



Configuring Cisco Performance Monitor

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Finding Feature Information

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

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

Information About Cisco Performance Monitor

Overview of Cisco Performance Monitor

Cisco Performance Monitor enables you to monitor the flow of packets in your network and become aware of any issues that might impact the flow before it starts to significantly impact the performance of the application in question. Performance monitoring is especially important for video traffic because high quality interactive

video traffic is highly sensitive to network issues. Even minor issues that may not affect other applications can have dramatic effects on video quality.

Because Cisco Performance Monitor uses similar software components and commands as Cisco NetFlow and Cisco Flexible NetFlow, familiarity with these products will help you to understand how to configure Cisco Performance Monitor. These products provide statistics on packets flowing through a router and are the standard for acquiring IP operational data from IP networks. They provide data to support network and security monitoring, network planning, traffic analysis, and IP accounting. For more information about Cisco NetFlow and Cisco Flexible NetFlow, see the documents listed in the Additional References section.

For more information about the design, configuration, and troubleshooting of Performance Monitor and other Cisco Medianet products, including a Quick Start Guide and Deployment Guide, see the Cisco Medianet Knowledge Base Portal, located at <http://www.cisco.com/web/solutions/medianet/knowledgebase/index.html>.

Prerequisites for Configuring Cisco Performance Monitor

The following prerequisites must be met before you can configure Cisco Performance Monitor:

IPv4 Traffic

- The networking device must be configured for IPv4 routing.
- One of the following must be enabled on your router and on any interfaces on which you want to enable Cisco Performance Monitor: Cisco Express Forwarding or distributed Cisco Express Forwarding.

IPv6 Traffic

- Cisco Express Forwarding must be enabled on your router and on any interfaces on which you want to enable Cisco Performance Monitor. You can use the **ipv6 cef** command to enable Cisco Express Forwarding.

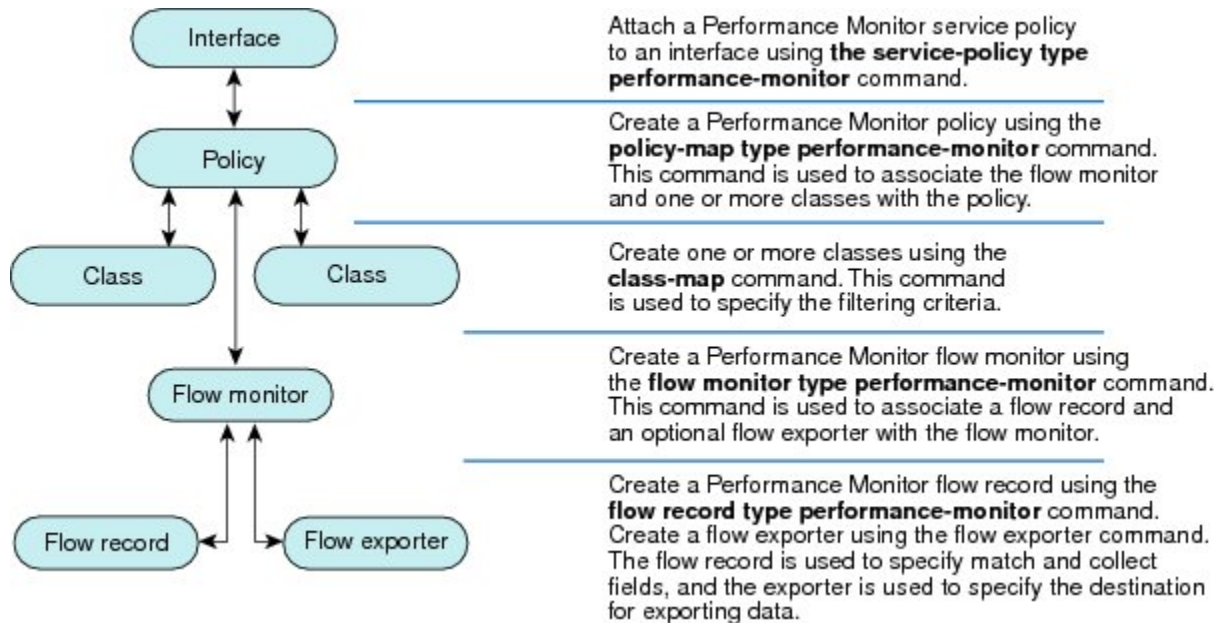
Configuration Components of Cisco Performance Monitor

To configure Cisco Performance Monitor, configure many of the same basic elements that you normally configure for Flexible NetFlow:

- Interface
- Policy
- Class
- Flow monitor
- Flow record
- Flow exporter

The figure below shows how these elements are related to each other. The elements at the bottom of the figure are configured first.

Figure 1: Cisco Performance Monitor Components



As shown above, a policy includes one or more classes. Each class has a flow monitor associated with it, and each flow monitor has a flow record and an optional flow exporter associated with it. These elements are configured in the following order:

- 1 Configure a flow record to specify the key and non-key fields that you want to monitor. This is configured using **match** and **collect** commands. You can also optimally configure a flow exporter to specify the export destination. For Cisco Performance Monitor, you must configure a **performance-monitor** type flow record.
- 2 Configure a flow monitor that includes the flow record and flow exporter. For Cisco Performance Monitor, you must configure a **performance-monitor** type flow monitor.
- 3 Configure a class to specify the filtering criteria using the **class-map** command.
- 4 Configure a policy to include one or more classes and one or more **performance-monitor** type flow monitors using the **policy-map** command. For Cisco Performance Monitor, you must configure **performance-monitor** type policies.
- 5 Associate a **performance-monitor** type policy to the appropriate interface using the **service-policy type performance-monitor** command. From release 15.5(2)T, you can add up to three different input and three different output policies on the same interface.

