
      retry-delay 30; # The time interval between attempts to send a file transfer log.
```

```
    destinations { # This defines the FTP servers that receive flow collector output.
      "ftp://user@192.168.56.89//tmp/collect1/" {  # The primary FTP server.
        password "$9$lXJK8xN-w2oZdbZDHmF30O1"; # SECRET-DATA
      }
      "ftp://user@192.168.252.1//tmp/collect2/" { # The second FTP server.
        password "$9$eIbvL7-dsgaGVwGjkP3nOBI"; # SECRET-DATA
      }
    }
    file-specification {  # Define sets of flow collector characteristics here.
      def-spec {
      }
      data-format flow-compressed; # The default compressed output format.
    }
    f1 {
      name-format "cFlowd-py69Ni69-0-%D_%T-%I_%N.bcp.bi.gz";
      data-format flow-compressed; # The default compressed output format.
      transfer timeout 1800 record-level 1000000; # Here are configured values.
    }
  }
  interface-map { # Allows you to map interfaces to flow collector interfaces.
    file-specification def-spec; # Flows generated for default traffic are sent to the
    collector cp-7/0/0; # default flow collector interface cp-7/0/0.
    so-0/1/0.0 {# Flows generated for the so-0/1/0 interface are sent
      collector cp-6/0/0; # to cp-6/0/0, and the file-specification used is “default”.
    }
    so-3/0/0.0 { # Flows generated for the so-3/0/0 interface are sent
      file-specification f1; # to cp-6/0/0, and the file-specification used is "f1."
      collector cp-6/0/0;
    }
    so-3/1/0.0; # Because no settings are defined, flows generated for this
  }
  transfer-log-archive { # Sends flow collector interface log files to an FTP server.
    filename-prefix so_3_0_0_log;
    maximum-age 15;
    archive-sites {
      "ftp://user@192.168.56.89//tmp/transfers/" {
        password "$9$IFaEyevMXNVsWLsgaU.m6/C";
      }
    }
  }
}
```

Verifying Your Work

To verify that your flow collector configuration is working, use the following commands on the monitoring station that is configured for flow collection:

- **clear services flow-collector statistics**
- **request services flow-collector change-destination (primary | secondary)**
- **request services flow-collector test-file-transfer**
- **show services flow-collector file interface (detail | extensive | terse)**

- **show services flow-collector (detail | extensive)**
- **show services flow-collector input interface (detail | extensive | terse)**

The following section shows the output of the **show** commands used with the configuration example:

```
user@router1> show services flow-collector input interface cp-6/0/0 detail
Interface                       Packets        Bytes
mo-7/1/0.0                         6170      8941592

user@router1>  show services flow-collector interface all detail
Flow collector interface: cp-6/0/0
Interface state: Collecting flows
  Packets     Bytes     Flows Uncompressed  Compressed     FTP bytes FTP files
                                    Bytes       Bytes
     6736   9757936    195993     21855798     3194148             0         0
Flow collector interface: cp-7/0/0
Interface state: Collecting flows
  Packets     Bytes     Flows Uncompressed  Compressed     FTP bytes FTP files
                                    Bytes       Bytes
        0         0         0           0           0             0         0

user@router1>  show services flow-collector input interface cp-6/0/0 extensive
Interface                       Packets        Bytes
mo-7/1/0.0                         6260      9074096

user@router1>  show services flow-collector interface cp-6/0/0 extensive
Flow collector interface: cp-6/0/0
Interface state: Collecting flows
Memory:
    Used: 19593212, Free: 479528656
Input:
    Packets: 6658, per second: 0, peak per second: 0
    Bytes: 9647752, per second: 12655, peak per second: 14311
    Flow records processed: 193782, per second: 252, peak per second: 287
Allocation:
    Blocks allocated: 174, per second: 0, peak per second: 0
    Blocks freed: 0, per second: 0, peak per second: 0
    Blocks unavailable: 0, per second: 0, peak per second: 0
Files:
    Files created: 1, per second: 0, peak per second: 0
    Files exported: 0, per second: 0, peak per second: 0
    Files destroyed: 0, per second: 0, peak per second: 0
Throughput:
    Uncompressed bytes: 21075152, per second: 52032, peak per second: 156172
    Compressed bytes: 3079713, per second: 7618, peak per second: 22999
Packet drops:
    No memory: 0, Not IP: 0
    Not IPv4: 0, Too small: 0
    Fragments: 0, ICMP: 0
    TCP: 0, Unknown: 0
    Not JUNOS flow: 0
File Transfer:
    FTP bytes: 0, per second: 0, peak per second: 0
    FTP files: 0, per second: 0, peak per second: 0
    FTP failure: 0
Export channel: 0
    Current server: Secondary
    Primary server state: OK, Secondary server state: OK
Export channel: 1
```

```
    Current server: Secondary
    Primary server state: OK, Secondary server state: OK

user@router1>  show services flow-collector file interface cp-6/0/0 terse
File name                                                        Flows State
cFlowd-py69Ni69-0-20031112_014301-so_3_0_0_0.bcp.bi.gz          185643 Active

user@router1>  show services flow-collector file interface cp-6/0/0 detail
Filename: cFlowd-py69Ni69-0-20031112_014301-so_3_0_0_0.bcp.bi.gz
  Throughput:
    Flow records: 187067, Uncompressed bytes: 21121960, Compressed bytes: 2965643

  Status:
    State: Active, Transfer attempts: 0

user@router1>  show services flow-collector file interface cp-6/0/0 extensive
Filename: cFlowd-py69Ni69-0-20031112_014301-so_3_0_0_0.bcp.bi.gz
  Throughput:
    Flow records: 188365, per second: 238, peak per second: 287
    Uncompressed bytes: 21267756, per second: 27007, peak per second: 32526
    Compressed bytes: 2965643, per second: 0, peak per second: 22999
  Status:
    Compressed blocks: 156, Block count: 156
    State: Active, Transfer attempts: 0
```

To clear statistics for a flow collector interface, issue the **clear services flow-collector statistics interface (all | *interface-name*)** command.

Another useful flow collector option allows you to change the FTP server from primary to secondary and test for FTP transfers. To force the flow collector interface to use a primary or secondary FTP server, include the **primary** or **secondary** option when you issue the **request services flow-collector change-destination interface cp-*fpc/pic/port*** command.

If you configure only one primary server and issue this command with the **primary** option, you receive the error message “Destination change not needed.” If the secondary server is not configured and you issue this command with the **secondary** option, you receive the error message “Destination not configured.” Otherwise, when both servers are configured properly, successful output appears as follows.

```
user@router1> request services flow-collector change-destination interface  cp-6/0/0 primary
Flow collector interface: cp-6/0/0
Interface state: Collecting flows
Destination change successful

user@router1>  request services flow-collector change-destination interface  cp-6/0/0
secondary
Flow collector interface: cp-6/0/0
Interface state: Collecting flows
Destination change successful
```

Other options for the **request services flow-collector change-destination interface cp-*fpc/pic/port*** command are **immediately** (which forces an instant switchover), **gracefully** (the default behavior that allows a gradual switchover), **clear-files** (which purges existing data files), and **clear-logs** (which purges existing log files).

To verify that transfer log files are being scheduled for delivery to the FTP servers, issue the **request services flow-collector test-file-transfer *filename* interface cp-*fpc/pic/port***

command. Include the desired export channel (zero or one) and target FTP server (primary or secondary) with this command.

```
user@router> request services flow-collector test-file-transfer test_file  interface cp-6/0/0
channel-one primary
Flow collector interface: cp-6/0/0
Interface state: Collecting flows
Response: Test file transfer successfully scheduled
```

Another way you can check for the success of your file transfers is by analyzing the transfer log. A transfer log sends detailed information about files that are collected and processed by the flow collector interface. Table 14 on page 63 explains the various fields available in the transfer log.

Table 14: Flow Collector Interface Transfer Log Fields

Field	Explanation
fn	Filename
sz	File size
nr	Number of records
ts	Timestamp with the format of year (4 digits), month (2 digits), day (2 digits), hours (2 digits), minutes (2 digits), and seconds (2 digits).
sf	Success flag—The values are **1** for success and **0** for failure.
ul	Server URL
rc	FTP result code
er	FTP error text
tt	Transfer time

This is an example of a successful transfer log:

```
fn="cFlowd-py69Ni69-0-20040227_230438-at_4_0_0_4_3.bcp.bi.gz":sz=552569
:nr=20000:ts="20040227230855":sf=1:ul="ftp://10.63.152.1/tmp/server1/:"rc=250:
er="":tt=3280
```

This is an example of a transfer log when an FTP session fails:

```
fn="cFlowd-py69Ni69-0-20040227_230515-at_4_0_0_2_8.bcp.bi.gz":sz=560436
:nr=20000:ts="20040227230855":sf=1:ul="ftp://10.63.152.1/tmp/server1/:"rc=250
:er="":tt=3290
```

As the flow collector interface receives and processes flow records, the PIC services logging process (fsad) handles the following tasks:

- When the flow collector interface transfers a file to the FTP server, a temporary log file is created in the **/var/log/flowc** directory. The temporary log file has this filenaming convention:

  <***hostname***>_<***filename_prefix***>_***YYYYMMDD_hhmmss***.tmp

  hostname is the hostname of the transfer server, ***filename_prefix*** is the same value defined with the **filename-prefix** statement at the [**edit services flow-collector transfer-log-archive**] hierarchy level, ***YYYYMMDD*** is the year, month, and date, and ***hhmmss*** is the timestamp indicating hours, minutes, and seconds.

- After the log file has been stored in the router for the length of time specified by the **maximum-age** statement at the [**edit services flow-collector transfer-log-archive**] hierarchy level (the default is 120 minutes), the temporary log file is converted to an actual log file and the temporary file is deleted. The new log file retains the same naming conventions, except the extension is **.log*.

- When the final log file is created and compressed, the PIC services logging process (fsad) tries to send the log file from the **/var/log/flowc** directory to an FTP server. You can specify up to five FTP servers to receive the log files by including the **archive-sites** statement at the [**edit services flow-collector transfer-log-archive**] hierarchy level. The logging process attempts to send the log file to one server at a time, in order of their appearance in the configuration. Upon the first successful transfer, the log file is deleted and the logging process stops sending log files to the remaining FTP servers in the list.

- If the log file transfer is not successful, the log file is moved to the **/var/log/flowc/failed** directory. Every 30 minutes, the logging process tries to resend the log files. After the log files are transferred successfully, they are deleted from the **/var/log/flowc/failed** directory.

NOTE: If the memory for a flow collector interface is full, the interface might drop incoming packets.

After the flow collector interface successfully delivers the processed information file to the FTP server, you can analyze the file. The file contains detailed information about the flows collected and processed by the flow collector interface. Table 15 on page 64 explains the various fields available in the flow collector interface file.

Table 15: Flow Collector Interface File Fields in Order of Appearance

Field	Explanation
linkDir	Link directory—A randomly generated number used to identify the record
analyzer-address	Analyzer address
analyzer-ID	Analyzer identifier

Table 15: Flow Collector Interface File Fields in Order of Appearance *(continued)*

Field	Explanation
ifAlias	Interface identifier
source-address	Source address
destination-address	Destination address
packets	Number of packets
bytes	Number of bytes
start-time	Start time
end-time	End time
source-port	Source port
destination-port	Destination port
tcp_flag	TCP flag
protocol	IP protocol number
src_AS_number	Source AS number
dst_AS_number	Destination AS number

This is an example of output from a flow collector interface file:

```
11799241612374557782|10.10.10.1|server1|at_4_0_0_4|192.168.10.100|10.0.0.1|8|
3136|1077926402|1077926402|8224|12336|27|6|0|0
```

Example: Dynamic Flow Capture Configuration

The following example shows a complete dynamic flow capture configuration. On Router 1, configure the dynamic flow capture interface, the interfaces that connect to the control source and content destination, and the interface that receives passively monitored traffic. Then, configure the capture group and specify your control source and content destination requirements. Next, configure filter-based forwarding (FBF) to send monitored traffic to logical unit 1 of the dynamic flow capture interface. Finally, configure a firewall filter and routing table groups to complete the configuration.

```
[edit]
interfaces {
   dfc-0/0/0 { # DFC PIC that processes requests from the control source.
      unit 0 {
         family inet {
```

```
            address 2.1.0.0/32 { # Address of the Routing Engine for the DFC PIC.
              destination 10.36.100.1; # Address of DFC PIC; used by
            } # the control source to communicate with the monitoring station.
          }
        }
        unit 1 { # This logical interface receives data packets.
          family inet;
        }
        unit 2 {  # This logical interface sends out copies of matched packets.
          family inet;
        }
      }
      fe-4/1/2 { # Interface that receives filtering requests from cs1.
        unit 0 {
          family inet {
            address 10.36.41.2/30;
          }
        }
      }
      ge-7/0/0 {  # Interface that sends monitored packets to cd1.
        unit 0 {
          family inet {
            address 10.36.70.1/30;
          }
        }
      }
      so-1/2/0 {  # Interface that receives traffic to be monitored.
        encapsulation ppp;
        unit 0 {
          passive-monitor-mode; # Enables this interface to be passively monitored.
          family inet {
            filter {
              input catch;
            }
          }
        }
      }
    }
    services {
      dynamic-flow-capture {
        capture-group g1 {
          interfaces dfc-0/0/0; # Specifies which interface to use for DFC processing.
          input-packet-rate-threshold 90k; # Traffic threshold for system log messages.
          pic-memory-threshold percentage 80; # Memory threshold for log messages.
          control-source cs1 { # Specifies addresses and ports for the control source.
            source-addresses 10.36.41.1;
            service-port 2400;
            notification-targets {
              10.36.41.1 port 2100;
            }
            shared-key "$9$ASxdsYoX7wg4aHk";
            allowed-destinations cd1;
          }
          content-destination cd1 { # Specifies content destination addresses and TTL.
            address 10.36.70.2;
            ttl 244;
```

```
        }
      }
    }
  }
  firewall {
    filter catch { # Places monitored traffic into the filter-based forwarding instance.
      interface-specific;
      term def {
        then {
          count counter;
          routing-instance fbf_inst;
        }
      }
    }
  }
  routing-instances {
    fbf_inst { # Sends matching traffic to the DFC PIC for processing.
      instance-type forwarding;
      routing-options {
        static {
          route 0.0.0.0/0 next-hop dfc-0/0/0.1;
        }
      }
    }
  }
  routing-options {
    interface-routes {
      rib-group inet common;
    }
    rib-groups {
      common { # Shares routes between the instance and the main routing table.
        import-rib [ inet.0 fbf_inst.inet.0 ];
      }
    }
    forwarding-table {
      export pplb;
    }
  }
```

Verifying Your Work

To verify that your dynamic flow capture configuration is operating correctly, issue the following command:

show services dynamic-flow-capture capture-group *group-name* control-source source-identifier *source-id* (detail)

The following section shows the output of this command when used with the configuration example.

Router 1

```
user@router1> show services dynamic-flow-capture control-source capture-group g1 source-identifier cs2 detail

Capture group: g1, Control source: cs2
Criteria added: 1, Criteria add failed: 0
```

```
Active criteria: 2
Static criteria: 0, Dynamic criteria: 2
Control protocol requests: 3
      Add        Delete          List       Refresh         No-op
Requests           1             0             1             0             1
Failed             0             0             0             0             0

Add request rate: 0
Add request peak rate: 1
Bandwidth across all criteria: 0
Total notifications: 0
Restart: 0, Rollover: 0, No-op: 0, Timeout: 0, Congestion: 0, Congestion delete: 0,
Dups dropped: 0
Criteria deleted: 0
Timeout idle: 0, Timeout total: 0, Packets: 0, Bytes: 0
Sequence number: 242
```

To clear dynamic flow capture criteria belonging to a particular control source, issue the **clear services dynamic-flow-capture** command. For more information on other dynamic flow capture-related operational mode commands, see the *Junos System Basics and Services Command Reference*.

CHAPTER 4

Active Flow Monitoring

Configuring Active Flow Monitoring

In active flow monitoring, the router participates in both the monitoring application and in the normal routing functionality of the network. Although the Monitoring Services PIC was designed initially for use as an offline passive flow monitoring tool, it can also be used in an active flow monitoring topology.

Table 16 on page 69 shows which Juniper Networks PICs and corresponding routers support active flow monitoring. For more information on Juniper Networks PICs, see the PIC guide that corresponds to your router.

Table 16: Passive and Active Flow Monitoring PIC Support

PIC Type and Service	J Series	M5/M10	M7i/M10i	M20	M40e	M120	M160	T Series/ M320	TX Matrix
Monitoring Services PIC: active flow monitoring	No	Yes (version 8 only)	Yes	Yes	Yes	No	Yes (version 8 only)	No	No

Table 16: Passive and Active Flow Monitoring PIC Support *(continued)*

PIC Type and Service	J Series	M5/M10	M7i/M10i	M20	M40e	M120	M160	T Series/ M320	TX Matrix
Monitoring Services II PIC: flow collection services	No	No	No	No	Yes	No	Yes (version 8 only)	No	No
Adaptive Services PIC: active flow monitoring	No	Yes (version 8 only)	Yes	Yes	Yes	No	Yes (version 8 only)	No	No
Adaptive Services II PIC: active flow monitoring	No	Yes (version 8 only)	Yes	Yes	Yes	Yes	Yes (version 8 only)	Yes	Yes
Adaptive Services II PIC: flow-tap services	No	No	Yes	Yes	Yes	Yes	No	Yes	No
MultiServices 100 PIC: active flow monitoring	No	No	Yes	No	Yes	No	No	Yes	Yes
MultiServices 400 PIC: active flow monitoring	No	No	No	No	Yes	Yes	No	Yes	Yes
MultiServices 500 PIC: active flow monitoring	No	No	No	No	Yes	Yes	No	Yes	Yes
Junos OS-enabled active flow monitoring	Yes (version 8 only)	No	No	No	No	No	No	No	No

Specified packets can be filtered and sent to the monitoring interface. For the Monitoring Services PIC, the interface name contains the **mo-** prefix. For the Adaptive Services PICs and MultiServices PICs, the interface name contains the **sp-** prefix.

NOTE: If you upgrade from the Monitoring Services PIC to the Adaptive Services PIC or MultiServices PIC for active flow monitoring, you must modify the interface name of your monitoring interface from **mo-*fpc/pic/port*** to **sp-*fpc/pic/port***.

The major active flow monitoring actions you can configure at the **[edit forwarding-options]** hierarchy level are as follows:

- Sampling, with the [**edit forwarding-options sampling**] hierarchy. This option extracts limited information (such as the source and destination IP address) from a copy of some of the packets in a flow, while the original packets are forwarded to the intended destination. This option is extended to define active sampling on a per Packet Forwarding Engine basis by defining a sampling instance that specifies a name for the sampling parameters and binding the instance to the particular Packet Forwarding Engine.
- Templates, with the [**edit forwarding-options sampling**] and [**edit services monitoring**] hierarchies. With active flow monitoring support for version 5, version 8, and the customizing version 9, you can use templates to organize the data gathered from sampling.
- Discard accounting, with the [**edit forwarding-options accounting**] hierarchy. This option quarantines unwanted packets, creates flow monitoring records that describe the packets, and discards the packets instead of forwarding them.
- Port mirroring, with the [**edit forwarding-options port-mirroring**] hierarchy. This option makes one full copy of all packets in a flow and delivers the copy to a single destination.
- Multiple port mirroring, with the [**edit forwarding-options next-hop-group**] hierarchy. This option allows multiple copies of selected traffic to be delivered to multiple destinations. (Multiple port mirroring requires a Tunnel Services PIC.)
- Flow-tap services processing, with the [**edit services flow-tap**] hierarchy. This option sends copies of packets that match dynamic filter criteria to one or more content destinations.

Unlike passive flow monitoring, you do not need to configure a monitoring group. Instead, you can send filtered packets to a monitoring services or adaptive services interface (**mo-** or **sp-)** by using sampling or discard accounting. Optionally, you can configure port mirroring or multiple port mirroring to direct packets to additional interfaces.

These active flow monitoring options provide a wide variety of actions that can be performed on network traffic flows. However, the following restrictions apply:

- The router can perform either sampling *or* port mirroring at any one time.
- The router can perform either forwarding *or* discard accounting at any one time.

Because the Monitoring Services PIC, Adaptive Services PIC, and MultiServices PIC allow only one action to be performed at any one time, the following configuration options are available:

- Sampling and forwarding
- Sampling and discard accounting
- Port mirroring and forwarding

- Port mirroring and discard accounting
- Sampling and port mirroring on different sets of traffic

To configure active flow monitoring, complete these steps:

Defining a Firewall Filter to Select Traffic for Active Flow Monitoring

The first step in active flow monitoring is to configure the match conditions for acceptable traffic or quarantined traffic. Common match actions for active flow monitoring include **sample**, **discard accounting**, **port-mirror**, and **accept**. To configure, include the desired action statements and a counter as part of the **then** statement in a firewall filter and apply the filter to an interface.

In sampling, the router reviews a portion of the traffic and sends reports about this sample to the flow monitoring server. Discard accounting traffic is counted and monitored, but not forwarded out of the router. Port-mirrored traffic is copied and sent to another interface. Accepted traffic is forwarded to the intended destination.

Most of these match combinations are valid. However, you can either port-mirror or sample with the same traffic at the same time, but not perform more than one action simultaneously on the same packets.