Data That You Can Monitor Using Cisco Performance Monitor

You can monitor the following information by configuring a flow record with **collect** or **match** commands for the corresponding non-key fields:

**Tip**

For more information about these statistics, see the **show performance monitor status** command in the *Cisco Media Monitoring Command Reference*.

- IP Packet Count
- IP TTL
- IP TTL minimum
- IP TTL maximum
- Flow to Interface Mapping
- IP Flow destination address and port, source address and port, and protocol
- RTP Synchronization Source (SSRC)
- IP Octets Count
- Media Stream Packet Count
- Media Stream Octet Count
- Media Byte Rate
- Media Byte Count
- Media Packet Rate
- Media Packet Loss Count
- Media Packet Loss Rate
- Packets Expected Count
- Measured Rate
- Media Loss Event Count
- Round Trip Time (RTT)
- Interarrival Jitter (RFC3550) max
- Interarrival Jitter (RFC3550) min 2
- Interarrival Jitter (RFC3550) mean
- Media Rate Variation
- Monitor Event
- Media Error
- Media Stop
- IP Byte Count
- IP Byte Rate
- IP Source Mask
- IP Destination Mask

- Epoch of A Monitoring Interval
- Packet Forwarding Status
- Packet Drops
- DSCP and IPv6 Traffic Class

SNMP MIB Support for Cisco Performance Monitor

Cisco Performance Monitor provides support for the use of the industry-standard Simple Network Management Protocol (SNMP) to monitor media streams. This support is implemented with the addition of the following Cisco proprietary SNMP Management Information Base (MIB) modules:

- **CISCO-FLOW-MONITOR-TC-MIB**—Defines the textual conventions common to the following MIB modules.
- **CISCO-FLOW-MONITOR-MIB**—Defines the framework that describes the flow monitors supported by a system, the flows that it has learned, and the flow metrics collected for those flows.
- **CISCO-RTP-METRICS-MIB**—Defines objects that describe the quality metrics collected for RTP streams, similar to those described by an RTCP Receiver Report packet (RFC 3550).
- **CISCO-IP-CBR-METRICS-MIB**—Defines objects that describe the quality metrics collected for IP streams that have a Constant Bit Rate (CBR).

For detailed information about these MIBs, and to locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at <http://www.cisco.com/go/mibs>.

This feature also includes two new command-line interface (CLI) commands and one modified CLI command. The commands are as follows:

- **snmp-server host**—Enables the delivery of flow monitoring SNMP notifications to a recipient.
- **snmp-server enable traps flowmon**—Enables flow monitoring SNMP notifications. By default, flow monitoring SNMP notifications are disabled.
- **snmp mib flowmon alarm history**—Sets the maximum number of entries maintained by the flow monitor alarm history log.

For more information about these commands, see the Cisco IOS Master Command List.

Limitations for the Catalyst 6500 Platform

Cisco Performance Monitor has the following limitations on the Catalyst 6000 platform:

- There are some limitations on which types of interfaces can be monitored. The next two tables list which types of interfaces are supported for ingress and egress monitoring on the Catalyst 6500 platform.

Table 1: Support for Ingress Interfaces

Interface Type	Support
Layer 3 Routed Port	Yes

Interface Type	Support
Layer 3 Sub-interface (a)	No
Layer 3 port channels	Yes
Layer 3 port-channel sub-interface (a)	No
Layer 3 SVI (b)	Partial (see the third bullet below)
L3 Tunnels	No
Layer 2 Physical (Switched) Ports	Yes
Layer 2 Port-channels	Yes
Layer 2 Vlans	Yes

Table 2: Support for Egress Interfaces

Interface Type	Support
Layer 3 Routed Port	Yes
Layer 3 Sub-interface (a)	Yes
Layer 3 port channels	Yes
Layer 3 port-channel sub-interface (a)	Yes
Layer 3 SVI (b)	Yes
L3 Tunnels	No
Layer 2 Physical (Switched) Ports	No
Layer 2 Port-channels	No
Layer 2 Vlans	Yes

- Performance monitoring on VRFs is not supported.
- Performance monitoring of multicast flows is supported on the ingress direction.
- Routed traffic from a trunk port on a VLAN interface cannot not be monitored because it is not possible to identify the source VLAN interface for the traffic. You will see the following syslog message: "Routed traffic from trunk ports will not be monitored by ingress policy on VLAN interface."

For a workaround, you can configure a performance monitoring policy on a trunk interface. This monitoring will result in additional CPU usage.

- You cannot use match all type Class maps. Only match any type of lookups are supported. If you configure performance monitoring to use match-all type class maps, it will result in the cloning of packet to the CPU. Packets will then again be classified in the CPU when match-all classes are properly applied and packet are dropped if required. This causes higher than expected CPU usage.
- Performance monitoring policy on the egress of a VLAN interface will not monitor traffic getting bridged within the VLAN. This is due to hardware limitation. Workaround is to apply the policy at the ingress of VLAN interface as well as egress. Policy on the ingress of the VLAN interface will monitor bridged packets.
- Cloned packets from Egress policies can only be software rate-limited. No hardware-based protection is available for these packets. Therefore, you might see high interrupt CPU usage during scenarios when many flows are being monitored.
- Egress performance monitoring makes use of a recirculation mechanism on the Catalyst 6500 platform. This introduces several microseconds of additional latency to the frame switching.
- Performance monitoring is not supported for the packets switched using the Fast (CEF) Path.
- Lawful intercept and performance monitoring makes use of the same mechanism for cloning the packets. The Lawful Intercept feature takes precedence over performance monitoring. Therefore, performance monitoring does not function when the Lawful Intercept feature is enabled. When this occurs, a syslog message is created.
- Performance monitoring makes use of same mechanism as other features, such as Optimized ACL logging, VACL Capture, IPv6 Copy, and so on. The feature that is enabled first takes precedence. The other features are blocked from being configured and a syslog message is created.

When reacts (including media-stop) are configured under a performance monitoring policy and when the traffic is unstable, syslog messages are logged into the buffer and are not printed on the console screen.

Restrictions for Performance Monitor

- On Cisco ASR 1000 Series Aggregation Services Routers, you can configure only 30 fields in a flow record.

How to Configure Troubleshoot and Maintain Cisco Performance Monitor

**Note**

Many of the Flexible NetFlow commands, keywords, and arguments used in used in these tasks are available in previous releases. For more information about these existing Flexible NetFlow commands, keywords, and arguments, refer to the *Cisco IOS Flexible NetFlow Command Reference*.

Configuring a Flow Exporter for Cisco Performance Monitor

Flow exporters are used to send the data that you collect with Cisco Performance Monitor to a remote system such as a NetFlow Collection Engine. Flow exporters use user datagram protocol (UDP) as the transport protocol and use the Version 9 export format.

To configure a flow exporter for the flow monitor, in order to export the data that is collected by Cisco Performance Monitor to a remote system for further analysis and storage, perform the following optional task. For Cisco Performance Monitor, flow exporters are configured the same way as they are configured for Cisco IOS Flexible NetFlow. For more information, see *Configuring Data Export for Cisco IOS Flexible NetFlow with Flow Exporters*.



Note

Each flow exporter supports only one destination. If you want to export the data to multiple destinations, you must configure multiple flow exporters and assign them to the flow monitor.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **flow exporter** *exporter-name*
4. **description** *description*
5. **destination** *{ip-address | hostname}* [**vrf** *vrf-name*]
6. **export-protocol** **netflow-v9**
7. **dscp** *dscp*
8. **source** *interface-type interface-number*
9. **option** *{exporter-stats | interface-table | sampler-table}* [**timeout** *seconds*]
10. **output-features**
11. **template data timeout** *seconds*
12. **transport udp** *udp-port*
13. **ttl** *seconds*
14. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.

	Command or Action	Purpose
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	flow exporter exporter-name Example: Router(config)# flow exporter EXPORTER-1	Creates the flow exporter and enters Flexible NetFlow flow exporter configuration mode. <ul style="list-style-type: none"> This command also allows you to modify an existing flow exporter.
Step 4	description description Example: Router(config-flow-exporter)# description Exports to the datacenter	(Optional) Configures a description to the exporter that will appear in the configuration and the display of the show flow exporter command.
Step 5	destination {ip-address hostname} [vrf vrf-name] Example: Router(config-flow-exporter)# destination 172.16.10.2	Specifies the IP address or hostname of the system to which the exporter sends data.
Step 6	export-protocol netflow-v9 Example: Router(config-flow-exporter)# export-protocol netflow-v9	Specifies the version of the NetFlow export protocol used by the exporter. Only the default value (netflow-v9) is supported.
Step 7	dscp dscp Example: Router(config-flow-exporter)# dscp 63	(Optional) Configures differentiated services code point (DSCP) parameters for datagrams sent by the exporter. <ul style="list-style-type: none"> The range for the <i>dscp</i> argument is from 0 to 63. Default: 0.
Step 8	source interface-type interface-number Example: Router(config-flow-exporter)# source ethernet 0/0	(Optional) Specifies the local interface from which the exporter will use the IP address as the source IP address for exported datagrams.
Step 9	option {exporter-stats interface-table sampler-table} [timeout seconds] Example: Router(config-flow-exporter)# option exporter-stats timeout 120	(Optional) Configures options data parameters for the exporter. <ul style="list-style-type: none"> You can configure all three options concurrently. The range for the <i>seconds</i> argument is 1 to 86,400. Default: 600.

	Command or Action	Purpose
Step 10	output-features Example: <pre>Router(config-flow-exporter)# output-features</pre>	(Optional) Enables sending export packets using quality of service (QoS) and encryption.
Step 11	template data timeout seconds Example: <pre>Router(config-flow-exporter)# template data timeout 120</pre>	(Optional) Configure resending of templates based on a timeout. <ul style="list-style-type: none"> • The range for the <i>seconds</i> argument is 1 to 86400 (86400 seconds = 24 hours).
Step 12	transport udp udp-port Example: <pre>Router(config-flow-exporter)# transport udp 650</pre>	Configures UDP as the transport protocol and specifies the UDP port on which the destination system is listening for exported datagrams. <ul style="list-style-type: none"> • The range for the <i>udp-port</i> argument is from 1 to 65536.
Step 13	ttl seconds Example: <pre>Router(config-flow-exporter)# ttl 15</pre>	(Optional) Configures the time-to-live (TTL) value for datagrams sent by the exporter. <ul style="list-style-type: none"> • The range for the <i>seconds</i> argument is from 1 to 255.
Step 14	end Example: <pre>Router(config-flow-exporter)# end</pre>	Exits flow exporter configuration mode and returns to privileged EXEC mode.