```
[edit]
firewall {
   family inet {
      filter active_filter {
         term quarantined_traffic {
            from {
               source-address {
                  10.36.1.2/32;
               }
            }
            then {
               count quarantined-counter;
```

```
            sample;
            discard accounting;
          }
        }
        term copy_and_forward_the_rest {
          then {
            port-mirror;
            accept;
          }
        }
      }
    }
  }
```

Configuring the Interfaces That Will Be Actively Monitored

Configure the input interfaces and apply the firewall filter that you defined earlier. Unlike passive flow monitoring, the input interfaces for active flow monitoring are not restricted, so you can select most standard network interfaces (such as ATM1 or Ethernet-based interfaces) as the input.

If you configure active flow monitoring with sampling, you can configure an interface filter in place of a firewall filter with the **sampling** statement at the **[edit interfaces** ***interface-name-fpc/pic/port*** **unit** ***unit-number*** **family inet]** hierarchy level.

```
[edit]
interfaces {
  so-2/2/0 {
    unit 0 {
      family inet {
        filter {
          input active_filter;
        }
        address 10.36.11.2/32 {
          destination 10.36.11.1;
        }
        sampling {
          (input | output | [input output]);
        }
      }
    }
  }
}
```

Enabling the Monitoring Services, Adaptive Services, or Multiservices Interfaces and the Export Interface

You configure the monitoring services, adaptive services, or multiservices interfaces with the **family inet** statement so they can process IPv4 traffic. However, you must remember that a monitoring services interface uses an **mo-** prefix and adaptive services and multiservices interfaces use an **sp-** prefix.

```
[edit]
interfaces {
```

```
    sp-2/0/0 {
      unit 0 {
        family inet {
          address 10.36.100.1/32 {
            destination 10.36.100.2;
          }
        }
      }
    }
}
```

Active flow monitoring records leave the router through an export interface to reach the flow monitoring server.

```
[edit]
interfaces {
  fe-1/0/0 {
    unit 0 {
      family inet {
        address 10.60.2.2/30;
      }
    }
  }
}
```

Flow Records Collection

Traffic flows can be exported in various flow monitoring version formats for active flow monitoring.

Collecting Flow Records

Traffic flows can be exported in flow monitoring version 5, 8, and 9 formats for active flow monitoring. The default export format for flow monitoring records is version 5. To change the export format to flow monitoring version 8, include the **version 8** statement at either the [**edit forwarding-options accounting *name* output flow-server *flow-server-address***] or the [**edit forwarding-options sampling output flow-server *flow-server-address***] hierarchy level. To change the export format to flow monitoring version 9, include the **version9 template *template-name*** statement at the [**edit forwarding-options sampling output flow-server *flow-server-address***] hierarchy level. For more information on flow record formats, see "Flow Monitoring Output Formats" on page 133.

To capture flow data generated by the Monitoring Services PIC, Adaptive Services PIC, or MultiServices PIC and export it to a flow server, you can use one of the following active flow monitoring methods:

Collecting Flow Records with a Sampling Group

If your needs for active flow monitoring are simple, you can collect flow records with a sampling group. Sampling does not require you to configure a monitoring group (as required in passive flow monitoring) because you can configure flow server information in the **sampling** hierarchy. When you wish to sample traffic, include the **sampling** statement at the **[edit forwarding-options]** hierarchy level.

The typical sampling configuration has one input interface and one export interface. The input interface is activated by the **then sample** statement in a firewall filter term. This match condition directs traffic to the sampling process. Alternatively, you can use an interface-based filter in place of a firewall filter if you include the **sampling** statement at the **[edit interfaces** *interface-name-fpc/pic/port* **unit** *unit-number* **family inet]** hierarchy level.

There are two types of sampling available: PIC-based sampling and Routing Engine-based sampling. PIC-based sampling occurs when a monitoring services or adaptive services interface is the target for the output of the sampling process. To enable PIC-based sampling, include the **interface** statement at the **[edit forwarding-options sampling output]** hierarchy level and specify a monitoring services or adaptive services interface as the output interface. If an output interface is not specified in the sampling configuration, sampling is performed by the Routing Engine.

To specify a flow server in a sampling configuration, include the **flow-server** statement at the **[edit forwarding-options sampling output]** hierarchy level. You must specify the IP address, port number, and flow monitoring version of the destination flow server. Routing Engine-based sampling supports flow aggregation of up to eight flow servers (version 5 servers and version 8 only) at a time. The export packets are replicated to all flow servers configured to receive them. In contrast, PIC-based sampling allows you to specify just one version 5 flow server and one version 8 server simultaneously. Flow servers operating simultaneously must have different IP addresses.

As part of the output interface statements, you must configure a source address. In contrast, the interface-level statements of **engine-id** and **engine-type** are both added automatically. However, you can override these values with manually configured

statements to track different flows with a single flow collector, as needed. When you configure sampling, SNMP input and output interface index information is captured in flow records by default.

```
[edit]
forwarding-options {
  sampling {
    input {
      family inet {
        rate 1;
      }
    }
    output {
      flow-server 10.60.2.1 {
        port 2055;
        version 5;
      }
      flow-inactive-timeout 15;
      flow-active-timeout 60;
      interface sp-2/0/0 {
        engine-id 5;
        engine-type 55;
        source-address 10.60.2.2;
      }
    }
  }
}
```

Collecting Flow Records with an Accounting Group

To perform discard accounting on specified traffic, you can collect flow records with the **accounting** statement at the **[edit forwarding-options]** hierarchy level. Like sampling, your topology must be simple (for example, one input interface and one export interface).

Again, you can collect flow records by specifying input and output interfaces. You can configure the input interface to perform discard accounting by applying a firewall filter that contains the **then discard accounting** statement. This match condition directs the filtered traffic to be converted into flow records and exported for analysis by the monitoring services or adaptive services interface. The original packets are then sent to the discard process. For the output, remember to specify the IP address and port of your flow server and the services interface you plan to use for processing flow records.

You must configure a source address, but the **engine-id** and **engine-type** output interface statements are added automatically. You can override these values manually to track different flows with a single flow collector. SNMP input and output interface index information is captured in flow records by default when you configure discard accounting.

```
[edit]
forwarding-options {
  accounting counter1 {
    output {
      flow-inactive-timeout 65;
      flow-active-timeout 65;
      flow-server 10.60.2.1 {
```

```
        port 2055;
        version 8;
        aggregation {
          protocol-port;
          source-destination-prefix;
        }
      }
      interface sp-2/0/0 {
        engine-id 1;
        engine-type 11;
        source-address 10.60.2.2;
      }
    }
  }
}
```

Replicating Routing Engine-Based Sampling to Multiple Flow Servers

Routing Engine-based sampling supports up to eight flow servers for both flow monitoring version 5 and version 8 configurations. The total number of flow servers is limited to eight, regardless of how many are configured for version 5 or version 8.

When you configure version 5 or version 8 sampling, the export packets are replicated to all flow servers configured to receive them. If two flow servers are configured to receive version 5 records, both flow servers will receive records for a specified flow.

NOTE: With Routing-Engine-based sampling, if multiple flow servers are configured with version 8 export format, all of them must use the same aggregation type (for example, all flow servers receiving version 8 export could be configured for source-destination aggregation type).

The following configuration example allows replication of export packets to two flow servers.

```
[edit]
forwarding-options {
  sampling {
    input {
      rate 1;
      }
    }
    output {
      flow-server 10.10.3.2 {
        port 2055;
        version 5;
        source-address 192.168.164.119;
      }
      flow-server 172.17.20.62 {
        port 2055;
        version 5;
        source-address 192.168.164.119;
      }
    }
```

```
    }
}
```

Collecting Flow Records with a Template

Flow monitoring version 9, which is based upon RFC 3954, provides a way to organize flow data into templates. Version 9 also provides a way to actively monitor IPv4, IPv6, MPLS, and peer AS billing traffic. Version 9 is not supported on the AS-I PIC.

To activate templates in flow monitoring, you must configure a template and include that template in the version 9 flow monitoring configuration. Version 9 does not work in conjunction with versions 5 and 8.

To configure a version 9 template, include the **template *template-name*** statement at the [**edit services flow-monitoring version9**] hierarchy level. The Junos OS supports five different templates: **ipv4-template**, **ipv6–template**, **mpls-template**, **mpls-ipv4-template**, and **peer-as-billing-template**. To view the fields selected in each of these templates, see "Version 9 Formats and Fields" on page 143.

```
[edit]
services flow-monitoring {
  version9 { # Specifies flow monitoring version 9.
    template mpls { # Specifies template you are configuring.
      template-refresh-rate {
        packets 6000; # The default is 4800 packets and the range is 1–480000
        # packets.
      seconds 90; # The default is 60 seconds and the range is 1–600 seconds.
        option--refresh-rate {
        packets 3000; # The default is 4800 packets and the range is 1–480000
          # packets.
        seconds 30; # The default is 60 seconds and the range is 1–600.
        flow-active-timeout 60; # The default is 60 seconds and the range is
          # 10–600.
        flow-inactive-timeout 30; # The default is 60 seconds and the range 10–600.
        template-refresh-rate seconds 10; # The default is 60 seconds and the
          # range is 10–600
        option-refresh-rate seconds 10; # The default is 60 seconds and the range
          # is 10–600 seconds.
        mpls-template {
          label-positions [1 | 2 | 3]; # Specifies label position for the MPLS template.
        }
      }
    }
  }
}
```

You can export to multiple templates at a time to a maximum of eight flow servers for AS PICs and one flow server for all other PICs. To assign a template to a flow output, include the **template *template-name*** statement at the [**edit forwarding options sampling output flow-server version9**] hierarchy level:

```
[edit]
forwarding-options {
  sampling {
    input {
```

```
        family mpls {
          rate 1;
          run-length 1;
        }
      }
      output {
        flow-server 10.60.2.1 { # The IP address and port of the flow server.
          port 2055;
          source-address 3.3.3.1;
          version9 { # Records are sent to the flow server using version 9 format.
            template { # Indicates a template will organize records.
              mpls; # Records are sent to the MPLS template.
            }
          }
        }
      }
    }
  }
```

Routing Engine-Based Sampling to Multiple Flow Servers

Routing Engine-based sampling supports up to eight flow servers for both version 5 and version 8 configurations. The total number of collectors is limited to eight, regardless of how many are configured for version 5 or version 8. When you configure sampling, the export packets are replicated to all collectors configured to receive them. If two collectors are configured to receive version 5 records, both collectors will receive records for a specified flow.

The following configuration example allows replication of export packets to two collectors.

```
forwarding-options {
  sampling {
    input {
      family inet {
        rate 1;
      }
    }
    output {
      cflowd 10.10.3.2 {
        port 2055;
        version 5;
        source-address 192.168.164.119;
      }
      cflowd 172.17.20.62 {
        port 2055;
        version 5;
        source-address 192.168.164.119;
      }
    }
  }
}
```

Replicating Version 9 Flow Aggregation to Multiple Flow Servers

With this feature, you can configure up to eight flow servers to receive packets for a version 9 flow monitoring template. Once a flow server is configured to receive this data, it will also receive the following periodic version 9 flow monitoring updates:

- Options data
- Template definition

With Routing Engine-based sampling, if multiple collectors are configured with version 8 export format, all of them must use the same aggregation-type.

The option and template definition refresh period is configured on a per-template basis at the [**edit services flow-monitoring**] hierarchy level.

The following configuration example allows replication of version 9 export packets to two flow servers.

```
forwarding-options {
  sampling {
    input {
      family inet {
        rate 1;
      }
    }
    output {
      flow-server 10.10.3.2 {
        port 2055;
        version9 {
          template {
            ipv4;
          }
        }
      }
      flow-server 172.17.20.62 {
        port 2055;
        version9 {
          template {
            ipv4;
          }
        }
      }
      flow-inactive-timeout 30;
      flow-active-timeout 60;
      interface sp-4/0/0 {
        source-address 10.10.3.4;
      }
    }
  }
}
```

Option: Configuring an Aggregate Export Timer

When you use flow monitoring version 8 records for active flow monitoring, you can configure an aggregate export timer. To configure this timer, include the **aggregate-export-interval** statement at the **[edit forwarding-options sampling output]** hierarchy level. The timer value has a default minimum setting of 90 seconds and a maximum value of 1800 seconds.

```
[edit]
forwarding-options {
  sampling {
    output {
      aggregate-export-interval duration;
    }
  }
}
```

Option: Configuring Port Mirroring

You can copy packets and reroute them to another interface by using port mirroring. To send packet copies to an interface, include the **interface** statement at the **[edit forwarding-options port-mirroring** family ***family-name*** **output]** hierarchy level and specify the interface to receive the traffic.

You can even send port-mirrored traffic to a monitoring services or adaptive services interface. If you choose this option, accepted traffic is copied and the packet copies are sent to the services interface for flow processing.

To configure how often packets are copied from the monitored traffic, include the **rate** statement at the **[edit forwarding-options port-mirroring** family ***family-name*** **input]** hierarchy level. A rate of **1** port-mirrors every packet, while a rate of **10** port-mirrors every tenth packet.

```
[edit]
forwarding-options {
  port-mirroring {
    family (inet | inet6) {
      input {
        rate 1;
      }
      output {
        interface sp-2/0/0.0;
      }
    }
  }
}
```

Option: Configuring Port Mirroring with Filter-Based Forwarding and a Monitoring Group

For active flow monitoring, you can load-balance traffic across multiple Monitoring Services PICs using the same method as passive flow monitoring. The only difference is

that you do not configure the input interface with the **passive-monitor-mode** statement at the **[edit interfaces *interface-name*]** hierarchy level.

To load-balance traffic for active flow monitoring, port-mirror the incoming packets to a tunnel services interface. Redirect this copy of the traffic to a filter-based forwarding instance by applying a firewall filter to the tunnel services interface. Configure the instance to send the traffic to a group of monitoring services interfaces. Finally, use a monitoring group to send flow records from the monitoring services interfaces to a flow server.

NOTE: When you load-balance port-mirrored traffic across several Monitoring Services interfaces, there are some limitations:

- The original Monitoring Services PIC supports this method. You cannot use a Monitoring Services II PIC.
- You must use the suite of **show passive-monitoring** commands to monitor traffic. The **show services accounting** commands are not supported.
- Because load-balanced traffic is routed through the Tunnel Services PIC, the total throughput of the load-balanced traffic coming from the Monitoring Services PICs cannot exceed the bandwidth of the tunnel interface.

For detailed information on this method, see "Copying and Redirecting Traffic with Port Mirroring and Filter-Based Forwarding" on page 22.

Option: Sending Traffic to Multiple Export Interfaces by Using Next-Hop Groups

To send port-mirrored traffic to multiple flow servers or packet analyzers, you can use the **next-hop-group** statement. The router can make up to 16 copies of traffic per group and send the traffic to the next-hop group members you configure. A maximum of 30 groups can be configured on a router at any given time. The port-mirrored traffic can be sent to any interface, except aggregated SONET/SDH, aggregated Ethernet, loopback (**lo0**), or administrative (**fxp0**) interfaces. To configure multiple port mirroring with next-hop groups, include the **next-hop-group** statement at the **[edit forwarding-options]** hierarchy level.

You must port-mirror the initial traffic to a tunnel interface so that it can be filtered and duplicated. Also, you need configure only the interface names for point-to-point interfaces, but you must configure the interface names and a next hop for multipoint interfaces (such as Ethernet).