Troubleshooting Tips

To check the configuration and status of your flow exporter, use the **show flow exporter** command.

Configuring a Flow Record for Cisco Performance Monitor

The basic concepts and techniques for configuring a flow record for Cisco Performance Monitor are the same as flow records for Flexible NetFlow. The flow record specifies how the data collected data is aggregated and presented. The only significant difference is that, for Cisco Performance Monitor, the command includes **type performance-monitor**.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **flow record type performance-monitor *record-name***
4. **match ipv4 {destination {address | prefix[minimum-mask *mask*]} | protocol} source {address | prefix[minimum-mask *mask*]}**
5. **match transport {destination-port | rtp [*ssrc*] | source-port}**
6. **collect application media {bytes {rate | counter} | packets {rate | counter} | events}**
7. **collect counter {bytes [long | rate] | packets [dropped [long] | long]}**
8. **collect interface {input | output}**
9. **collect ipv4 {destination mask [minimum-mask *mask*] | dscp | source mask [minimum-mask *mask*] | ttl [minimum | maximum]}**
10. **collect monitor event**
11. **collect routing forwarding-status [reason]**
12. **collect timestamp internal**
13. **collect transport {event packet-loss counter | packets {expected counter | lost {counter | rate}} | round-trip-time | rtp jitter {minimum | mean | maximum}}**
14. **collect flow direction**
15. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	flow record type performance-monitor <i>record-name</i> Example: Router(config)# flow record type performance-monitor record-8	Creates a flow record and enters flow record configuration mode. <ul style="list-style-type: none"> • This command also allows you to modify an existing flow record.
Step 4	match ipv4 {destination {address prefix[minimum-mask <i>mask</i>]} protocol} source {address prefix[minimum-mask <i>mask</i>]}	Specifies that one or more of the IPv4 fields will be used as a key field.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router(config-flow-record)# match ipv4 destination address</pre>	
Step 5	<p>match transport {destination-port rtp [ssrc] source-port}</p> <p>Example:</p> <pre>Router(config-flow-record)# match transport destination-port</pre>	Specifies that one or more of the transport layer fields will be used as a key field, including the Synchronization Source (SSRC) field in the Real-Time Transport Protocol (RTP) packet header.
Step 6	<p>collect application media {bytes{rate counter} packets{rate counter} events}</p> <p>Example:</p> <pre>Router(config-flow-record)# collect application media events</pre>	Specifies that the application media bytes, packets, or events will be used as a nonkey field. An application event occurs when either one of the thresholds specified by a react statement for the flow was crossed at least once in the monitoring interval or no media packets were seen.
Step 7	<p>collect counter {bytes[long rate] packets[dropped[long] long]}</p> <p>Example:</p> <pre>Router(config-flow-record)# collect counter bytes long</pre>	Specifies the number of bytes or packets that will be used as a nonkey field.
Step 8	<p>collect interface {input output}</p> <p>Example:</p> <pre>Router(config-flow-record)# collect interface input</pre>	Specifies that the input or output interface will be used as a nonkey field.
Step 9	<p>collect ipv4 {destination mask[minimum-mask mask] dscp source mask[minimum-mask mask] ttl[minimum maximum]}</p> <p>Example:</p> <pre>Router(config-flow-record)# collect ipv4 dscp</pre>	Specifies that the IPv4 differentiated services code point (DCSP) field or the IPv4 time-to-live (TTL) field will be used as a nonkey field.
Step 10	<p>collect monitor event</p> <p>Example:</p> <pre>Router(config-flow-record)# collect monitor event</pre>	Specifies that the monitor event field will be used as a nonkey field. A monitor event occurs when no media application packets were seen

	Command or Action	Purpose
Step 11	collect routing forwarding-status [reason] Example: <pre>Router(config-flow-record)# collect routing forwarding-status</pre>	Specifies that the one or more of the routing attributes will be used as a nonkey field.
Step 12	collect timestamp internal Example: <pre>Router(config-flow-record)# collect timestamp internal</pre>	Specifies that the system timestamp of the first seen or last seen packet in a flow will be used as a nonkey field.
Step 13	collect transport {event packet-loss counter packets {expected counter lost {counter rate} } round-trip-time rtp jitter {minimum mean maximum} } Example: <pre>Router(config-flow-record)# collect transport packets expected counter</pre>	Specifies that one or more of the transport layer fields will be used as a nonkey field. These fields include metrics for: <ul style="list-style-type: none"> • Packet-loss counter • Expected packets counter • Jitter
Step 14	collect flow direction Example: <pre>Router(config-flow-record)# collect flow direction</pre>	Specifies that the flow direction field will be used as a nonkey field.
Step 15	end Example: <pre>Router(config-flow-record)# end</pre>	Exits flow record configuration mode and returns to privileged EXEC mode.

Troubleshooting Tips

To check the configuration and status of your flow record, use the **show flow record type performance-monitor** command.

Configuring a Flow Monitor for Cisco Performance Monitor

The basic concepts for configuring a flow monitor for Cisco Performance Monitor are the same as flow monitors for Flexible NetFlow. Each flow monitor has a separate cache assigned to it and requires a record to define the contents and layout of its cache entries.

When you configure a flow monitor, you must use either:

- An existing flow record that you configured
- One of the following default predefined records:
 - The default RTP record (**default-rtp**)
 - The default TCP record (**default-tcp**)
 - Flexible NetFlow's "NetFlow IPv4 original input"

**Note**

To modify a flow record, you must remove it from all flow monitors it is associated with.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **flow monitor type performance-monitor** *monitor-name*
4. **description** *description*
5. **cache** {**entries**|**timeout**|**type**}
6. **statistics** {**packet**}
7. **exporter** *exporter-name*
8. **record** {*record-name*|**default-rtp**|**default-tcp**|**netflow ipv4 original-input**}
9. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	flow monitor type performance-monitor <i>monitor-name</i> Example: Device(config)# flow monitor type performance-monitor FLOW-MONITOR-2	Creates a flow monitor and enters flow monitor configuration mode. <ul style="list-style-type: none"> • This command also allows you to modify an existing flow monitor.

	Command or Action	Purpose
Step 4	description <i>description</i> Example: <pre>Device(config-flow-monitor)# description Used for monitoring IPv4 traffic</pre>	(Optional) Creates a description for the flow monitor.
Step 5	cache { <i>entries</i> <i>timeout</i> <i>type</i> } Example: <pre>Device(config-flow-monitor)# cache timeout 20</pre>	(Optional) Creates a cache for the flow monitor.
Step 6	statistics { <i>packet</i> } Example: <pre>Device(config-flow-monitor)# statistics</pre>	(Optional) specifies whether statistics are collected for the flow monitor.
Step 7	exporter <i>exporter-name</i> Example: <pre>Device(config-flow-monitor)# exporter export-4</pre>	Specifies the flow exporter for the flow monitor.
Step 8	record { <i>record-name</i> default-rtp default-tcp netflow ipv4 original-input } Example: <pre>Device(config-flow-monitor)# record default-rtp</pre>	Specifies the flow record for the flow monitor.
Step 9	end Example: <pre>Device(config-flow-monitor)# end</pre>	Exits flow monitor configuration mode and returns to privileged EXEC mode.

Troubleshooting Tips

To check the configuration and status of your flow monitor, use the **show flow monitor type performance-monitor** command and the **show running-config flow monitor** command.

Configuring a Flow Class for Cisco Performance Monitor

The basic concepts and techniques for configuring a class for Cisco Performance Monitor are the same as for any other type of class. The class specifies the filter that determines which flow traffic to monitor. The filter is configured using various match commands in class-map mode.

If you do not already have a flow monitor configured, see [Configuring a Flow Monitor for Cisco Performance Monitor](#), on page 13:



Note

Nested class maps are not supported. In other words, you cannot use the **class-map** command while in class-map configuration mode (config-cmap).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **class-map** *class-name*
4. **description** *description*
5. **match** {*access-group* {*access-group* | **name** *access-group-name*} | **any** | **class-map** *class-map-name* | **cos** *cos-value* | **destination-address** **mac** *address* | **discard-class** *class-number* | **dscp** *dscp-value* | **flow** {**direction** | **sampler**} | **fr-de** | **fr-dlci** *dlci-number* | **input-interface** *interface-name* | **ip** {**rtp** *starting-port-number* *port-range* | **precedence** | **dscp**} | **mpls experimental topmost** *number* | **not match-criterion** | **packet length** {**max** *maximum-length-value* [**min** *minimum-length-value*] | **min** *minimum-length-value* [**max** *maximum-length-value*]} | **precedence** {*precedence-criteria1* | *precedence-criteria2* | *precedence-criteria3* | *precedence-criteria4*} | **protocol** *protocol-name* | **qos-group** *qos-group-value* | **source-address** **mac** *address-destination* | **vlan** {*vlan-id* | *vlan-range* | *vlan-combination*}}
6. **rename** *class-name*
7. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	class-map <i>class-name</i> Example: Device(config)# class-map class-4	Specifies a class to include in the policy. Repeat this command for each class that you want to include in the policy.
Step 4	description <i>description</i> Example: Device(config-cmap)# description match any packets	(Optional) Creates a description for the flow class.
Step 5	match { <i>access-group</i> { <i>access-group</i> name <i>access-group-name</i> } any class-map <i>class-map-name</i> cos <i>cos-value</i> destination-address mac <i>address</i> discard-class <i>class-number</i> dscp <i>dscp-value</i> flow { direction sampler } fr-de fr-dlci <i>dlci-number</i> input-interface <i>interface-name</i> ip { rtp <i>starting-port-number</i> <i>port-range</i> precedence dscp } mpls experimental topmost <i>number</i> not match-criterion packet length { max <i>maximum-length-value</i> [min <i>minimum-length-value</i>] min <i>minimum-length-value</i> [max <i>maximum-length-value</i>]} precedence { <i>precedence-criteria1</i> <i>precedence-criteria2</i> <i>precedence-criteria3</i> <i>precedence-criteria4</i> } protocol <i>protocol-name</i> qos-group <i>qos-group-value</i> source-address mac <i>address-destination</i> vlan { <i>vlan-id</i> <i>vlan-range</i> <i>vlan-combination</i> }} Example: Device(config-cmap)# match any	Specifies the classification criteria. For more information and examples, see the <i>Cisco Media Monitoring Command Reference</i> .
Step 6	rename <i>class-name</i> Example: Device(config-cmap)# rename class-4	Specifies a new name for the flow class.
Step 7	end Example: Device(config-cmap)# end	Exits the current configuration mode and returns to privileged EXEC mode.