```
[edit]
forwarding-options {
  port-mirroring {
    family inet {
      input {
        rate 1;
      }
      output {
        interface vt-3/3/0.1;
```

```
            no-filter-check;
          }
        }
      }
      next-hop-group ftp-traffic {
        interface so-4/3/0.0;
        interface so-0/3/0.0;
      }
      next-hop-group http-traffic {
        interface ge-1/1/0.0 {
          next-hop 10.12.1.2;
        }
        interface ge-1/2/0.0 {
          next-hop 10.13.1.2;
        }
      }
      next-hop-group default-collect {
        interface so-7/0/0.0;
        interface so-7/0/1.0;
      }
    }
```

NOTE: **Next-hop groups are supported on M Series routers only, except the M120 router and the M320 router.**

Option: Using the Flow-Tap Application to Send Packets to a Mediation Device

Dynamic flow capture passively monitors packet flows on the basis of dynamic filtering criteria, using Dynamic Tasking Control Protocol (DTCP) requests.

Option: Using the Flow-Tap Application to Send Packets to a Mediation Device

Dynamic flow capture enables you to capture passively monitored packet flows on the basis of dynamic filtering criteria, using Dynamic Tasking Control Protocol (DTCP) requests. The flow-tap application extends the use of DTCP to intercept IPv4 packets in an active flow monitoring station and send a copy of packets that match filter criteria to one or more content destinations. Flow-tap data can be used for lawful intercept purposes and provides flexible trend analysis for detection of new security threats. The flow-tap application is supported on M Series and T Series routers, except M160 routers and TX Matrix platforms.

NOTE: **For information about dynamic flow capture, see** **"Using a Dynamic Flow Capture Interface to Monitor Traffic On Demand" on page 34****. For information about DTCP, see Internet draft draft-cavuto-dtcp-01.txt at http://www.ietf.org/internet-drafts.**

For detailed information about the flow-tap application, see the following sections:

Flow-Tap Architecture

The flow-tap architecture consists of one or more *mediation devices* that send requests to a Juniper Networks router to monitor incoming data. Any packets that match specific filter criteria are forwarded to a set of one or more *content destinations*:

- Mediation device—A client that monitors electronic data or voice transfer over the network. The mediation device sends filter requests to the Juniper Networks router using the DTCP. The clients are not identified for security reasons, but have permissions defined by a set of special login classes.
- Monitoring platform—A Juniper Networks M Series or T Series router containing one or more Adaptive Services (AS) PICs, which are configured to support the flow-tap application. The monitoring platform processes the requests from the mediation devices, applies the dynamic filters, monitors incoming data flows, and sends the matched packets to the appropriate content destinations.
- Content destination—Recipient of the matched packets from the monitoring platform. Typically the matched packets are sent using an IP Security (IPSec) tunnel from the monitoring platform to another router connected to the content destination. The content destination and the mediation device can be physically located on the same host.
- Dynamic filters—The Packet Forwarding Engine automatically generates a firewall filter that is applied to all IPv4 routing instances. Each term in the filter includes a **flow-tap** action that is similar to the existing **sample** or **port-mirroring** actions. As long as one of the filter terms matches an incoming packet, the router copies the packet and forwards it to the AS PIC that is configured for flow-tap service. The AS PIC runs the packet through the client filters and sends a copy to each matching content destination. For security, filters installed by one client are not visible to others and the CLI configuration does not reveal the identity of the monitored target.

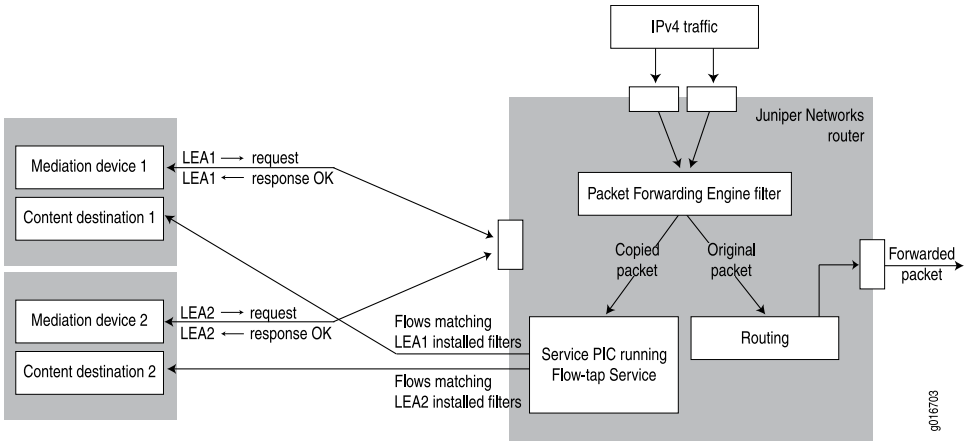
  Following is a sample filter configuration; note that it is dynamically generated by the router (no user configuration is required):

```
filter combined_LEA_filter {
    term LEA1_filter {
        from {
            source-address 1.2.3.4;
            destination-address 3.4.5.6;
        }
        then {
            flow-tap;
```

```
        }
      }
      term LEA2_filter {
        from {
          source-address 10.1.1.1;
          source-port 23;
        }
        then {
          flow-tap;
        }
      }
    }
```

Figure 5 on page 85 shows a sample topology that uses two mediation devices and two content destinations.

Figure 5: Flow-Tap Topology Diagram



Related Documentation

- Configuring the Flow-Tap Interface on page 85
- Configuring Flow-Tap Security Properties on page 86
- Flow-Tap Application Restrictions on page 87
- Example: Flow-Tap Configuration on page 87

Configuring the Flow-Tap Interface

To configure an AS PIC interface for the flow-tap service, include the **interface** statement at the [**edit services flow-tap**] hierarchy level:

```
interface sp-fpc/pic/port.unit-number;
```

You can assign any AS PIC in the active monitoring station for flow-tap service, and use any logical unit on the PIC.

NOTE: You cannot configure dynamic flow capture and flow-tap features on the same router simultaneously.

You must also configure the logical interface at the **[edit interfaces]** hierarchy level:

```
interface sp-fpc/pic/port {
  unit logical-unit-number {
    family inet;
  }
}
```

Related Documentation

- Flow-Tap Architecture on page 84
- Configuring Flow-Tap Security Properties on page 86
- Flow-Tap Application Restrictions on page 87
- Example: Flow-Tap Configuration on page 87

Configuring Flow-Tap Security Properties

You can add an extra level of security to DTCP transactions between the mediation device and the router by enabling DTCP sessions on top of the SSH layer. To configure, include the **flow-tap-dtcp** statement at the [**edit system services**] hierarchy level:

```
flow-tap-dtcp {
  ssh {
    connection-limit value;
    rate-limit value;
  }
}
```

To configure client permissions for viewing and modifying flow-tap configurations and for receiving tapped traffic, include the **permissions** statement at the **[edit system login class *class-name*]** hierarchy level:

```
permissions [ permissions ];
```

The permissions needed to use flow-tap features are as follows:

- **flow-tap**—Can view flow-tap configuration.
- **flow-tap-control**—Can modify flow-tap configuration.
- **flow-tap-operation**—Can tap flows.

You can also specify user permissions on a RADIUS server, for example:

```
Bob Auth-Type := Local, User-Password = = “abc123”
Juniper-User-Permissions = “flow-tap-operation”
```

For details on **[edit system]** and RADIUS configuration, see the *Junos System Basics Configuration Guide*.

Related Documentation

- Flow-Tap Architecture on page 84
- Configuring the Flow-Tap Interface on page 85
- Flow-Tap Application Restrictions on page 87
- Example: Flow-Tap Configuration on page 87

Flow-Tap Application Restrictions

The following restrictions apply to flow-tap services:

- You cannot configure dynamic flow capture and flow-tap services on the same router simultaneously.
- When the dynamic flow capture process or an AS PIC configured for flow-tap processing restarts, all filters are deleted and the mediation devices are disconnected.
- Only the first fragment of an IPv4 fragmented packet stream is sent to the content destination.
- Port mirroring might not work in conjunction with flow-tap processing.
- If the flow-tap application is configured, you cannot configure the filter action **then syslog** for any firewall filter running on the same platform.
- Running the flow-tap application over an IPsec tunnel on the same router can cause packet loops and is not supported.

Related Documentation

- Flow-Tap Architecture on page 84
- Configuring the Flow-Tap Interface on page 85
- Configuring Flow-Tap Security Properties on page 86
- Example: Flow-Tap Configuration on page 87

Example: Flow-Tap Configuration

The following example shows all the parts of a complete flow-tap configuration.

```
services {
   flow-tap {
      interface sp-1/2/0.100;
   }
}
interfaces {
   sp-1/2/0 {
      unit 100 {
         family inet;
      }
   }
}
system {
   services {
      flow-tap-dtcp {
         ssh {
            connection-limit 5;
            rate-limit 5;
         }
      }
   }
   login {
```

```
        class ft-class {
            permissions flow-tap-operation;
        }
        user ft-user1 {
            class ft-class;
            authentication {
                encrypted-password “xxxx”;
            }
        }
    }
}
```

Related Documentation

- Flow-Tap Architecture on page 84
- Configuring the Flow-Tap Interface on page 85
- Configuring Flow-Tap Security Properties on page 86
- Flow-Tap Application Restrictions on page 87

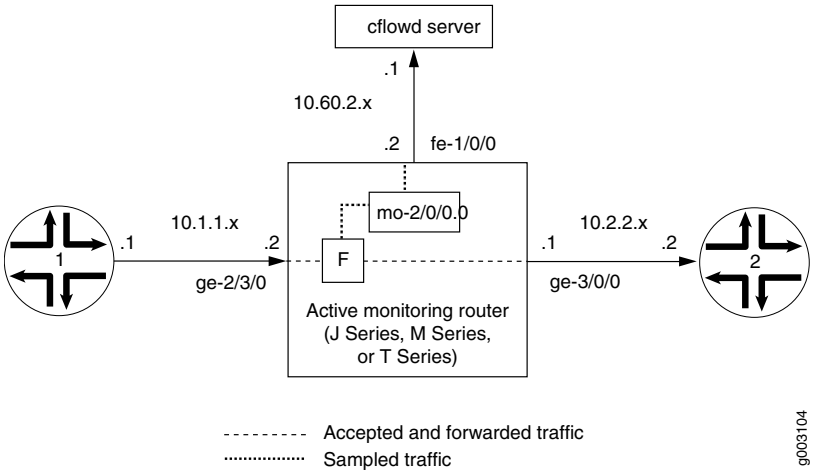
CHAPTER 5

Active Flow Monitoring Configuration Examples

This section contains configuration examples and commands you can issue to verify an active flow monitoring configuration:

Example: Sampling Configuration

Figure 6: Active Flow Monitoring—Sampling Configuration Topology Diagram



In Figure 6 on page 89, traffic from Router 1 arrives on the monitoring router's Gigabit Ethernet **ge-2/3/0** interface. The exit interface on the monitoring router that leads to destination Router 2 is **ge-3/0/0**. In active flow monitoring, both the input interface and

exit interface can be any interface type (such as SONET/SDH, Gigabit Ethernet, and so on). The export interface leading to the flow server is **fe-1/0/0**.

Configure a firewall filter to sample, count, and accept all traffic. Apply the filter to the input interface, and configure the exit interface (for traffic forwarding), the adaptive services interface (for flow processing), and the export interface (for exporting flow records).

Configure sampling at the **[edit forwarding-options]** hierarchy level. Include the IP address and port of the flow server with the **flow-server** statement and specify the adaptive services interface to be used for flow record processing with the **interface** statement at the **[edit forwarding-options sampling]** hierarchy level.

Router 1

```
[edit]
interfaces {
    sp-2/0/0 { # This adaptive services interface creates the flow records.
        unit 0 {
            family inet {
                address 10.5.5.1/32 {
                    destination 10.5.5.2;
                }
            }
        }
    }
    fe-1/0/0 { # This is the interface where records are sent to the flow server.
        unit 0 {
            family inet {
                address 10.60.2.2/30;
            }
        }
    }
    ge-2/3/0 { # This is the input interface where all traffic enters the router.
        unit 0 {
            family inet {
                filter {
                    input catch_all; # This is where the firewall filter is applied.
                }
                address 10.1.1.1/20;
            }
        }
    }
    ge-3/0/0 { # This is the interface where the original traffic is forwarded.
        unit 0 {
            family inet {
                address 10.2.2.1/24;
            }
        }
    }
}
forwarding-options {
    sampling { # Traffic is sampled and sent to a flow server.
        input {
            rate 1; # Samples 1 out of x packets (here, a rate of 1 sample per packet).
            }
        }
```

```
    family inet {
      output {
        flow-server 10.60.2.1 { # The IP address and port of the flow server.
          port 2055;
          version 5; # Records are sent to the flow server using version 5 format.
        }
        flow-inactive-timeout 15;
        flow-active-timeout 60;
        interface sp-2/0/0 { # Adding an interface here enables PIC-based sampling.
          engine-id 5; # Engine statements are dynamic, but can be configured.
          engine-type 55;
          source-address 10.60.2.2; # You must configure this statement.
        }
      }
    }
  }
  firewall {
    family inet {
      filter catch_all { # Apply this filter on the input interface.
        term default {
          then {
            sample;
            count counter1;
            accept;
          }
        }
      }
    }
  }
```

Verifying Your Work

To verify that your configuration is correct, use the following commands on the monitoring station that is configured for active flow monitoring:

- **show services accounting errors**
- **show services accounting (flow | flow-detail)**
- **show services accounting memory**
- **show services accounting packet-size-distribution**
- **show services accounting status**
- **show services accounting usage**
- **show services accounting aggregation template template-name** *name* **(detail | extensive | terse)** (version 9 only)

Most active flow monitoring operational mode commands contain equivalent output information to the following passive flow monitoring commands:

- **show services accounting errors = show passive-monitoring error**
- **show services accounting flow = show passive-monitoring flow**

- **show services accounting memory = show passive-monitoring memory**
- **show services accounting status = show passive-monitoring status**
- **show services accounting usage = show passive-monitoring usage**

The active flow monitoring commands can be used with most active flow monitoring applications, including sampling, discard accounting, port mirroring, and multiple port mirroring. However, you can use the passive flow monitoring commands only with configurations that contain a monitoring group at the **[edit forwarding-options monitoring]** hierarchy level.

The following shows the output of the **show** commands used with the configuration example:

```
user@router> show services accounting errors
Service Accounting interface: sp-2/0/0, Local interface index: 542
Service name: (default sampling)
  Error information
    Packets dropped (no memory): 0, Packets dropped (not IP): 0
    Packets dropped (not IPv4): 0, Packets dropped (header too small): 0
    Memory allocation failures: 0, Memory free failures: 0
    Memory free list failures: 0
    Memory overload: No, PPS overload: No, BPS overload: Yes

user@router> show services accounting flow-detail limit 10
Service Accounting interface: sp-2/0/0, Local interface index: 468
Service name: (default sampling)
Protocol   Source         Source  Destination Destination    Packet        Byte
           Address          Port  Address             Port     count       count
udp(17)    10.1.1.2           53  10.0.0.1              53      4329     3386035
ip(0)      10.1.1.2            0  10.0.0.2               0      4785     3719654
ip(0)      10.1.1.2            0  10.0.1.2               0      4530     3518769
udp(17)    10.1.1.2            0  10.0.7.1               0      5011     3916767
tcp(6)     10.1.1.2           20  10.3.0.1              20         1        1494
tcp(6)     10.1.1.2           20  10.168.80.1           20         1         677
tcp(6)     10.1.1.2           20  10.69.192.1           20         1         446
tcp(6)     10.1.1.2           20  10.239.240.1          20         1        1426
tcp(6)     10.1.1.2           20  10.126.160.1          20         1         889
tcp(6)     10.1.1.2           20  10.71.224.1           20         1        1046

user@router> show services accounting memory
Service Accounting interface: sp-2/0/0, Local interface index: 468
Service name: (default sampling)
  Memory utilization
    Allocation count: 437340, Free count: 430681, Maximum allocated: 6782
    Allocations per second: 3366, Frees per second: 6412
    Total memory used (in bytes): 133416928, Total memory free (in bytes):
133961744

user@router> show services accounting packet-size-distribution
Service Accounting interface: sp-2/0/0, Local interface index: 468
Service name: (default sampling)
Range start     Range end     Number of packets     Percentage packets
         64            96               1705156                    100

user@router> show services accounting status
Service Accounting interface: sp-2/0/0, Local interface index: 468
Service name: (default sampling)
  Interface state: Monitoring
```

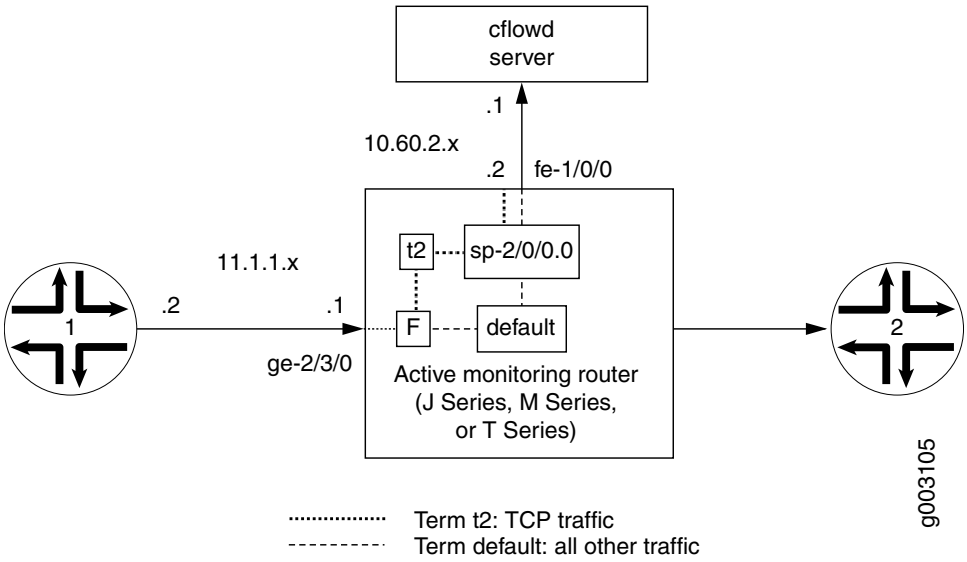
```
  Group index: 0
  Export interval: 60 secs, Export format: cflowd v5
  Protocol: IPv4, Engine type: 55, Engine ID: 5
  Route record count: 13, IFL to SNMP index count: 30, AS count: 1
  Time set: Yes, Configuration set: Yes
  Route record set: Yes, IFL SNMP map set: Yes

user@router> show services accounting usage
Service Accounting interface: sp-2/0/0, Local interface index: 468
Service name: (default sampling)
  CPU utilization
    Uptime: 4790345 milliseconds, Interrupt time: 1668537848 microseconds
    Load (5 second): 71%, Load (1 minute): 63%
```

Example: Sampling and Discard Accounting Configuration

Discard accounting allows you to sample traffic, send it to a flow server for analysis, and discard all packets without forwarding them to their intended destination. Discard accounting is enabled with the **discard accounting** *group-name* statement in a firewall filter at the **[edit firewall family inet filter** *filter-name* **term** *term-name* **then]** hierarchy level. Then, the filter is applied to an interface with the **filter** statement at the **[edit interfaces** *interface-name* **unit** *unit-number* **family inet]** hierarchy level and processed with the **output** statement at the **[edit forwarding-options accounting** *group-name***]** hierarchy level.

Figure 7: Active Flow Monitoring—Sampling and Discard Accounting Topology Diagram



In Figure 7 on page 93, traffic from Router 1 arrives on the monitoring router's Gigabit Ethernet **ge-2/3/0** interface. The export interface leading to the flow server is **fe-1/0/0** and there is no exit interface.

In this example, TCP traffic is sent to one accounting group and all other traffic is diverted to a second group. After being sampled and counted, the two types of traffic are acted upon by the sampling and accounting processes. These processes create flow records and send the records to the version 8 flow server for analysis. Because multiple types of

traffic are sent to the same server, we recommend that you configure the **engine-id**, **engine-type**, and **source-address** statements manually in your accounting and sampling hierarchies. This way, you can differentiate between traffic types when they arrive at the flow server.