Troubleshooting Tips

To check the configuration and status of your flow class, use the **show policy-map type performance-monitor** or **show class-map** command.

Configuring a Flow Policy for Cisco Performance Monitor Using an Existing Flow Monitor

The basic concepts and techniques for configuring a class for Cisco Performance Monitor are the same as for any other type of class. The class specifies which flow monitor is included. The only significant difference is that, for Cisco Performance Monitor, the **policy-map** command includes **type performance-monitor**.

If you do not already have a flow monitor configured or do not want to use any of your existing flow monitors for a new class, you can configure it using the flow monitor inline option and specifying which flow record and flow exporter are included.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map type performance-monitor** *policy-name*
4. **parameter-map type performance-monitor system-default-aor**
5. **class** {*class-name* | **class-default**}
6. **flow monitor** *monitor-name*
7. **monitor metric ip-cbr**
8. **rate layer3** {*byte-rate* {**bps** | **kbps** | **mbps** | **gbps**} | **packet**}
9. **exit**
10. **monitor metric rtp**
11. **clock-rate** {*type-number* | *type-name* | **default**} *rate*
12. **max-dropout** *number*
13. **max-reorder** *number*
14. **min-sequential** *number*
15. **ssrc maximum** *number*
16. **exit**
17. **monitor parameters**
18. **flows** *number*
19. **interval duration** *number*
20. **history** *number*
21. **timeout** *number*
22. **exit**
23. **react** *ID* {**media-stop** | **mrvt** | **rtp-jitter-average** | **transport-packets-lost-rate**}
24. **action** {**snmp** | **syslog**}
25. **alarm severity** {**alert** | **critical** | **emergency** | **error** | **info**}
26. **alarm type** {**discrete** | **grouped** {**count** *number* | **percent** *number*}}
27. **threshold value** {**ge** *number* | **gt** *number* | **le** *number* | **lt** *number* | **range** *rng-start* *rng-end*}
28. **description** *description*
29. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Device> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Device# configure terminal	Enters global configuration mode.
Step 3	policy-map type performance-monitor <i>policy-name</i> Example: Device(config)# policy-map type performance-monitor FLOW-MONITOR-4	Creates a policy and enters policy configuration mode. <ul style="list-style-type: none"> • This command also allows you to modify an existing policy.
Step 4	parameter-map type performance-monitor system-default-aor Example: Device(config-pmap)# parameter-map type performance-monitor system-default-aor	Creates a parameter map for Performance Monitor. The only map available is the system-default -aor map
Step 5	class { <i>class-name</i> class-default } Example: Device(config-pmap)# class class-4	Specifies a class to include in the policy. Repeat this command for each class that you want to include in the policy.
Step 6	flow monitor <i>monitor-name</i> Example: Device(config-pmap-c)# flow monitor FLOW-MONITOR-4	Enters flow monitor configuration mode. If you do not want to use an existing flow monitor, you can use the inline option to configure a new one, as described in the Configuring a Flow Policy for Cisco Performance Monitor Without Using an Existing Flow Monitor , on page 23.
Step 7	monitor metric ip-cbr Example: Device(config-pmap-c)# monitor metric ip-cbr	(Optional) Enters IP-CBR monitor metric configuration mode.
Step 8	rate layer3 { <i>byte-rate</i> { bps kpbs mbps gbps } packet }	(Optional) Specifies the rate for monitoring the metrics. <ul style="list-style-type: none"> • <i>byte-rate</i> --Data rate in Bps, kBps, mBps, or gBps. The range is 1 to 65535.

	Command or Action	Purpose
	<p>Example:</p> <pre>Device(config-pmap-c-mipcbr)# rate layer3 248 mbps</pre>	<ul style="list-style-type: none"> • packet --Packet rate in packets per second.
Step 9	<p>exit</p> <p>Example:</p> <pre>Device(config-pmap-c-mipcbr)# exit</pre>	Returns to policy class configuration mode.
Step 10	<p>monitor metric rtp</p> <p>Example:</p> <pre>Device(config-pmap-c)# monitor metric rtp</pre>	Enters RTP monitor metric configuration mode.
Step 11	<p>clock-rate {<i>type-number</i> <i>type-name</i> default} <i>rate</i></p> <p>Example:</p> <pre>Device(config-pmap-c-mrtp)# clock-rate 8 9600</pre>	<p>Specifies the clock rate used to sample RTP video-monitoring metrics.</p> <p>For more information about the clock-type numbers and names, see the <i>Cisco Media Monitoring Command Reference</i>.</p> <p>The range for <i>rate</i> is 1 kHz to 192 kHz.</p>
Step 12	<p>max-dropout <i>number</i></p> <p>Example:</p> <pre>Device(config-pmap-c-mrtp)# max-dropout 2</pre>	Specifies the maximum number of dropouts allowed when sampling RTP video-monitoring metrics.
Step 13	<p>max-reorder <i>number</i></p> <p>Example:</p> <pre>Device(config-pmap-c-mrtp)# max-reorder 4</pre>	Specifies the maximum number of reorders allowed when sampling RTP video-monitoring metrics.
Step 14	<p>min-sequential <i>number</i></p> <p>Example:</p> <pre>Device(config-pmap-c-mrtp)# min-sequential 2</pre>	Specifies the minimum number of sequential packets required to identify a stream as being an RTP flow.
Step 15	<p>ssrc maximum <i>number</i></p> <p>Example:</p> <pre>Device(config-pmap-c-mrtp)# ssrc maximum 20</pre>	Specifies the maximum number of SSRCs that can be monitored within the same flow. A flow is defined by the protocol, source/destination address, and source/destination port).

	Command or Action	Purpose
Step 16	exit Example: Device(config-pmap-c-mrtp)# exit	Returns to policy class configuration mode.
Step 17	monitor parameters Example: Device(config-pmap-c)# monitor parameters	Enters monitor parameters configuration mode.
Step 18	flows number Example: Device(config-pmap-c-mparam)# flows 40	Specifies the maximum number of flows for each monitor cache.
Step 19	interval duration number Example: Device(config-pmap-c-mparam)# interval duration 40	Specifies the interval, in seconds, between samples taken of video-monitoring metrics.
Step 20	history number Example: Device(config-pmap-c-mparam)# history 4	Specifies the number of historical buckets of collected video-monitoring metrics.
Step 21	timeout number Example: Device(config-pmap-c-mparam)# timeout 20	Specifies the number of intervals before a stopped flow is removed from the database.
Step 22	exit Example: Device(config-pmap-c-mparam)# exit	Returns to policy class configuration mode.
Step 23	react ID {media-stop mrv rtp-jitter-average transport-packets-lost-rate} Example: Device(config-pmap-c)# react 41 rtp-jitter-average	Enters a mode where you can specify what reaction occurs when a threshold is violated for the following metrics: <ul style="list-style-type: none"> • ID-- ID for react configuration. Range is 1 to 65535. • media-stop --No traffic is found for the flow. • mrv --Ratio calculated by dividing the difference between the actual rate and the expected rate, by the expected rate. • rtp-jitter-average --Average jitter.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • transport-packets-lost-rate --Ratio calculated by dividing the number of lost packets by the expected packet count.
Step 24	action {snmp syslog} Example: Device(config-pmap-c-react)# action syslog	Specifies how violations of the thresholds will be reported.
Step 25	alarm severity {alert critical emergency error info} Example: Device(config-pmap-c-react)# alarm severity critical	Specifies which level of alarm will be reported. The default setting is info .
Step 26	alarm type {discrete grouped {count number percent number}} Example: Device(config-pmap-c-react)# alarm type discrete	Specifies which types of levels are considered alarms that require reporting. The default setting is discrete .
Step 27	threshold value {ge number gt number le number lt number range rng-start rng-end} Example: Device(config-pmap-c-react)# threshold value ge 20	<p>Specifies which types of threshold values are considered alarms that require reporting.</p> <p>If no value is set but the application name is configured as a key field, then the system uses the value for the threshold that it finds in the default map. If no value is set and the application name is not configured as a key field, then the default value is used for the threshold.</p> <p>If more than one react command is configured for the same policy and class but only one of the react configurations has threshold values set, then the values of the configured react take precedence and the rest of the threshold values are ignored.</p> <p>If more than one react command is configured for the same policy and none of them have the threshold value configured, then the default threshold value is applied for the configuration with the lowest react ID.</p>
Step 28	description description Example: Device(config-cmap-c-react)# description rtp-jitter-average above 40	(Optional) Creates a description for the reaction.

	Command or Action	Purpose
Step 29	end Example: Device(config-pmap-c-react)# end	Exits the current configuration mode and returns to privileged EXEC mode.

Troubleshooting Tips

To check the configuration and status of your flow policy, use the **show policy-map type performance-monitor** command.

Configuring a Flow Policy for Cisco Performance Monitor Without Using an Existing Flow Monitor

The basic concepts and techniques for configuring a class for Cisco Performance Monitor are the same as for any other type of class. The class specifies which flow monitor is included. The only significant difference is that, for Cisco Performance Monitor, the **policy-map** command includes **type performance-monitor**.

If you do not already have a flow monitor configured or do not want to use any of your existing flow monitors for a new class, you can configure it under the class configuration mode, by specifying which flow record and flow exporter are included.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map type performance-monitor** *policy-name*
4. **class** {*class-name* | **class-default**}
5. **flow monitor inline**
6. **record** {*record-name* | **default-rtp** | **default-tcp**}
7. **exporter** *exporter-name*
8. **exit**
9. **monitor metric ip-cbr**
10. **rate layer3** {*byte-rate* {**bps** | **kbits** | **mbits** | **gbits**} | **packet**}
11. **exit**
12. **monitor metric rtp**
13. **clock-rate** {*type-number* | *type-name*} *rate*
14. **max-dropout** *number*
15. **max-reorder** *number*
16. **min-sequential** *number*
17. **ssrc maximum** *number*
18. **exit**
19. **monitor parameters**
20. **flows** *number*
21. **interval duration** *number*
22. **history** *number*
23. **timeout** *number*
24. **exit**
25. **react** *ID* {**media-stop** | **mrvt** | **rtp-jitter-average** | **transport-packets-lost-rate**}
26. **action** {**snmp** | **syslog**}
27. **alarm severity** {**alert** | **critical** | **emergency** | **error** | **info**}
28. **alarm type** {**discrete** | **grouped** {**count** *number* | **percent** *number*}}
29. **threshold value** {**ge** *number* | **gt** *number* | **le** *number* | **lt** *number* | **range** *rng-start* *rng-end*}
30. **description** *description*
31. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable	Enables privileged EXEC mode.