```
[edit]
interfaces {
    sp-2/0/0 { # This adaptive services interface creates the flow records.
        unit 0 {
            family inet {
                address 10.5.5.1/32 {
                    destination 10.5.5.2;
                }
            }
        }
    }
    fe-1/0/0 { # This is the interface where records are sent to the flow server.
        unit 0 {
            family inet {
                address 10.60.2.2/30;
            }
        }
    }
    ge-2/3/0 { # This is the input interface where traffic enters the router.
        unit 0 {
            family inet {
                filter {
                    input catch_all;
                }
                address 10.1.1.1/20;
            }
        }
    }
}
forwarding-options {
    sampling { # The router samples the traffic.
        input {
            rate 100; # One out of every 100 packets is sampled.
            }
        }
            family inet {
                output { # The sampling process creates and exports flow records.
                flow-server 10.60.2.1 { # You can configure a variety of settings.
                    port 2055;
                    version 8;
                    aggregation { # Aggregation is unique to flow version 8.
                        protocol-port;
                        source-destination-prefix;
                    }
                }
                aggregate-export-interval 90;
                flow-inactive-timeout 60;
                flow-active-timeout 60;
                interface sp-2/0/0 { # This statement enables PIC-based sampling.
                    engine-id 5; # Engine statements are dynamic, but can be configured.
```

```
            engine-type 55;
            source-address 10.60.2.2; # You must configure this statement.
          }
        }
      }
      accounting counter1 { # This discard accounting process handles default traffic.
        output { # This process creates and exports flow records.
          flow-inactive-timeout 65;
          flow-active-timeout 65;
          flow-server 10.60.2.1 { # You can configure a variety of settings.
            port 2055;
            version 8;
            aggregation { # Aggregation is unique to version 8.
              protocol-port;
              source-destination-prefix;
            }
          }
          interface sp-2/0/0 {  # This statement enables PIC-based discard accounting.
            engine-id 1; # Engine statements are dynamic, but can be configured.
            engine-type 11;
            source-address 10.60.2.3; # You must configure this statement.
          }
        }
      }
      accounting t2 { # The second discard accounting process handles the TCP traffic.
        output { # This process creates and exports flow records.
          aggregate-export-interval 90;
          flow-inactive-timeout 65;
          flow-active-timeout 65;
          flow-server 10.60.2.1 { # You can configure a variety of settings for the server.
            port 2055;
            version 8;
            aggregation { # Aggregation is unique to version 8.
              protocol-port;
              source-destination-prefix;
            }
          }
          interface sp-2/0/0 { # This statement enables PIC-based discard accounting.
            engine-id 2; # Engine statements are dynamic, but can be configured.
            engine-type 22;
            source-address 10.60.2.4;# You must configure this statement.
          }
        }
      }
    }
    firewall {
      family inet {
        filter catch_all { # Apply the firewall filter on the input interface.
          term t2 { # This places TCP traffic into one group for sampling and
            from { # discard accounting.
              protocol tcp;
            }
            then {
              count c2;# The count action counts traffic as it enters the router.
              sample; # The sample action sends the traffic to the sampling process.
              discard accounting t2; # The discard accounting discards traffic.
```

```
        }
      }
      term default { # Performs sampling and discard accounting on all other traffic.
        then {
          count counter; # The count action counts traffic as it enters the router.
          sample# The sample action sends the traffic to the sampling process.
          discard accounting counter1; # This activates discard accounting.
        }
      }
    }
  }
}
```

Verifying Your Work

To verify that your configuration is correct, use the following commands on the monitoring station that is configured for active flow monitoring:

- **show services accounting aggregation** (for version 8 flows only)
- **show services accounting errors**
- **show services accounting (flow | flow-detail)**
- **show services accounting memory**
- **show services accounting packet-size-distribution**
- **show services accounting status**
- **show services accounting usage**

The following shows the output of the **show** commands used with the configuration example:

```
user@router> show services accounting flow name t2
Service Accounting interface: sp-2/0/0, Local interface index: 468
Service name: t2
  Flow information
    Flow packets: 56130820, Flow bytes: 3592372480
    Flow packets 10-second rate: 13024, Flow bytes 10-second rate: 833573
    Active flows: 600, Total flows: 600
    Flows exported: 28848, Flows packets exported: 960
    Flows inactive timed out: 0, Flows active timed out: 35400

user@router> show services accounting
Service Name:
    (default sampling)
    counter1
    t2

user@router> show services accounting aggregation protocol-port detail name t2
Service Accounting interface: sp-2/0/0, Local interface index: 468
Service name: t2

  Protocol: 6, Source port: 20, Destination port: 20
  Start time: 442794, End time: 6436260
  Flow count: 1, Packet count: 4294693925, Byte count: 4277471552

user@router> show services accounting aggregation source-destination-prefix name
```

```
t2 limit 10 order packets
Service Accounting interface: sp-2/0/0, Local interface index: 542
Service name: t2
     Source     Destination  Input SNMP  Output SNMP   Flow  Packet    Byte
     Prefix          Prefix       Index        Index  count   count   count
10.1.1.2/20    10.225.0.1/0          24           26      0      13    9650
10.1.1.2/20   10.143.80.1/0          24           26      0      13   10061
10.1.1.2/20   10.59.176.1/0          24           26      0      13   10426
10.1.1.2/20     10.5.32.1/0          24           26      0      13   12225
10.1.1.2/20    10.36.16.1/0          24           26      0      13    9116
10.1.1.2/20     10.1.96.1/0          24           26      0      12   11050
10.1.1.2/20    10.14.48.1/0          24           26      0      13   10812
10.1.1.2/20   10.31.192.1/0          24           26      0      13   11473
10.1.1.2/20  10.129.144.1/0          24           26      0      13    7647
10.1.1.2/20  10.188.160.1/0          24           26      0      13   10056

user@router> show services accounting aggregation source-destination-prefix name
t2 extensive limit 3
Service Accounting interface: sp-2/0/0, Local interface index: 542
Service name: t2

  Source address: 10.1.1.2, Source prefix length: 20
  Destination address: 10.200.176.1, Destination prefix length: 0
  Input SNMP interface index: 24, Output SNMP interface index: 26
  Source-AS: 69, Destination-AS: 69
  Start time: Fri Feb 21 14:16:57 2003, End time: Fri Feb 21 14:22:50 2003
  Flow count: 0, Packet count: 6, Byte count: 5340

  Source address: 10.1.1.2, Source prefix length: 20
  Destination address: 10.243.160.1, Destination prefix length: 0
  Input SNMP interface index: 24, Output SNMP interface index: 26
  Source-AS: 69, Destination-AS: 69
  Start time: Fri Feb 21 14:16:57 2003, End time: Fri Feb 21 14:22:50 2003
  Flow count: 0, Packet count: 6, Byte count: 5490

  Source address: 10.1.1.2, Source prefix length: 20
  Destination address: 10.162.160.1, Destination prefix length: 0
  Input SNMP interface index: 24, Output SNMP interface index: 26
  Source-AS: 69, Destination-AS: 69
  Start time: Fri Feb 21 14:16:57 2003, End time: Fri Feb 21 14:22:50 2003
  Flow count: 0, Packet count: 6, Byte count: 4079
```

Example: Multiple Port Mirroring with Next-Hop Groups Configuration

When you need to analyze traffic containing more than one packet type, or you wish to perform multiple types of analysis on a single type of traffic, you can implement multiple port mirroring and next-hop groups. You can make up to 16 copies of traffic per group and send the traffic to next-hop group members. A maximum of 30 groups can be configured on a router at any given time. The port-mirrored traffic can be sent to any interface, except aggregated SONET/SDH, aggregated Ethernet, loopback (**lo0**), or administrative (**fxp0**) interfaces. To send port-mirrored traffic to multiple flow servers or packet analyzers, you can use the **next-hop-group** statement at the **[edit forwarding-options]** hierarchy level.

Figure 8: Active Flow Monitoring—Multiple Port Mirroring with Next-Hop Groups Topology Diagram

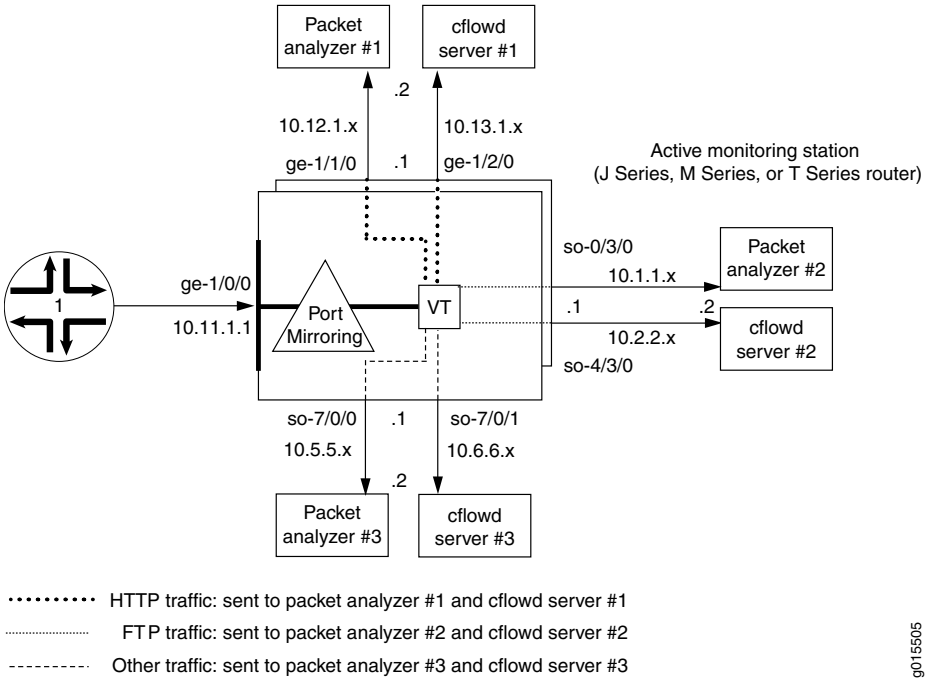


Figure 8 on page 98 shows an example of how to configure multiple port mirroring with next-hop groups. All traffic enters the monitoring router at interface **ge-1/0/0**. A firewall filter counts and port-mirrors all incoming packets to a Tunnel Services PIC. A second filter is applied to the tunnel interface and splits the traffic into three categories: HTTP traffic, FTP traffic, and all other traffic. The three types of traffic are assigned to three separate next-hop groups. Each next-hop group contains a unique pair of exit interfaces that lead to different groups of packet analyzers and flow servers.

```
[edit]
interfaces {
   ge-1/0/0 { # This is the input interface where packets enter the router.
      unit 0 {
         family inet {
            filter {
               input mirror_pkts; # Here is where you apply the first filter.
            }
            address 10.11.1.1/24;
         }
      }
   }
   ge-1/1/0 { # This is an exit interface for HTTP packets.
      unit 0 {
         family inet {
            address 10.12.1.1/24;
         }
      }
   }
   ge-1/2/0 { # This is an exit interface for HTTP packets.
```

```
        unit 0 {
            family inet {
                address 10.13.1.1/24;
            }
        }
    }
    so-0/3/0 { # This is an exit interface for FTP packets.
        unit 0 {
            family inet {
                address 10.1.1.1/30;
            }
        }
    }
    so-4/3/0 { # This is an exit interface for FTP packets.
        unit 0 {
            family inet {
                address 10.2.2.1/30;
            }
        }
    }
    so-7/0/0 { # This is an exit interface for all remaining packets.
        unit 0 {
            family inet {
                address 10.5.5.1/30;
            }
        }
    }
    so-7/0/1 { # This is an exit interface for all remaining packets.
        unit 0 {
            family inet {
                address 10.6.6.1/30;
            }
        }
    }
    vt-3/3/0 { # The tunnel interface is where you send the port-mirrored traffic.
        unit 0 {
            family inet;
        }
        unit 1 {
            family inet {
                filter {
                    input collect_pkts;  # This is where you apply the second firewall filter.
                }
            }
        }
    }
}
forwarding-options {
    port-mirroring { # This is required when you configure next-hop groups.
        family inet {
            input {
                rate 1; # This port-mirrors all packets (one copy for every packet received).
            }
            output { # Sends traffic to a tunnel interface to enable multiport mirroring.
                interface vt-3/3/0.1;
                no-filter-check;
```

```
        }
      }
    }
    next-hop-group ftp-traffic { # Point-to-point interfaces require you to specify the
      interface so-4/3/0.0; # interface name.
      interface so-0/3/0.0;
    }
    next-hop-group http-traffic { # Configure a next hop for all multipoint interfaces.
      interface ge-1/1/0.0 {
        next-hop 10.12.1.2;
      }
      interface ge-1/2/0.0 {
        next-hop 10.13.1.2;
      }
    }
    next-hop-group default-collect {
      interface so-7/0/0.0;
      interface so-7/0/1.0;
    }
  }
  firewall {
    family inet {
      filter mirror_pkts { # Apply this filter to the input interface.
        term catch_all {
          then {
            count input_mirror_pkts;
            port-mirror; # This action sends traffic to be copied and port-mirrored.
          }
        }
      }
      filter collect_pkts { # Apply this filter to the tunnel interface.
        term ftp-term { # This term sends FTP traffic to an FTP next-hop group.
          from {
            protocol ftp;
          }
          then next-hop-group ftp-traffic;
        }
        term http-term { # This term sends HTTP traffic to an HTTP next-hop group.
          from {
            protocol http;
          }
          then next-hop-group http-traffic;
        }
        term default { # This sends all remaining traffic to a final next-hop group.
          then next-hop-group default-collectors;
        }
      }
    }
  }
```

Example: Sampling Instance Configuration

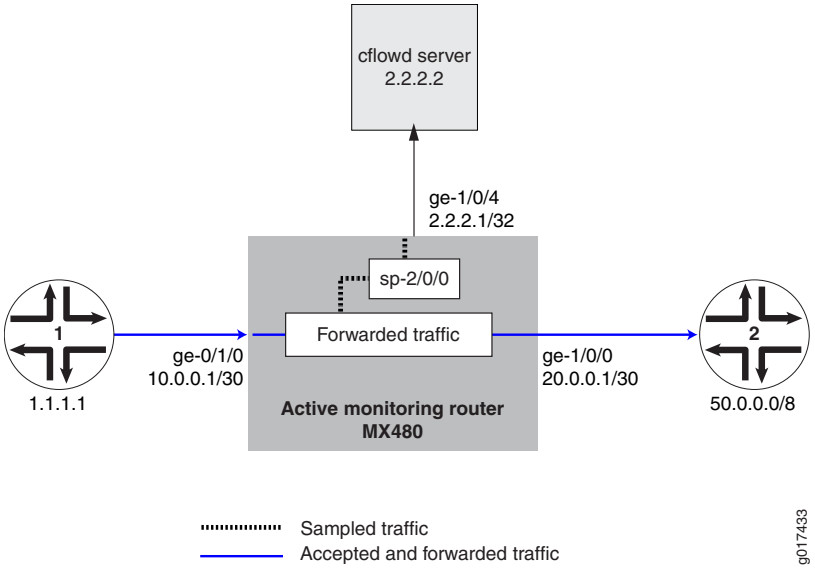
You can configure active sampling using a sampling instance and associate that sampling instance to a particular Packet Forwarding Engine. In addition, you can define multiple sampling instances associated with multiple destinations (as many as the number of

Packet Forwarding Engines in the chassis), with multiple protocol families per each sampling instance destination. This configuration example shows one sampling instance configured and associated with one Packet Forward Engine. Sampling instance configuration is supported on MX Series, M120, M320, and T Series routers.

Example Network Details

The following example shows the configuration of one sampling instance on an MX480 router running Junos OS Release 9.6.

Figure 9: Active Flow Monitoring—Sampling Instance Configuration Topology Diagram



In Figure 9 on page 101, packets from Router 1 arrive on the monitoring router's Gigabit Ethernet **ge-0/1/0** interface, the packets are sampled by the services interface **sp-2/0/0** and sent to the cflowd server by the export interface **ge-1/0/4**. Normal traffic flow from **ge-0/1/0** to **ge-1/0/0** and on to Router 2 continues undisturbed during the sampling process. In active flow monitoring, both the input interface and exit interface can be any interface type (such as SONET/SDH, Gigabit Ethernet, and so on).

The sampling configuration for this example includes the following:

- A sampling instance configured to collect sampling data at the **[edit forwarding-options]** hierarchy level. The **flow-server** statement includes the IP address, port, and template of the flow server. The **interface** statement includes the services interface **sp-2/0/0** for flow record processing.

- The sampling instance associated with the Packet Forwarding Engine using the **sampling-instance** statement at the **[edit chassis fpc *slot*]** hierarchy level.
- Sampling activated on the input interface **ge-0/1/0** using the **sampling** statement at the **[edit interfaces *interface-name* unit *unit-number* family *family*]** hierarchy level.

In this example, the **ping** command is issued on Router 1 to Router 2 via the MX480 router to generate traffic. After the packets are generated, **show** commands are issued to verify that the sampling configuration is working as expected.

Example Router Configuration

The following output shows the configuration of an MX480 router with a sampling instance.

```
user@MX480-router> show configuration
[...Output Truncated...]
}
chassis {
    fpc 0 { # The fpc number is associated with the interface on which sampling
is enabled, ge-0/1/0 in this example.
        sampling-instance s0;
    }
}
interfaces {
    ge-0/1/0 { # This interfaces has sampling activated.
        unit 0 {
            family inet {
                sampling { # Here sampling is activated.
                    input;
                }
                address 10.0.0.1/30;
            }
        }
    }
    ge-1/0/0 { # The interface on which packets are exiting the router.
        unit 0 {
            family inet {
                address 20.0.0.1/30;
            }
        }
    }
    ge-1/0/4 { # The interface connected to the cflowd server.
        unit 0 {
            family inet {
                address 2.2.2.1/32;
            }
        }
    }
    sp-2/0/0 { # The service interface that samples the packets.
        unit 0 {
            family inet;
        }
    }
}
forwarding-options {
    sampling {
        instance {
            s0 {
                input {
```

```
                    rate 1;
                    run-length 0;
                }
                family inet {
                    output {
                      flow-server 2.2.2.2 { # The address of the external server.

                            port 2055;
                            version9 {
                                template {
                                    v4;
                                }
                            }
                        }
                        interface sp-2/0/0 {
                          source-address 1.1.1.1; # Source address of the sampled
 packets
                        }
                    }
                }
            }
        }
    }
}

routing-options {
    static {
        route 50.0.0.0/8 next-hop 20.0.0.2;
    }
}
services {
    flow-monitoring {
        version9 {
            template v4 {
                flow-active-timeout 30;
                flow-inactive-timeout 30;
                ipv4-template;
            }
        }
    }
}
```

Configuration Commands Used for the Configuration Example

The following **set** commands are used for the configuration of the sampling instance in this example. Replace the values in these commands with values relevant to your own network.

- **set chassis fpc 0 sampling-instance s0**
- **set interfaces ge-0/1/0 unit 0 family inet sampling input**
- **set interfaces ge-0/1/0 unit 0 family inet address**
- **set interfaces ge-1/0/0 unit 0 family inet address**
- **set interfaces sp-2/0/0 unit 0 family inet**
- **set forwarding-options sampling instance s0 input rate 1**

- set forwarding-options sampling instance s0 input run-length 0
- set forwarding-options sampling instance s0 family inet output flow-server 2.2.2.2 port 2055
- set forwarding-options sampling instance s0 family inet output flow-server 2.2.2.2 version9 template v4;
- set forwarding-options sampling instance s0 family inet output interface sp-2/0/0 source-address 1.1.1.1
- set routing-options static route 50.0.0.0/8 next-hop 20.0.0.2
- set services flow-monitoring version9 template v4 flow-active-timeout 30
- set services flow-monitoring version9 template v4 flow-inactive-timeout 30
- set services flow-monitoring version9 template v4 ipv4-template

Verifying Your Work

To verify that your configuration is working as expected, use the following commands on the router that is configured with the sampling instance:

- show services accounting aggregation template template-name *template-name*
- show services accounting flow

The following shows the output of the **show** commands issued on the MX480 router used in this configuration example:

```
user@MX480-router> show services accounting aggregation template template-name v4
                                Src   Dst
                               Port/ Port/
Source          Destination     ICMP  ICMP                          Packet
Address         Address         Type  Code  Proto TOS               Count
10.0.0.6        50.0.0.3         100  1000     17   8                  14
10.0.0.5        50.0.0.2         100  1000     17   8                  15
10.0.0.3        50.0.0.3         100  1000     17   8                  15
10.0.0.2        50.0.0.3         100  1000     17   8                  15
10.0.0.4        50.0.0.2         100  1000     17   8                  15
10.0.0.6        50.0.0.2         100  1000     17   8                  15
10.0.0.4        50.0.0.3         100  1000     17   8                  15
10.0.0.2        50.0.0.2         100  1000     17   8                  16
10.0.0.3        50.0.0.2         100  1000     17   8                  15
10.0.0.5        50.0.0.3         100  1000     17   8                  15

user@MX480-router> show services accounting aggregation template template-name v4
                                Src   Dst
                               Port/ Port/
Source          Destination     ICMP  ICMP                          Packet
Address         Address         Type  Code  Proto TOS               Count
10.0.0.6        50.0.0.3         100  1000     17   8                  16
10.0.0.5        50.0.0.2         100  1000     17   8                  17
10.0.0.3        50.0.0.3         100  1000     17   8                  16
10.0.0.2        50.0.0.3         100  1000     17   8                  16
10.0.0.4        50.0.0.2         100  1000     17   8                  17
10.0.0.6        50.0.0.2         100  1000     17   8                  17
10.0.0.4        50.0.0.3         100  1000     17   8                  16
10.0.0.2        50.0.0.2         100  1000     17   8                  17
```

```
10.0.0.3        50.0.0.2          100  1000     17   8                  17
10.0.0.5        50.0.0.3          100  1000     17   8                  16

user@MX480-router> show services accounting flow
  Flow information
    Interface name: sp-2/0/0, Local interface index: 152
    Flow packets: 884, Flow bytes: 56576
    Flow packets 10-second rate: 0, Flow bytes 10-second rate: 628
    Active flows: 10, Total flows: 35
    Flows exported: 75, Flows packets exported: 14
    Flows inactive timed out: 25, Flows active timed out: 75

user@MX480-router> show services accounting flow
  Flow information
    Interface name: sp-2/0/0, Local interface index: 152
    Flow packets: 898, Flow bytes: 57472
    Flow packets 10-second rate: 0, Flow bytes 10-second rate: 628
    Active flows: 10, Total flows: 35
    Flows exported: 75, Flows packets exported: 14
    Flows inactive timed out: 25, Flows active timed out: 75
```

Example: VRF Routing Engine-Based Sampling

Traffic sampling enables you to copy traffic to a Physical Interface Card (PIC) while the router forwards the packet to its original destination. This example describes how to configure a router to perform sampling on the Routing Engine using the **sampled** process. For this method, you configure a filter (input or output) with a matching term that contains the **then sample** statement. In addition, for VPN routing and forwarding (VRF) Routing Engine-based sampling, you configure a VRF routing instance that maps to an interface. Each VRF instance corresponds with a forwarding table. Routes on the interface go into the corresponding forwarding table.

For VRF Routing Engine-based sampling, the kernel queries the correct VRF route table based on the ingress interface index for the received packet. For interfaces configured in VRF, the sampled packets contain the correct input and output interface SNMP index, the source and destination AS numbers, and the source and destination mask.

NOTE: With Junos OS Release 10.1, VRF Routing Engine-based sampling is performed only on IPv4 traffic. You cannot use Routing Engine-based sampling on IPv6 traffic or on MPLS label-switched paths.

This example describes how to configure and verify VRF Routing Engine-based sampling on one router in a four-router topology.

Requirements

This example uses the following hardware and software components:

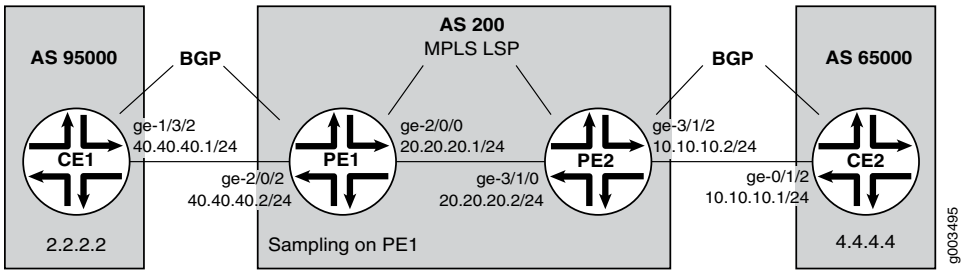
- Junos OS Release 10.1 or later
- M Series, MX Series, or T Series router

Before you configure VRF Routing Engine-Based sampling on your router, be sure you have an active connection between the routers on which you configure sampling. In addition, you need to have an understanding of VRF to configure the interfaces and routing instances that form the basis of the sampling configuration; and an understanding of the BGP, MPLS, and OSPF protocols to configure the other routers in the network to bring up the sampling configuration.

Overview and Topology

The scenario in this example illustrates VRF Routing Engine-based sampling configured on the PE1 router in a four-router network. The CE routers use BGP as the routing protocol to communicate with the PE routers. MPLS LSPs pass traffic between the PE routers. Packets from the CE1 router are sampled on the PE1 router. Regular traffic is forwarded to the original destination (the CE2 router).

Figure 10: Routing Engine-Based Sampling Network Topology



Configuration

In this configuration example, the VRF Routing Engine-based sampling is configured on the PE1 router that samples the traffic that goes through the interface and routes configured in the VRF. The configurations on the other three routers are included to show the sampling configuration on the PE1 router working in the context of a network.

To configure VRF Routing Engine-based sampling for the network example, perform these tasks:

- Configuring the CE1 Router on page 107
- Configuring the PE1 Router on page 109
- Configuring the PE2 Router on page 115
- Configuring the CE2 Router on page 120

Configuring the CE1 Router

Step-by-Step Procedure

In this step, you configure interfaces, routing options, protocols, and policy options for the CE1 router. To configure the CE1 router:

1. Configure one interface with two IP addresses. One address is for traffic to the PE1 router; the other address is to check that traffic is flowing to the CE2 router:

```
[edit interfaces]
user@router-ce1# set ge-1/3/2 unit 0 family inet address 40.40.40.1/24

user@router-ce1# set ge-1/3/2 unit 0 family inet address 2.2.2.2/8
```

2. Configure the autonomous system to establish a connection between BGP peers:

```
[edit routing-options]
user@router-ce1# set autonomous-system 95000
```

3. Configure BGP as the routing protocol between the CE router and the PE router:

```
[edit protocols]
user@router-ce1# set bgp group to_r1 type external

user@router-ce1# set bgp group to_r1 export my_lo0_addr

user@router-ce1# set bgp group to_r1 peer-as 200

user@router-ce1# set bgp group to_r1 neighbor 40.40.40.2
```

4. Configure the policies that ensure that the CE routers exchange routing information. In this example, Router CE1 exchanges routing information with Router CE2:

```
[edit policy-options]
user@router-ce1# set policy-statement my_lo0_addr term one from protocol direct

user@router-ce1# set policy-statement my_lo0_addr term one from route-filter
10.255.15.32/32 exact

user@router-ce1# set policy-statement my_lo0_addr term one then accept

user@router-ce1# set policy-statement my_lo0_addr term four from protocol direct

user@router-ce1# set policy-statement my_lo0_addr term four from route-filter
2.0.0.0/8 exact

user@router-ce1# set policy-statement my_lo0_addr term four then accept
```

Results The output below shows the configuration of the CE1 router:

```
[edit]
user@router-ce1# show
[...Output Truncated...]
interfaces {
    ge-1/3/2 {
        unit 0 {
            family inet {
                address 40.40.40.1/24;
                address 2.2.2.2/8;
            }
        }
    }
}
routing-options {
    autonomous-system 95000;
}
protocols {
    bgp {
        group to_r1 {
            type external;
            export my_lo0_addr;
            peer-as 200;
            neighbor 40.40.40.2;
        }
    }
}
policy-options {
    policy-statement my_lo0_addr {
        term one {
            from {
                protocol direct;
                route-filter 10.255.15.32/32 exact;
            }
```

```
            then accept;
        }
        term four {
            from {
                protocol direct;
                route-filter 2.0.0.0/8 exact;
            }
            then accept;
        }
    }
}
```

Configuring the PE1 Router

Step-by-Step Procedure

In this step, you configure a filter with a matching term that contains the **then sample** statement and apply the filter to the ingress interface. You also configure a VRF routing instance with import and export policies. In addition, you configure interfaces, forwarding options, routing options, protocols, and policy options for the PE1 router. To configure the PE1 router:

1. Create the **fw** firewall filter that is applied to the logical interface being sampled:

```
[edit firewall]
user@router-pe1# set family inet filter fw term 1 from protocol tcp

user@router-pe1# set family inet filter fw term 1 from port bgp

user@router-pe1# set family inet filter fw term 1 then accept

user@router-pe1# set family inet filter fw term 2 then sample
```

2. Configure two interfaces, one interface that connects to the CE1 router (**ge-2/0/2**), and another that connects to the PE2 router (**ge-2/0/0**):

```
[edit interfaces]
user@router-pe1# set ge-2/0/2 unit 0 family inet address 40.40.40.2/24

user@router-pe1# set ge-2/0/0 unit 0 family inet address 20.20.20.1/24

user@router-pe1# set ge-2/0/0 unit 0 family mpls
```

3. Enable MPLS on the interface that connects to the PE2 router (**ge-2/0/0**):

```
[edit interfaces]
user@router-pe1# set ge-2/0/0 unit 0 family mpls
```

4. On the interface that connects to the CE1 router, apply the **fw** filter that was configured in the firewall configuration:

```
[edit interfaces]
user@router-pe1# set ge-2/0/2 unit 0 family inet filter input fw

user@router-pe1# set ge-2/0/2 unit 0 family inet filter output fw
```

5. Configure the management (**fxp0**) and loopback (**lo0**) interfaces:

```
[edit interfaces]
user@router-pe1# set fxp0 unit 0 family inet address 192.168.69.153/21

user@router-pe1# set lo0 unit 0 family inet address 127.0.0.1/32
```

6. Configure the **sampled** log file in the **/var/log** directory to record traffic sampling:

```
[edit forwarding-options]
user@router-pe1# set sampling traceoptions file sampled

user@router-pe1# set sampling traceoptions file world-readable

user@router-pe1# set sampling traceoptions flag all
```

7. Specify the sampling rate and threshold value for traffic sampling:

```
[edit forwarding-options]
user@router-pe1# set sampling input rate 1

user@router-pe1# set sampling input run-length 0

user@router-pe1# set sampling input max-packets-per-second 20000
```

8. Specify active and inactive flow periods, and the router (**2.2.2.2**) that sends out the monitored information:

```
[edit forwarding-options]
user@router-pe1# set sampling family inet output flow-active-timeout 60

user@router-pe1# set sampling family inet output flow-inactive-timeout 60

user@router-pe1# set sampling family inet output flow-server 2.2.2.2 port 2055

user@router-pe1# set sampling family inet output flow-server 2.2.2.2 local-dump

user@router-pe1# set sampling family inet output flow-server 2.2.2.2 version 500
```

9. Configure the autonomous system to establish a connection between BGP peers:

```
[edit routing-options]
user@router-pe1# set autonomous-system 200
```

10. Configure RSVP to support MPLS label-switched paths (LSPs) between the PE routers:

```
[edit protocols]
user@router-pe1# set rsvp interface all

user@router-pe1# set rsvp interface fxp0.0 disable
```

11. Configure an MPLS LSP from the PE1 router to the PE2 router:

```
[edit protocols]
user@router-pe1# set mpls label-switched-path R1toR2 from 20.20.20.1

user@router-pe1# set mpls label-switched-path R1toR2 to 20.20.20.2

user@router-pe1# set mpls interface all

user@router-pe1# set mpls interface fxp0.0 disable
```

12. Configure an internal BGP group for the PE routers. Include the **family inet-vpn unicast** statement to enable BGP to carry network layer reachability information (NLRI) parameters and for BGP peers to only carry unicast routes for forwarding:

```
[edit protocols]
user@router-pe1# set bgp group to_r2 type internal

user@router-pe1# set bgp group to_r2 local-address 20.20.20.1

user@router-pe1# set bgp group to_r2 neighbor 20.20.20.2 family inet-vpn unicast
```


13. Configure OSPF as the interior gateway protocol (IGP) and to compute the MPLS LSPs:

```
user@router-pe1# set ospf traffic-engineering

user@router-pe1# set ospf area 0.0.0.0 interface all

user@router-pe1# set ospf area 0.0.0.0 interface fxp0.0 disable
```

14. Create the extended community that is applied in the policy options configuration:

```
[edit policy-options]
user@router-pe1# set community vpna-comm members target:200:100
```

15. Define the **vpna-export** routing policy that is applied in the **vrf-export** statement in the routing instance configuration. Also, apply the **vpna-comm** community from which routes are learned:

```
[edit policy-options]
user@router-pe1# set policy-statement vpna-export term one from protocol bgp

user@router-pe1# set policy-statement vpna-export term one from protocol direct

user@router-pe1# set policy-statement vpna-export term one then community add
vpna-comm

user@router-pe1# set policy-statement vpna-export term one then accept

user@router-pe1# set policy-statement vpna-export term two then reject
```

16. Define the **vpna-import** routing policy that is applied in the **vrf-import** statement in the routing instance configuration. Also, apply the **vpna-comm** community from which routes are learned:

```
[edit policy-options]
user@router-pe1# set policy-statement vpna-import term one from protocol bgp

user@router-pe1# set policy-statement vpna-import term one from community
vpna-comm

user@router-pe1# set policy-statement vpna-import term one then accept

user@router-pe1# set policy-statement vpna-import term two then reject
```

17. Configure a VRF routing instance so that routes received from the provider edge-provider edge (PE-PE) session can be imported into any of the instance's VRF secondary routing tables:

```
[edit routing-instances]
user@router-pe1#set vrf1 instance-type vrf set vrf1 interface ge-2/0/2.0

user@router-pe1# set vrf1 route-distinguisher 10.255.15.51:1

user@router-pe1# set vrf1 vrf-import vpna-import

user@router-pe1# set vrf1 vrf-export vpna-export

user@router-pe1# set vrf1 protocols bgp group customer type external

user@router-pe1# set vrf1 protocols bgp group customer peer-as 95000

user@router-pe1# set vrf1 protocols bgp group customer as-override

user@router-pe1# set vrf1 protocols bgp group customer neighbor 30.30.30.1
```

```
user@router-pe1# set vrf1 protocols bgp group customer neighbor 40.40.40.1
```

Results Check the results of the configuration for the PE1 router:

```
user@router-pe1> show configuration
[...Output Truncated...]
}
interfaces {
    ge-2/0/0 {
        unit 0 {
            family inet {
                address 20.20.20.1/24;
            }
            family mpls;
        }
    }
    ge-2/0/2 {
        unit 0 {
            family inet {
                filter {
                    input fw;
                    output fw;
                }
                address 40.40.40.2/24;
            }
        }
    }
    fxp0 {
        unit 0 {
            family inet {
                address 192.168.69.153/21;
            }
        }
    }
    lo0 {
        unit 0 {
            family inet {
                address 127.0.0.1/32;
            }
        }
    }
}
forwarding-options {
    sampling {
        traceoptions {
            file sampled world-readable;
            flag all;
        }
        input {
            rate 1;
            run-length 0;
            max-packets-per-second 20000;
        }
        family inet {
            output {
                flow-inactive-timeout 60;
                flow-active-timeout 60;
                flow-server 2.2.2.2 {
                    port 2055;
                    local-dump;
```

```
                    version 500;
                }
            }
        }
    }
}
routing-options {
[...Output Truncated...]
    autonomous-system 200;
}
protocols {
    rsvp {
        interface all;
        interface fxp0.0 {
            disable;
        }
    }
    mpls {
        label-switched-path R1toR2 {
            from 20.20.20.1;
            to 20.20.20.2;
        }
        interface all;
        interface fxp0.0 {
            disable;
        }
    }
    bgp {
        group to_r2 {
            type internal;
            local-address 20.20.20.1;
            neighbor 20.20.20.2 {
                family inet-vpn {
                    unicast;
                }
            }
        }
    }
    ospf {
        traffic-engineering;
        area 0.0.0.0 {
            interface all;
            interface fxp0.0 {
                disable;
            }
        }
    }
}
policy-options {
    policy-statement vpna-export {
        term one {
            from protocol [ bgp direct ];
            then {
                community add vpna-comm;
                accept;
            }
        }
        term two {
            then reject;
        }
    }
```

```
    policy-statement vpna-import {
        term one {
            from {
                protocol bgp;
                community vpna-comm;
            }
            then accept;
        }
        term two {
            then reject;
        }
    }
    community vpna-comm members target:200:100;
}
firewall {
    family inet {
        filter fw {
            term 1 {
                from {
                    protocol tcp;
                    port bgp;
                }
                then accept;
            }
            term 2 {
                then sample;
            }
        }
    }
}
routing-instances {
    vrf1 {
        instance-type vrf;
        interface ge-2/0/2.0;
        route-distinguisher 10.255.15.51:1;
        vrf-import vpna-import;
        vrf-export vpna-export;
        protocols {
            bgp {
                group customer {
                    type external;
                    peer-as 95000;
                    as-override;
                    neighbor 30.30.30.1;
                    neighbor 40.40.40.1;
                }
            }
        }
    }
}
```

Configuring the PE2 Router

Step-by-Step Procedure

In this step, you configure a filter with a matching term that contains the **then sample** statement and apply the filter to the ingress interface. You also configure a VRF routing instance with import and export policies. In addition, you configure interfaces, forwarding options, routing options, protocols, and policy options for the PE2 router. To configure the PE2 router:

1. Create the **fw** firewall filter that is applied to the logical interface being sampled:

```
[edit firewall]
user@router-pe2# set family inet filter fw term 1 from protocol tcp

user@router-pe2# set family inet filter fw term 1 from port bgp

user@router-pe2# set family inet filter fw term 1 then accept

user@router-pe2# set family inet filter fw term 2 then sample

user@router-pe2# set family inet filter fw term 2 then accept
```

2. Configure two interfaces, one interface that connects to the CE2 router (**ge-3/1/2**), and another that connects to the PE1 router (**ge-3/1/0**):

```
[edit interfaces]
user@router-pe2# set ge-3/1/0 unit 0 family inet address 20.20.20.2/24

user@router-pe2#  set ge-3/1/0 unit 0 family mpls

user@router-pe2#  set ge-3/1/2 unit 0 family inet address 10.10.10.2/24
```

3. Enable MPLS on the interface that connects to the PE1 router (**ge-3/1/0**):

```
[edit interfaces]
user@router-pe2#  set ge-3/1/0 unit 0 family mpls
```

4. On the interface that connects to the CE2 router, apply the **fw** filter that was configured in the firewall configuration:

```
[edit interfaces]
user@router-pe2#  set ge-3/1/2 unit 0 family inet filter input fw

user@router-pe2#  set ge-3/1/2 unit 0 family inet filter output fw
```

5. Configure the **sampled** log file in the **/var/log** directory to record traffic sampling:

```
[edit forwarding-options]
user@router-pe2# set sampling traceoptions file sampled

user@router-pe2# set sampling traceoptions file world-readable

user@router-pe1# set sampling traceoptions flag all
```

6. Specify the sampling rate and threshold value for traffic sampling:

```
[edit forwarding-options]
user@router-pe2# set sampling input rate 1

user@router-pe2# set sampling input run-length 0

user@router-pe2# set sampling input max-packets-per-second 20000
```

7. Specify active and inactive flow periods, and the router (**2.2.2.2**) that sends out the monitored information:

```
[edit forwarding-options]
user@router-pe2# set sampling family inet output flow-active-timeout 60

user@router-pe2# set sampling family inet output flow-inactive-timeout 60

user@router-pe2# set sampling family inet output flow-server 2.2.2.2 port 2055

user@router-pe2# set sampling family inet output flow-server 2.2.2.2 local-dump

user@router-pe2# set sampling family inet output flow-server 2.2.2.2 version 500
```

8. Configure the autonomous system to establish a connection between BGP peers:

```
[edit routing-options]
user@router-pe2# set autonomous-system 200
```

9. Configure RSVP to support MPLS label-switched paths (LSPs) between the PE routers:

```
[edit protocols]
user@router-pe2# set rsvp interface all

user@router-pe2# set rsvp interface fxp0.0 disable
```

10. Configure an MPLS LSP from the PE2 router to the PE1 router:

```
[edit protocols]
user@router-pe2# set mpls label-switched-path R2toR1 from 20.20.20.2

user@router-pe2# set mpls label-switched-path R2toR1 to 20.20.20.1

user@router-pe2# set mpls interface all

user@router-pe2# set mpls interface fxp0.0 disable
```

11. Configure an internal BGP group for the PE routers. Include the **family inet-vpn unicast** statement to enable BGP to carry network layer reachability information (NLRI) parameters and for BGP peers to only carry unicast routes for forwarding:

```
[edit protocols]
user@router-pe2# set bgp group to_r1 type internal

user@router-pe2# set bgp group to_r1 local-address 20.20.20.2

user@router-pe2# set bgp group to_r1 neighbor 20.20.20.1 family inet-vpn unicast
```

12. Configure OSPF as the interior gateway protocol (IGP) and to compute the MPLS LSPs:

```
[edit protocols]
user@router-pe2# set ospf traffic-engineering

user@router-pe2# set ospf area 0.0.0.0 interface all

user@router-pe2# set ospf area 0.0.0.0 interface fxp0.0 disable
```

13. Create the extended community that is applied in the policy options configuration:

```
[edit policy-options]
user@router-pe2# set community vpna-comm members target:200:100
```

14. Define the **vpna-export** routing policy that is applied in the **vrf-export** statement in the routing instance configuration. Also, apply the **vpna-comm** community from which routes are learned:

```
[edit policy-options]
user@router-pe2# set policy-statement vpna-export term one from protocol bgp

user@router-pe2# set policy-statement vpna-export term one from protocol direct

user@router-pe2# set policy-statement vpna-export term one then community add
vpna-comm

user@router-pe2# set policy-statement vpna-export term one then accept

user@router-pe2# set policy-statement vpna-export term two then reject
```

15. Define the **vpna-import** routing policy that is applied in the **vrf-import** statement in the routing instance configuration. Also, apply the **vpna-comm** community from which routes are learned:

```
[edit policy-options]
user@router-pe2# set policy-statement vpna-import term one from protocol bgp

user@router-pe2# set policy-statement vpna-import term one from community
vpna-comm

user@router-pe2# set policy-statement vpna-import term one then accept

user@router-pe2# set policy-statement vpna-import term two then reject
```

16. Configure a VRF routing instance so that routes received from the provider edge-provider edge (PE-PE) session can be imported into any of the instance's VRF secondary routing tables:

```
[edit routing-instances]
user@router-pe2# set vrf1 instance-type vrf

user@router-pe2# set vrf1 interface ge-3/1/2.0

user@router-pe2# set vrf1 route-distinguisher 10.255.19.12:1

user@router-pe2# set vrf1 vrf-import vpna-import

user@router-pe2# set vrf1 vrf-export vpna-export

user@router-pe2#set vrf1 protocols bgp group R3-R4 type external

user@router-pe2# set vrf1 protocols bgp group R3-R4 peer-as 65000

user@router-pe2# set vrf1 protocols bgp group R3-R4 as-override

user@router-pe2# set vrf1 protocols bgp group R3-R4 neighbor 10.10.10.1
```

Results Check the results of the configuration for the PE2 router:

```
user@router-pe2> show configuration
[...Output Truncated...]
}
interfaces {
    ge-3/1/0 {
        unit 0 {
            family inet {
```

```
                address 20.20.20.2/24;
            }
            family mpls;
        }
    }
    ge-3/1/2 {
        unit 0 {
            family inet {
                filter {
                    input fw;
                    output fw;
                }
                address 10.10.10.2/24;
            }
        }
    }
}
forwarding-options {
    sampling {
        traceoptions {
            file sampled world-readable;
            flag all;
        }
        input {
            rate 1;
            run-length 0;
            max-packets-per-second 20000;
        }
        family inet {
            output {
                flow-inactive-timeout 60;
                flow-active-timeout 60;
                flow-server 2.2.2.2 {
                    port 2055;
                    local-dump;
                    version 500;
                }
            }
        }
    }
}
routing-options {
[...Output Truncated...]
    autonomous-system 200;
}
protocols {
    rsvp {
        interface all;
        interface fxp0.0 {
            disable;
        }
    }
    mpls {
        label-switched-path R2toR1 {
            from 20.20.20.2;
            to 20.20.20.1;
        }
        interface all;
        interface fxp0.0 {
            disable;
        }
```

```
    }
    bgp {
        group to_r1 {
            type internal;
            local-address 20.20.20.2;
            neighbor 20.20.20.1 {
                family inet-vpn {
                    unicast;
                }
            }
            neighbor 40.40.40.1;
        }
    }
    ospf {
        traffic-engineering;
        area 0.0.0.0 {
            interface all;
            interface fxp0.0 {
                disable;
            }
        }
    }
}
policy-options {
    policy-statement vpna-export {
        term one {
            from protocol [ bgp direct ];
            then {
                community add vpna-comm;
                accept;
            }
        }
        term two {
            then reject;
        }
    }
    policy-statement vpna-import {
        term one {
            from {
                protocol bgp;
                community vpna-comm;
            }
            then accept;
        }
        term two {
            then reject;
        }
    }
    community vpna-comm members target:200:100;
}
firewall {
    family inet {
        filter fw {
            term 1 {
                from {
                    protocol tcp;
                    port bgp;
                }
                then accept;
            }
            term 2 {
```

```
                then {
                    sample;
                    accept;
                }
            }
        }
    }
}
routing-instances {
    vrf1 {
        instance-type vrf;
        interface ge-3/1/2.0;
        route-distinguisher 10.255.19.12:1;
        vrf-import vpna-import;
        vrf-export vpna-export;
        protocols {
            bgp {
                group R3-R4 {
                    type external;
                    peer-as 65000;
                    as-override;
                    neighbor 10.10.10.1;
                }
            }
        }
    }
}
```

Configuring the CE2 Router

Step-by-Step Procedure

In this step, you configure interfaces, routing options, protocols, and policy options for the CE2 router. To configure the CE2 router:

1. Configure one interface with two IP addresses. One address is for traffic to the PE2 router and the other address is to check that traffic is flowing from the CE1 router:

```
[edit interfaces]
user@router-ce2# set ge-0/1/2 unit 0 family inet address 10.10.10.1/24

user@router-ce2#  set ge-0/1/2 unit 0 family inet address 4.4.4.4/16
```

2. Configure the autonomous system to establish a connection between BGP peers:

```
[edit routing-options]
user@router-ce1# set autonomous-system 65000
```

3. Configure BGP as the routing protocol between the CE and the PE routers:

```
[edit protocols]
user@router-ce2# set bgp group R3-R4 type external

user@router-ce2#  set bgp group R3-R4 export l3vpn-policy

user@router-ce2#  set bgp group R3-R4 peer-as 200

user@router-ce2#  set bgp group R3-R4 neighbor 10.10.10.2
```

4. Configure the policies that ensure that the CE routers exchange routing information. In this example, Router CE2 exchanges routing information with Router CE1:

```
[edit policy-options]
user@router-ce2# set policy-statement l3vpn-policy term one from protocol direct
```

```
user@router-ce2# set policy-statement l3vpn-policy term one from route-filter
10.255.15.75/32 exact

user@router-ce2# set policy-statement l3vpn-policy term one then accept

user@router-ce2# set policy-statement l3vpn-policy term two from protocol direct

user@router-ce2# set policy-statement l3vpn-policy term two from route-filter
4.4.0.0/16 exact

user@router-ce2# set policy-statement l3vpn-policy term two then accept
```

Results The output below shows the configuration of the CE2 router:

```
[edit]
user@router-ce2# show
[...Output Truncated...]
interfaces {
    ge-0/1/2 {
        unit 0 {
            family inet {
                address 10.10.10.1/24;
                address 4.4.4.4/16;
            }
        }
    }
}
routing-options {
    autonomous-system 65000;
}
protocols {
    bgp {
        group R3-R4 {
            type external;
            export l3vpn-policy;
            peer-as 200;
            neighbor 10.10.10.2;
        }
    }
}
policy-options {
    policy-statement l3vpn-policy {
        term one {
            from {
                protocol direct;
                route-filter 10.255.15.75/32 exact;
            }
            then accept;
        }
        term two {
            from {
                protocol direct;
                route-filter 4.4.0.0/16 exact;
            }
            then accept;
        }
    }
}
```

Verification

After you have completed the configuration of the four routers, you can verify that traffic is flowing from the CE1 router to the CE2 router, and you can observe the sampled traffic from two locations. To confirm that the configuration is working properly, perform these tasks:

- Verifying the Traffic Flow Between the CE Routers on page 123
- Verifying Sampled Traffic on page 123
- Cross Verifying Sampled Traffic on page 124

Verifying the Traffic Flow Between the CE Routers

Purpose Use the **ping** command to verify traffic between the CE routers.

Action From the CE1 router, issue the **ping** command to the CE2 router:

```
user@router-ce2> ping 4.4.4.4 source 2.2.2.2
PING 4.4.4.4 (4.4.4.4): 56 data bytes
64 bytes from 4.4.4.4: icmp_seq=0 ttl=64 time=0.861 ms
64 bytes from 4.4.4.4: icmp_seq=1 ttl=64 time=0.869 ms
64 bytes from 4.4.4.4: icmp_seq=2 ttl=64 time=0.786 ms
^C
--- 4.4.4.4 ping statistics ---
3 packets transmitted, 3 packets received, 0% packet loss
round-trip min/avg/max/stddev = 0.786/0.839/0.869/0.037 ms
```

Meaning The output from the **ping** command shows that the **ping** command was successful. Traffic is flowing between the CE routers.

Verifying Sampled Traffic

Purpose You can observe the sampled traffic using the **show log sampled** command from the CLI or from the router shell using the **tail –f /var/log/sampled** command. In addition, you can collect the logs in a flowcollector. The same information appears in the output of both commands and in the flow collector. For information about using a flow collector, see "Sending cflowd Records to Flow Collector Interfaces" and ""Example: Flow Collector Interface Configuration" on page 55."

Action From the PE1 router, use the **show log sampled** command:

```
user@router-pe1> show log sampled
[...Output Truncated...]
Nov 16 23:24:19    Src addr: 2.2.2.2
Nov 16 23:24:19    Dst addr: 4.4.4.4
Nov 16 23:24:19    Nhop addr: 20.20.20.2
Nov 16 23:24:19  Input interface: 503      # SNMP index of the incoming interface on PE1
Nov 16 23:24:19  Output interface: 505      # SNMP index of the outgoing interface on
PE1
Nov 16 23:24:19    Pkts in flow: 5
Nov 16 23:24:19    Bytes in flow: 420
Nov 16 23:24:19    Start time of flow: 602411369
Nov 16 23:24:19    End time of flow: 602415369
Nov 16 23:24:19    Src port: 0
Nov 16 23:24:19    Dst port: 2048
Nov 16 23:24:19    TCP flags: 0x0
Nov 16 23:24:19    IP proto num: 1
Nov 16 23:24:19    TOS: 0x0
Nov 16 23:24:19  Src AS: 95000      # The autonomous system of CE1
Nov 16 23:24:19  Dst AS: 65000,,,,,# The autonomous system of CE2
Nov 16 23:24:19  Src netmask len: 8
Nov 16 23:24:19  Dst netmask len: 16
Nov 16 23:24:19 cflowd header:
Nov 16 23:24:19   Num-records: 1
Nov 16 23:24:19   Version: 500
Nov 16 23:24:19   Flow seq num: 13
```



```
Nov 16 23:24:19   Sys Uptime: 602450382 (msecs)
Nov 16 23:24:19   Time-since-epoch: 1258413859 (secs)
Nov 16 23:24:19   Engine id: 0
Nov 16 23:24:19   Engine type: 0
Nov 16 23:24:19   Sample interval: 1
[...Output Truncated...]
```

Meaning The output from the **show log sampled** command shows the correct SNMP index for the incoming and outgoing interfaces on the PE1 router. Also, the source and destination addresses for the autonomous systems for the two CE routers are correct.

Cross Verifying Sampled Traffic

Purpose You can also double check that the sampled traffic is the correct traffic by using the **show interface** ***interface-name-fpc/pic/port.unit-number*** **| match SNMP** command and the **show route** ***route-name*** **detail** command.

Action The following output is a cross check of the output in the "Verifying Sampled Traffic" on page 123 task:

```
user@router-pe1> show interfaces ge-2/0/2.0 | match SNMP
  Logical interface ge-2/0/2.0 (Index 76) (SNMP ifIndex 503)
    Flags: SNMP-Traps 0x4000000 Encapsulation: ENET2

user@router-pe1> show route 4.4.4.4 detail

vrf1.inet.0: 5 destinations, 5 routes (5 active, 0 holddown, 0 hidden)
4.4.0.0/16 (1 entry, 1 announced)
        *BGP    Preference: 170/-101
                Route Distinguisher: 10.255.19.12:1
                Next hop type: Indirect
                Next-hop reference count: 6
                Source: 20.20.20.2
                Next hop type: Router, Next hop index: 659
                Next hop: 20.20.20.2 via ge-2/0/0.0 weight 0x1, selected
                Label operation: Push 299776
                Protocol next hop: 20.20.20.2
                Push 299776
                Indirect next hop: 8e6f780 1048574
                State: <Secondary Active Int Ext>
                Local AS:   200 Peer AS:   200
                Age: 3d 19:49:32  Metric2: 65535
                Task: BGP_200.20.20.20.2+179
                Announcement bits (3): 0-RT 1-BGP RT Background 2-KRT
                AS path: 65000 I
                AS path: Recorded
                Communities: target:200:100
                Import Accepted
                VPN Label: 299776
                Localpref: 100
                Router ID: 10.10.10.2
                Primary Routing Table bgp.l3vpn.0
```

Meaning The output of the **show interfaces ge-2/0/2.0 | match SNMP** command shows that the SNMP ifIndex field has the same value (**503**) as the output for the **show log sampled**

command in the "Verifying Sampled Traffic" on page 123 task, indicating that the intended traffic is being sampled.

The output of the **show route 4.4.4.4 detail** command shows that the source address **4.4.4.4**, the source mask (**16**), and the source AS (**65000**) have the same values as the output for the **show log sampled** command in the "Verifying Sampled Traffic" on page 123 task, indicating that the intended traffic is being sampled.

Related Documentation

- Configuring Traffic Sampling
- Flow Monitoring

Example: IPv6 Support for FlowTapLite

This example describes how to configure IPv6 support for FlowTapLite on an M120 router with Enhanced III FPCs. The configuration of FlowTapLite is similar on an M320 router and an MX Series router with Enhanced III FPCs. However, because the MX Series routers do not support Tunnel Services PICs, you configure a DPC and the corresponding Packet Forwarding Engine to use tunneling services at the **[edit chassis]** hierarchy level.

With Junos OS Release 10.1, the FlowTapLite service supports lawful interception of IPv6 packets; previously only interception of IPv4 packets was supported. The intercepted packets are sent to a content destination, while the flow of original packets to the actual destination is unaffected.

A mediation device installs dynamic filters on the router (or server) by sending DTCP requests. These filters include the quintuple information (source address, destination address, source port, destination port, and protocol) about the intercepted flows and the details (IP addresses and port information) of the content destination.

Below is an example of such a filter:

```
ADD DTCP/0.8
Csource-ID: ftap
Cdest-ID: cd1
Source-Address: 7234:5678:ABCD:EF12:3456:78AB:ABC8:1235/112
Dest-Address: affe::1:1
Source-Port: 1234
Dest-Port: 2345
Protocol: *
Priority: 2
X-JTap-Input-Interface: ge-2/0/1
X-JTap-Cdest-Dest-Address: 6.3.4.5
X-JTap-Cdest-Dest-Port: 2300
X-JTap-Cdest-Source-Address: 208.223.208.9
X-JTap-Cdest-Source-Port: 65535
X-JTap-Cdest-TTL: 255
X-JTap-IP-Version: ipv6
Flags: STATIC
```

Following are descriptions of the parameters in the dynamic filter:

- **Csource-ID**—The username configured in the router at the [**edit system login user**] hierarchy level.
- **Cdest-ID**—The content destination identifier.
- **Source-Address**, **Dest-Address Source-Port**, **Dest-Port**, **Protocol**—Parameters that determine which packet flows need to be intercepted.
- **X-JTap-Input-Interface**—The interface through which the actual flows are coming into the router. Depending on the type of filters installed, the value in this field can include the following: **X-JTap-Output-Interface** to install output interface filters; **X-JTap-VRF-NAME** to install VRF filters; and to install global filters, no parameters are specified.
- **X-JTap-Cdest-Dest**—All parameters that start with this string specify different parameters associated with the content destination.
- **X-JTap-IP-Version**–Differentiates between IPv6 and IPv4 filters.

From the Packet Forwarding Engine console, you can verify that the filters are installed and working correctly.

This example describes how to configure IPv6 support for FlowTapLite on an M120 router:

Requirements

This example uses the following hardware and software components:

- Junos OS Release 10.1 or later
- M120 router with a tunnel (**vt**) interface

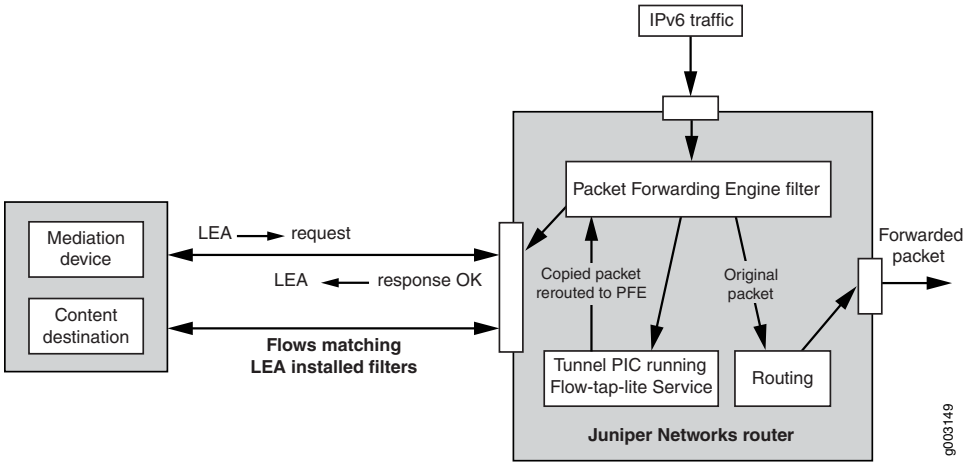
Before you configure IPv6 FlowTapLite on your router, be sure you have:

- A tunnel PIC that is up
- A connection from the router to the mediation device and the content destination
- Traffic flow to and from the router

Overview and Topology

Figure 11 on page 127 shows the FlowTapLite configuration for one M120 router to lawfully intercept packets.

Figure 11: FlowTapLite Topology



In this example, the IPv6 packets enter the Packet Forwarding Engine and, depending on the filters installed, a new flow is created for the intercepted packets while the original packets are forwarded normally. The new flow is rerouted through the tunnel PIC back to the Packet Forwarding Engine for a route lookup, and then on to the content destination.

Configuration

To configure IPv6 FlowTapLite on an M120 router, perform these tasks:

- Configuring User Credentials on page 127
- Configuring the Tunnel Interface for FlowTapLite on page 128
- Configuring the Logical Tunnel Interface on page 128
- Configuring FlowTapLite on page 128

CLI Quick Configuration

To quickly configure IPv6 FlowTapLite, copy the following commands and paste them into the CLI:

```
set system login class flowtap permissions flow-tap-operation
set system login user ftap uid 2000
set system login user ftap class flowtap
set system login user ftap authentication encrypted-password "xxxxxx"
set system services flow-tap-dtcp ssh
set interfaces vt-4/0/0 unit 0 family inet
set interfaces vt-4/0/0 unit 0 family inet6
set services flow-tap tunnel-interface vt-4/0/0.0
```

Configuring User Credentials

Step-by-Step Procedure

The username and password configured here are used by the mediation device when connecting and sending out DTCP requests.

1. Define a login class called **flowtap**:

```
[edit system]
user@router# set login class flowtap permissions flow-tap-operation
```

2. For the meditation device, configure a user called **ftap** with a unique identifier (UID):

```
[edit system]
user@router# set login user ftap uid 2000
```

3. Apply the **flowtap** class to the **ftap** user:

```
[edit system]
user@router# set login user ftap class flowtap
```

4. Configure the password used by the mediation device:

```
[edit system]
user@router# set login user ftap authentication encrypted-password xxxxxx
```

5. Commit the configuration:

```
[edit system]
user@router# commit
```

Configuring the Tunnel Interface for FlowTapLite

Step-by-Step Procedure

You can add an extra level of security to DTCP transactions between the mediation device and the router by enabling DTCP sessions on top of the SSH layer.

1. Configure SSH from the **[edit system]** hierarchy level:

```
[edit system]
user@router# set services flow-tap-dtcp ssh
```

2. Commit the configuration:

```
[edit system]
user@router# commit
```

Configuring the Logical Tunnel Interface

Step-by-Step Procedure

1. Configure the logical interface and assign it to the dynamic flow control process (dfcd) at the **[edit interfaces]** hierarchy level:

```
[edit interfaces]
user@router# set vt-4/0/0 unit 0 family inet
```

2. Include the mandatory **inet6** statement:

```
[edit interfaces]
user@router# set vt-4/0/0 unit 0 family inet6
```

3. Commit the configuration:

```
[edit interfaces]
user@router# commit
```

Configuring FlowTapLite

Step-by-Step Procedure

1. Include the **flow-tap** statement and the tunnel interface at the **[edit services]** hierarchy level:

```
[edit services]
user@router# set flow-tap tunnel-interface vt-4/0/0.0
```

2. Commit the configuration:

```
[edit services]
user@router# commit
```

Results Check the results of the configuration:

```
[edit]
user@router-re0# show
system {
    [...Output Truncated...]
    login {
        class flowtap {
            permissions flow-tap-operation;
        }
        user ftap {
            uid 2000;
            class flowtap;
            authentication {
                encrypted-password "xxxxxx"; ## SECRET-DATA
            }
        }
    }
    services {
        telnet;
        flow-tap-dtcp {
            ssh;
        }
    }
}
interfaces {
    vt-4/0/0 {
        unit 0 {
            family inet;
            family inet6;
        }
    }
}
[...Output Truncated...]
services {
    flow-tap {
        tunnel-interface vt-4/0/0.0;
    }
}
```

Verification

To confirm that the configuration is working properly, perform the following tasks:

- Verifying That the Router Received the Filter Request on page 130
- Checking That Filters Are Installed and Working on the Router on page 130
- Sending a List Request on page 130

Verifying That the Router Received the Filter Request

Purpose After the mediation device sends the filters to the router, the mediation device must receive a message from the router confirming that the router has received the filter request.

Action Check that the mediation device has received a message similar to the one below:

```
DTCP/0.8 200 OK
SEQ: 1
CRITERIA-ID: 1
TIMESTAMP: 2009-09-29 06:12:05.725
AUTHENTICATION-INFO: 55f9dc3debd3c7356951410f165f2a9cc5606063
```

Meaning The message above is an example of a successfully received filter request.

Checking That Filters Are Installed and Working on the Router

Action Use the **show filter** and the **show filter index** commands to check that filters are installed:

```
ADPC2(diving vty)# show filter
Program Filters:
---------------
   Index     Dir     Cnt    Text     Bss  Name
--------  ------  ------  ------  ------  --------
       1     104       0      20      20  __default_bpdu_filter__
   17000      52       0       4       4  __default_arp_policer__
   57007     104     144      16      16  __flowtap_inet__
   65280      52       0       4       4  __auto_policer_template__
   65281     104       0      16      16  __auto_policer_template_1__
   65282     156       0      32      32  __auto_policer_template_2__
   65283     208       0      48      48  __auto_policer_template_3__
   65284     260       0      64      64  __auto_policer_template_4__
   65285     312       0      80      80  __auto_policer_template_5__
   65286     364       0      96      96  __auto_policer_template_6__
   65287     416       0     112     112  __auto_policer_template_7__
   65288     468       0     128     128  __auto_policer_template_8__
37748736  156  144   80   80 __ftaplite_filter__ifl__70__out__ipv6_
37748737  156  144   80   80 __ftaplite_filter__vrf__4__in__ipv6_
37748738  156  144   80   80 __ftaplite_filter__ifl__71__in__ipv6_
37748739  156  144   80   80 __ftaplite_filter__vrf__0__in__ipv6_

ADPC2(diving vty)# show filter index 37748738 counters
Filter Counters/Policers:
   Index               Packets                  Bytes  Name
--------  --------------------  --------------------  --------
37748738               8851815             601923420
__ftaplite_term_ftap_3___counter
```

Meaning The last four filters in the output for the **show filter** command above are the filters installed on the Packet Forwarding Engine. The **show filter index** command shows a non-zero packet count, indicating that the packets are hitting the filter.

Sending a List Request

Purpose To verify that the correct filters are installed in the Packet Forwarding Engine.

Action Use client software to send a list request to the Packet Forwarding Engine. In your list request, you can include the following three parameters individually or together: **CSource-Id**, **CDest-ID**, and **Criteria-ID**. With all requests, you must include the **CSource-Id**. Below is an example of a list request using the **CSource-Id**:

```
LIST DTCP/0.8
Csource-ID: ftap1
Flags: Both
```

Below is an example of a response:

```
DTCP/0.8 200 OK
SEQ: 51
TIMESTAMP: 2009-10-04 07:56:43.003
CRITERIA-ID: 1
CSOURCE-ID: ftap1
CDEST-ID: cd1
CSOURCE-ADDRESS: 10.209.152.15
FLAGS: Static
AVERAGE-BANDWIDTH: 0
MATCHING-PACKETS: 0
MATCHING-BYTES: 0
NUM-REFRESH: 0
LAST-REFRESH: 2009-10-04 07:54:30.870
X-JTAP-INPUT-INTERFACE: ge-2/1/1.0,ge-2/1/1.1,ge-2/1/1.2
SOURCE-ADDRESS: 40.0.0.1
DEST-ADDRESS: 50.0.0.1/32
SOURCE-PORT: 1000
DEST-PORT: 2000
PROTOCOL: 17
X-JTAP-CDEST-DEST-ADDRESS: 212.25.99.81
X-JTAP-CDEST-DEST-PORT: 8001
X-JTAP-CDEST-SOURCE-ADDRESS: 208.223.208.9
X-JTAP-CDEST-SOURCE-PORT: 34675
X-JTAP-CDEST-TTL: 64
CRITERIA-NUM: 1
CRITERIA-COUNT: 1
AUTHENTICATION-INFO: 0f49ff600a3d8d7d312c5031f74cc17540bc9200
```

You can also delete the request. Below is an example of a delete request:

```
DELETE DTCP/0.8
Csource-ID: ftap
CDest-ID: cd1
Flags: STATIC
```

Related Documentation

- Configuring FlowTapLite
- flow-tap
- Configuring the Junos OS to Support Tunnel Interfaces on MX Series 3D Universal EdgeRouters

CHAPTER 6

Formats for Flow Monitoring Output

Flow Monitoring Output Formats

When you implement passive flow monitoring and active flow monitoring, you should be familiar with flow monitoring formats and fields. Version 5 and version 8 export data into specified fields. Version 9 exports data into templates.

The flow monitoring station monitors the traffic flow and exports the data in flow format to an external server. The Junos OS collects information about the following fields:

- Source and destination IP address
- Total number of bytes and packets sent
- Start and end times of the data flow
- Source and destination port numbers
- TCP flags
- IP protocol and IP type of service
- Originating AS of source and destination address
- Source and destination address prefix mask lengths
- Next-hop router's IP address
- MPLS label (version 9 only)
- ICMP (version 9 only)

Detailed descriptions of the formats are available as follows:

- Version 5 Formats and Fields on page 134
- Version 8 Formats and Fields on page 137

- Version 9 Formats and Fields on page 143

Version 5 Formats and Fields

A detailed explanation of version 5 packet formats and fields is shown in the following figures and tables:

- Figure 12 on page 134
- Table 17 on page 134
- Figure 13 on page 135
- Table 18 on page 135

Figure 12: Version 5 Packet Header Format

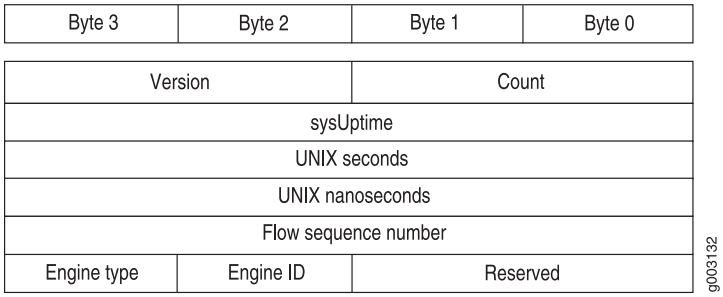


Table 17: Export Version 5 Packet Header Fields

Field	Description	Comments
Version	5	–
Count	The number of records in the Protocol Data Unit (PDU) or packet	–
sysUptime	Current time elapsed, in milliseconds, since the router started	–
UNIX seconds	Current seconds since 0000 UTC 1970	NTP synchronized time; the clock on each services PIC is autonomous (200–400 msec jitter) across PICs in a chassis
UNIX nanoseconds	Residual nanoseconds since 0000 UTC 1970	See Comments above for UNIX seconds
Flow sequence number	Sequence number of total flows received	–
Engine type	User-configured 8-bit value	Also known as VIP type on other vendors' equipment
Engine ID	User-configured 8-bit value	–

Figure 13: Version 5 Flow-Export Flow Header Format

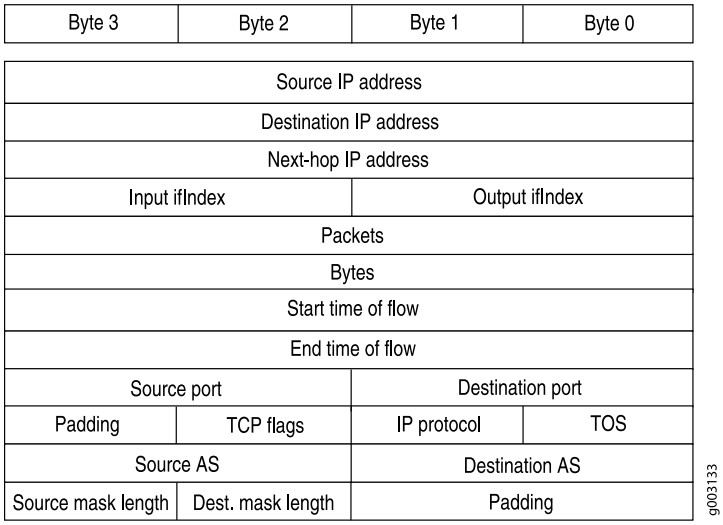


Table 18: Export Version 5 Flow-Export Flow Header Fields

Field	Description	Comments
Source IP address	Source IP address of the flow	–
Destination IP address	Destination IP address of the flow	–
Next-hop IP address	IP address of the router where flows are forwarded	–
Input ifIndex	SNMP index value for the input interface where the router receives flows	Junos OS Release 5.7 and later—Dynamically inserted, but overridden by manual configuration Junos OS Release 5.5—Manually set Junos OS Release 5.4—Set to zero
Output ifIndex	SNMP index value for the output interface where the router forwards flows	Junos OS Release 5.7 and later—Dynamically inserted, but overridden by manual configuration Junos OS Release 5.5—Manually set Junos OS Release 5.4—Set to zero
Packets	Total number of packets received in a flow	–
Bytes	Total number of bytes received in a flow	–
Start time of flow	System up time, in seconds, at the start of the flow	System up time for the services PIC accepting flows

Table 18: Export Version 5 Flow-Export Flow Header Fields *(continued)*

Field	Description	Comments
End time of flow	System up time, in seconds, at the end of the flow	System up time for the services PIC accepting flows
Source port	Source application port	–
Destination port	Destination application port	The ICMP type is placed in the high-order byte and the ICMP type code is placed in the low-order byte of this field
TCP flags	TCP flags set in the flow	–
IP protocol	IP protocol number	–
TOS	IP type of service	–
Source AS	AS number of the source address	Junos OS Release 5.7 and later—Dynamically inserted if AS information is available
Destination AS	AS number of the destination address	Junos OS Release 5.7 and later—Dynamically inserted if AS information is available
Source mask length	Source address network mask length	–
Dest. mask length	Destination address network mask length	–
Padding	Bytes available to ensure a minimum packet length	–

Useful formulas for flow monitoring are:

- start flow timestamp absolute = *unixTime* x 1000 – (*sysUptime* – start flow timestamp)
- end flow timestamp absolute = *unixTime* x 1000 – (*sysUptime* – end flow timestamp)

NOTE: **In the 2-byte destination port field of the export version 5 flow-export flow format, the following information can be derived:**

- High-order byte—ICMP type
- Low-order byte—ICMP type code

For example, if the ICMP type is 3 (00000011 in binary) and the ICMP type code is network unreachable (Type Code 0, or 00000000 in binary), the resulting destination port field value is 00000011 00000000 (768 in decimal).

For more information on ICMP type and type code, see RFC 792 at **http://www.ietf.org**.

Version 8 Formats and Fields

A detailed explanation of version 8 packet formats and fields is shown as follows:

Figure 14: Version 8 Template Flow Format

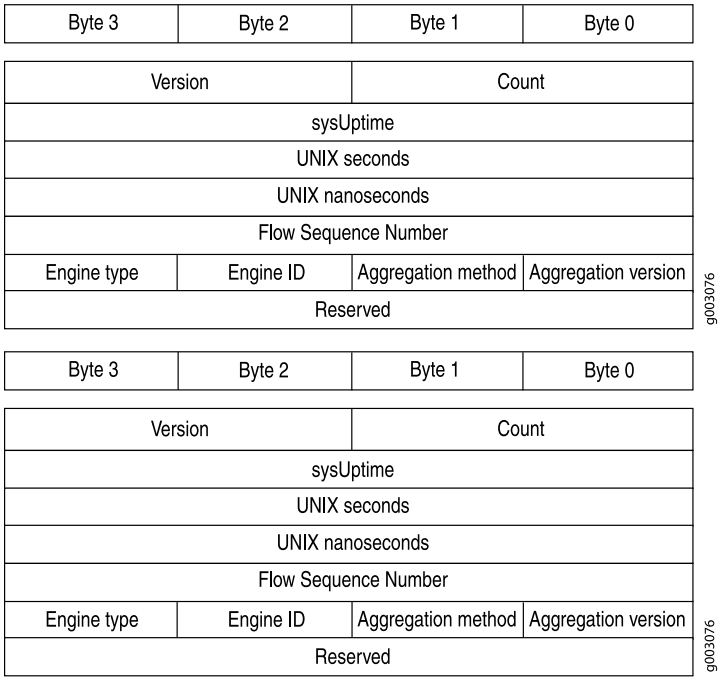


Table 19: Version 8 Flow Template Fields

Field	Description
Version	8
Count	The number of records in the protocol data unit (PDU) or packet
sysUptime	Current time elapsed, in milliseconds, since the router started
UNIX seconds	Current seconds since 0000 UTC 1970
UNIX nanoseconds	Residual nanoseconds since 0000 UTC 1970
Flow sequence number	Sequence counter of total flows received
Engine type	Type of flow switching engine
Engine ID	ID number of the flow switching engine
Aggregation method	Aggregation method used
Aggregation version	Version of the aggregation export
Reserved	Empty field reserved for future usage

Figure 15: Version 8 AS Aggregation Flow Entry Format

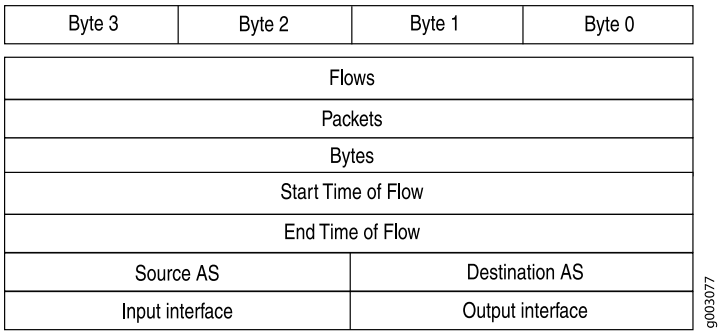


Table 20: Version 8 AS Aggregation Flow Entry Fields

Field	Description
Flows	Total number of flows
Packets	Total number of packets received in a flow
Bytes	Total number of bytes received in a flow
Start time of flow	System up time, in seconds, at the start of the flow

Table 20: Version 8 AS Aggregation Flow Entry Fields *(continued)*

Field	Description
End time of flow	System up time, in seconds, at the end of the flow
Source AS	AS number of the source address
Destination AS	AS number of the destination address
Input interface	SNMP index value for the input interface where the router receives flows
Output interface	SNMP index value for the output interface where the router forwards flows

Figure 16: Version 8 Protocol/Port Aggregation Flow Entry Format

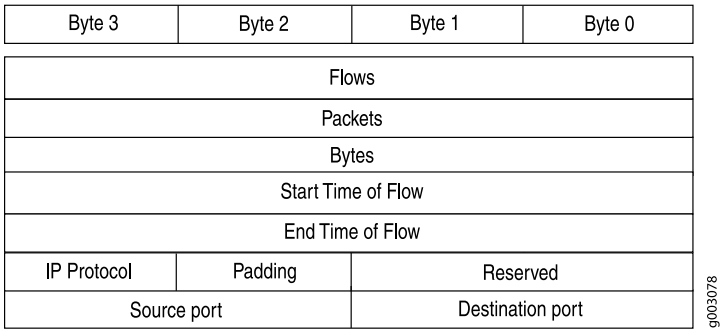


Table 21: Version 8 Protocol/Port Aggregation Flow Entry Fields

Field	Description
Flows	Total number of flows
Packets	Total number of packets received in a flow
Bytes	Total number of bytes received in a flow
Start time of flow	System up time, in seconds, at the start of the flow
End time of flow	System up time, in seconds, at the end of the flow
IP protocol	IP protocol number
Padding	Bytes available to ensure a minimum packet length
Reserved	Empty field reserved for future usage
Source port	Source application port
Destination port	Destination application port

Figure 17: Version 8 Prefix Aggregation Flow Entry Format

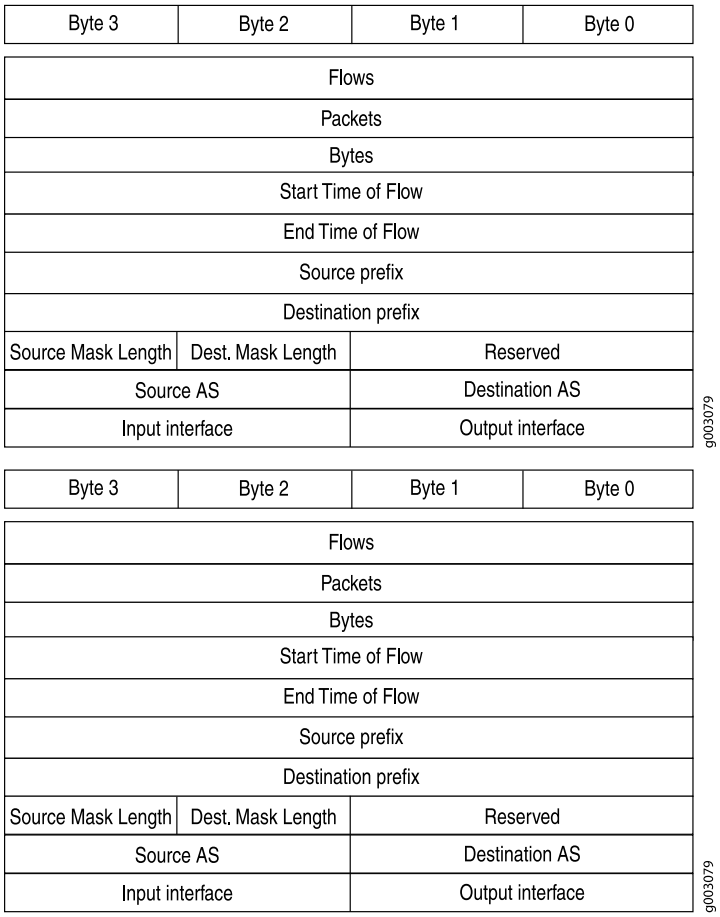


Table 22: Version 8 Prefix Aggregation Flow Entry Fields

Field	Description
Flows	Total number of flows
Packets	Total number of packets received in a flow
Bytes	Total number of bytes received in a flow
Start time of flow	System up time, in seconds, at the start of the flow
End time of flow	System up time, in seconds, at the end of the flow
Source prefix	Source IP address prefix
Destination prefix	Destination IP address prefix
Source mask length	Source address network mask length

Table 22: Version 8 Prefix Aggregation Flow Entry Fields *(continued)*

Field	Description
Dest. mask length	Destination address network mask length
Reserved	Empty field reserved for future usage
Source AS	AS number of the source address
Destination AS	AS number of the destination address
Input interface	SNMP index value for the input interface where the router receives flows
Output interface	SNMP index value for the output interface where the router forwards flows

Figure 18: Version 8 Source Prefix Aggregation Flow Entry Format

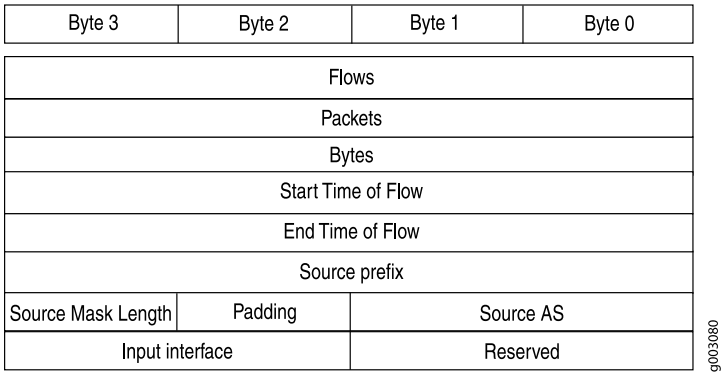


Table 23: Version 8 Source Prefix Aggregation Flow Entry Fields

Field	Description
Flows	Total number of flows
Packets	Total number of packets received in a flow
Bytes	Total number of bytes received in a flow
Start time of flow	System up time, in seconds, at the start of the flow
End time of flow	System up time, in seconds, at the end of the flow
Source prefix	Source IP address prefix
Source mask length	Source address network mask length
Padding	Bytes available to ensure a minimum packet length

Table 23: Version 8 Source Prefix Aggregation Flow Entry Fields *(continued)*

Field	Description
Source AS	AS number of the source address
Input interface	SNMP index value for the input interface where the router receives flows
Reserved	Empty field reserved for future usage

Figure 19: Version 8 Destination Prefix Aggregation Flow Entry Format

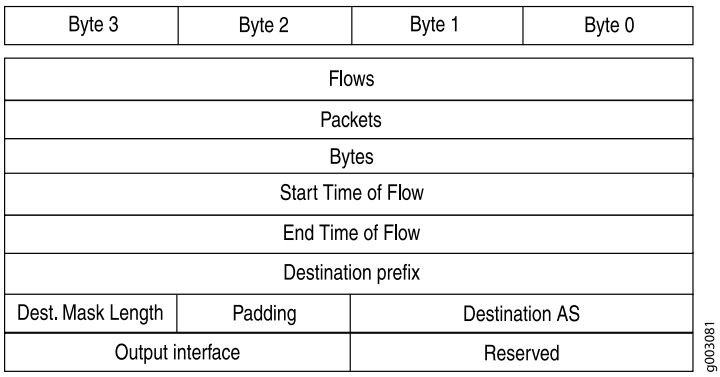


Table 24: Version 8 Destination Prefix Aggregation Flow Entry Fields

Field	Description
Flows	Total number of flows
Packets	Total number of packets received in a flow
Bytes	Total number of bytes received in a flow
Start time of flow	System up time, in seconds, at the start of the flow
End time of flow	System up time, in seconds, at the end of the flow
Destination prefix	Destination IP address prefix
Dest. mask length	Destination address network mask length
Padding	Bytes available to ensure a minimum packet length
Destination AS	AS number of the destination address
Output interface	SNMP index value for the output interface where the router forwards flows
Reserved	Empty field reserved for future usage

For more information about version 5 and version 8 packet formats and fields, see **http://www.caida.org**.

Version 9 Formats and Fields

A detailed explanation of active flow monitoring version 9 packet formats and fields is shown as follows:

- Table 25 on page 143
- Figure 20 on page 145
- Table 26 on page 145
- Figure 22 on page 148
- Table 26 on page 145
- Figure 23 on page 149
- Table 30 on page 149
- Figure 24 on page 149
- Table 31 on page 150

The Junos OS supports the version 9 template formats:

Table 25: Flow Monitoring Version 9 Template Formats

Template	Fields
IPv4	Flow selectors: • Source and destination IP address • Source and destination address prefix mask lengths • Source and destination port numbers • IP protocol and IP type of service • ICMP type Flow nonselectors: • TCP flags • Input and output SNMP • Input bytes • Input packets • Start time • End time

Table 25: Flow Monitoring Version 9 Template Formats *(continued)*

Template	Fields
MPLS	Flow selectors: • MPLS label 1 • MPLS label 2 • MPLS label 3 Flow nonselectors: • Input and output SNMP • Input bytes • Input packets • Start time • End time
MPLS_IPv4	Flow selectors: • MPLS label 1 • MPLS label 2 • MPLS label 3 • MPLS top-level FEC address Flow nonselectors: • Input and output SNMP • Input bytes • Input packets • Start time • End time
IPv6	Flow selectors: • IP protocol and IP type of service • Source and destination port numbers • Input SNMP • Source and destination IPv6 address • ICMP type Flow nonselectors: • Input bytes • Input packets • TCP flags • Output SNMP • Source and destination autonomous system • Last and first switched • IPv6 source and destination mask • IP protocol version • IPv6 next hop

Table 25: Flow Monitoring Version 9 Template Formats *(continued)*

Template	Fields
Peer AS billing	Flow selectors: • IPv4 class of service • Ingress interface information • BGP peer destination AS number • BGP IPv4 nest hop address Flow nonselectors • Input and output SNMP • Input bytes • Input packets • First switch • Last switched

Figure 20: Version 9 Flow Header Format

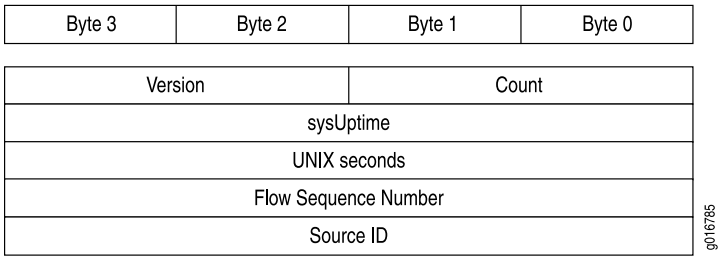


Table 26: Version 9 Flow Header Fields

Field	Description
Version	9
Count	Total number of records in the protocol data unit (PDU) or packet. This number includes all of the options FlowSet records, template FlowSet records, and data FlowSet records.
sysUptime	Current time elapsed, in milliseconds, since the router started.
UNIX seconds	Current seconds since 0000 UTC 1970.
Flow sequence number	Sequence counter of total flows received.
Source ID	32-bit value that identifies the data exporter. Version 9 uses the integrated field diagnostics (IFD) SNMP index of the PIC or device that is exporting the data flow. This field is equivalent to engine type and engine ID fields found in versions 5 and 8.

Figure 21: Version 9 Template FlowSet Format

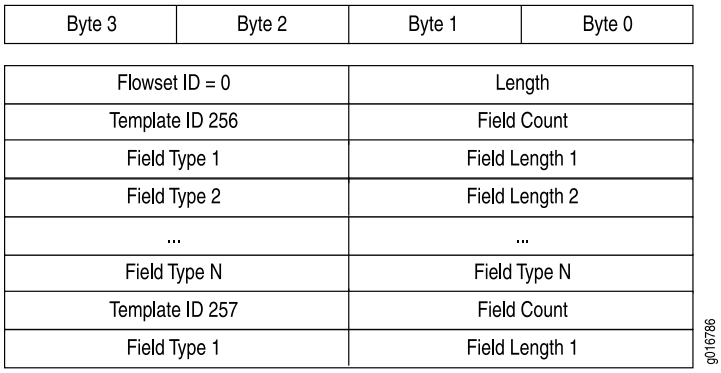


Table 27: Version 9 Template FlowSet Fields

Field	Description
FlowSet ID	FlowSet type. FlowSet ID 0 is reserved for the Template FlowSet.
Length	FlowSet length. Individual template FlowSets might contain multiple template records, which means that the length of template FlowSets varies.
Template ID	Unique template ID assigned to each newly generated template. Templates numbered 256 and higher define data formats. Templates numbered 0 through 255 define FlowSet IDs.
Field Count	Fields in the template record. This field allows the collector to determine the end of the current template record and the start of the next.
Field Type	Field type. These are defined in Table 28 on page 146.
Field Length	Length, in bytes, of the corresponding field type.

Table 28: Field Type Definitions Supported in the Junos OS

Field Type	Description
1	IN_BYTES: The number of bytes associated with an IP flow. By default, the length is 4 bytes.
2	IN_PKTS: The number of packets associated with an IP flow. By default, the length is 4 packets.
4	PROTOCOL: The IP protocol byte.
5	TOS: The type-of-service byte setting of an incoming packet.

Table 28: Field Type Definitions Supported in the Junos OS *(continued)*

Field Type	Description
6	TCP_FLAGS: The cumulative TCP flags associated with a flow.
7	L4_SRC_PORT: The TCP/UDP source port.
8	IPv4_SRC_ADDR: The IPv4 source address.
9	SRC_MASK: The number of contiguous bits in the source subnet mask.
10	INPUT_SNMP: The IFD SNMP input interface index. By default, the length is 2.
11	L4_DST_PORT: The TCP/UDP destination port number.
12	IPV4_DST_ADDR: The IPv4 destination address.
13	DST_MASK: The number of contiguous bits in the destination subnet mask.
14	OUTPUT_SNMP: The IFD SNMP output interface index. By default, the length is 2.
16	SRC_AS: The source autonomous system number. This is always set to zero.
17	DST_AS: The destination autonomous system number. This is always set to zero.
18	BGP_IPV4_NEXT_HOP: The BGP IPV4 next-hop address.
21	LAST_SWITCHED: The uptime of the device (in milliseconds) at which the last packet of the flow was switched.
22	FIRST_SWITCHED: The uptime of the device (in milliseconds) at which the first packet of the flow was switched.
29	IPV6_SRC_MASK: The length of the IPv6 source mask, in contiguous bits.
30	IPV6_DST_MASK: The length of the IPv6 destination mask, in contiguous bits.
32	ICMP_TYPE: The ICMP type.
34	SAMPLING_INTERVAL: The rate at which packets are sampled. As an example, a rate of 100 means that one packet is sampled for every 100 packets in the data flow.
35	SAMPLING_ALGORITHM: The type of algorithm being used. Ox01 indicates deterministic sampling and 0x02 indicates random sampling.
47	MPLS_TOP_LABEL_IP_ADDRESS: The MPLS top- label address.
60	IP_PROTOCOL_VERSION: The IP protocol version being used.
62	IPV6_NEXT_HOP: The IPv6 address of the next-hop router.

Table 28: Field Type Definitions Supported in the Junos OS *(continued)*

Field Type	Description
70	MPLS_LABEL_1: The first MPLS label in the stack.
71	MPLS_LABEL_2: The second MPLS label in the stack.
72	MPLS_LABEL_3: The third MPLS label in the stack.
128	DST_PEER_AS: The destination of the BGP peer AS.

Figure 22: Version 9 Data FlowSet Format

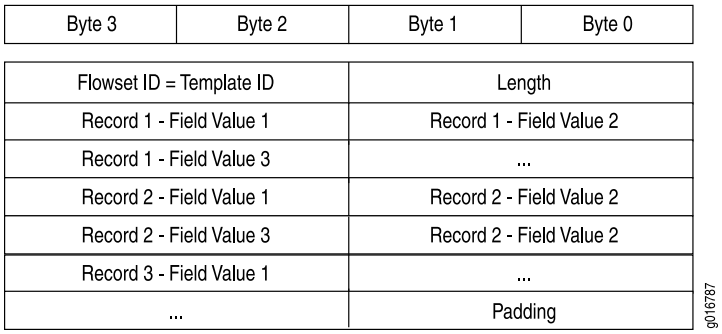


Table 29: Version 9 Data FlowSet Format

Field	Description
FlowSet ID = Template ID	Data FlowSet that associated with a FlowSet ID. The FlowSet ID maps to a previously generated template ID. The flow collector must use the FlowSet ID to find the corresponding template record and decode the flow records from the FlowSet.
Length	FlowSet length. Data FlowSets are fixed in length.
Record Number - Field Value Number	Flow data records, each containing a set of field values. The template record identified by the FlowSet ID dictates the type and length of the field values.
Padding	Bytes (in zeros) that the exporter inserts so that the subsequent FlowSet starts at a 4-byte aligned boundary.

Figure 23: Version 9 Options Template Format

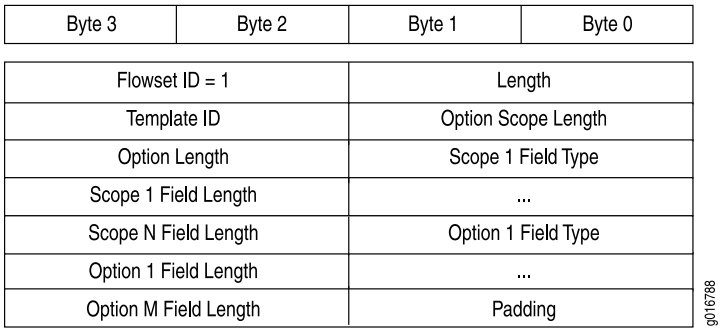


Table 30: Version 9 Options Template Format

Field	Description
FlowSet ID	FlowSet type. FlowSet ID 1 is reserved for the options template.
Length	FlowSet length. Option template FlowSets are fixed in length.
Template ID	Template ID of the options template. Options template values are greater than 255.
Option Scope Length	Length, in bytes, of any scope field definition that is part of the options template record.
Scope 1 Field Type	Relevant process. The Junos OS supports the system process (1).
Scope 1 Field Length	Length, in bytes, of the option field.
Padding	Bytes the exporter inserts so that the subsequent FlowSet starts at a 4-byte aligned boundary.

Figure 24: Active Flow Monitoring Version 9 Options Data Record Format

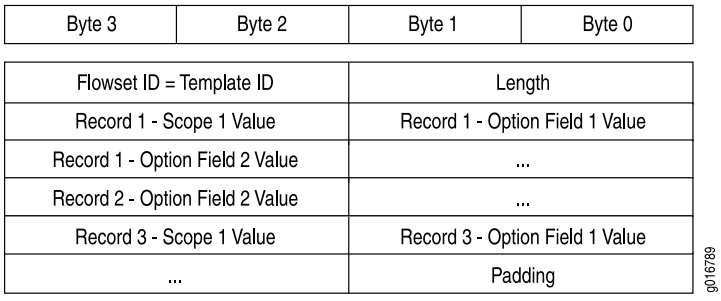


Table 31: Active Flow Monitoring Version 9 Options Data Record Format

Field	Description
FlowSet ID = Template ID	ID that precedes each options data flow record. The FlowSet ID maps to a previously generated template ID. The collector must use the FlowSet ID to find the corresponding template record and decode the options data flow records from the FlowSet.
Length	FlowSet length. Option FlowSets are fixed in length.
Number of Flow Data Records	Remainder of the options data FlowSet is a collection of flow data records, each containing a set of field values. The template record identified by the FlowSet ID dictates the type and length of the field values.
Padding	Bytes (in zeros) the exporter inserts so that the subsequent FlowSet starts at a 4-byte aligned boundary.

More Information About Passive and Active Flow Monitoring

To learn more about passive flow monitoring, active flow monitoring, cflowd versions 5 and 8, and flow monitoring version 9 see the following:

- Version 9: RFC 3954 at **http://www.faqs.org/rfcs/rfc3954.html**
- Versions 5 and 8: Cooperative Association for Internet Data Analysis (CAIDA) website at **http://www.caida.org**.
- *Junos Services Interfaces Configuration Guide*
- *Junos Policy Framework Configuration Guide*
- Internet draft draft-cavuto-dtcp-01.txt, *DTCP: Dynamic Tasking Control Protocol* (expires March 2007)

For more information on IPSec and the ES PIC, see the *Junos System Basics Configuration Guide*.

PART 2

Index

Index

N

S