	Command or Action	Purpose
	<p>Example:</p> <pre>Router> enable</pre>	<ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	<p>configure terminal</p> <p>Example:</p> <pre>Router# configure terminal</pre>	Enters global configuration mode.
Step 3	<p>policy-map type performance-monitor <i>policy-name</i></p> <p>Example:</p> <pre>Router(config)# policy-map type performance-monitor FLOW-MONITOR-4</pre>	<p>Creates a policy and enters policy configuration mode.</p> <ul style="list-style-type: none"> • This command also allows you to modify an existing policy.
Step 4	<p>class {<i>class-name</i> class-default}</p> <p>Example:</p> <pre>Router(config-pmap)# class class-4</pre>	Specifies a class to include in the policy. Repeat this command for each class that you want to include in the policy.
Step 5	<p>flow monitor inline</p> <p>Example:</p> <pre>Router(config-pmap-c)# flow monitor inline</pre>	Enters inline mode and enables you to configure a new flow monitor.
Step 6	<p>record {<i>record-name</i> default-rtp default-tcp}</p> <p>Example:</p> <pre>Router(config-pmap-c-flowmon)# record default-tcp</pre>	Specifies a flow record to associate with the flow monitor.
Step 7	<p>exporter <i>exporter-name</i></p> <p>Example:</p> <pre>Router(config-pmap-c-flowmon)# exporter exporter-4</pre>	Specifies a flow record to associate with the flow exporter.
Step 8	<p>exit</p> <p>Example:</p> <pre>Router(config-pmap-c-flowmon)# exit</pre>	Returns to policy class configuration mode.

	Command or Action	Purpose
Step 9	<p>monitor metric ip-cbr</p> <p>Example:</p> <pre>Router(config-pmap-c)# monitor metric ip-cbr</pre>	(Optional) Enters IP-CBR monitor metric configuration mode.
Step 10	<p>rate layer3 {<i>byte-rate</i> {bps kbps mbps gbps} packet}</p> <p>Example:</p> <pre>Router(config-pmap-c-mipcbr)# rate layer3 248 mbps</pre>	<p>(Optional) Specifies the rate for monitoring the metrics.</p> <ul style="list-style-type: none"> • <i>byte-rate</i> --Data rate in Bps, kBps, mBps, or gBps. The range is 1 to 65535. • packet --Packet rate in packets per second.
Step 11	<p>exit</p> <p>Example:</p> <pre>Router(config-pmap-c-mipcbr)# exit</pre>	Returns to policy class configuration mode.
Step 12	<p>monitor metric rtp</p> <p>Example:</p> <pre>Router(config-pmap-c)# monitor metric rtp</pre>	Enters RTP monitor metric configuration mode.
Step 13	<p>clock-rate {<i>type-number</i> <i>type-name</i>} <i>rate</i></p> <p>Example:</p> <pre>Router(config-pmap-c-mrtp)# clock-rate 8 9600</pre>	<p>Specifies the clock rate used to sample RTP video-monitoring metrics.</p> <p>For more information about the clock-type numbers and names, see the <i>Cisco Media Monitoring Command Reference</i>.</p> <p>The range for <i>rate</i> is 1 kHz to 192 kHz.</p>
Step 14	<p>max-dropout <i>number</i></p> <p>Example:</p> <pre>Router(config-pmap-c-mrtp)# max-dropout 2</pre>	Specifies the maximum number of dropouts allowed when sampling RTP video-monitoring metrics.
Step 15	<p>max-reorder <i>number</i></p> <p>Example:</p> <pre>Router(config-pmap-c-mrtp)# max-reorder 4</pre>	Specifies the maximum number of reorders allowed when sampling RTP video-monitoring metrics.
Step 16	<p>min-sequential <i>number</i></p> <p>Example:</p> <pre>Router(config-pmap-c-mrtp)# min-sequential 2</pre>	Specifies the minimum number of sequential packets required to identify a stream as being an RTP flow.

	Command or Action	Purpose
Step 17	ssrc maximum <i>number</i> Example: Router(config-pmap-c-mrtp)# ssrc maximum 20	Specifies the maximum number of SSRCs that can be monitored within the same flow. A flow is defined by the protocol, source/destination address, and source/destination port).
Step 18	exit Example: Router(config-pmap-c-mrtp)# exit	Returns to policy class configuration mode.
Step 19	monitor parameters Example: Router(config-pmap-c)# monitor parameters	Enters monitor parameters configuration mode.
Step 20	flows <i>number</i> Example: Router(config-pmap-c-mparam)# flows 40	Specifies the maximum number of flows for each monitor cache.
Step 21	interval duration <i>number</i> Example: Router(config-pmap-c-mparam)# interval duration 40	Specifies the duration of the intervals, in seconds, for collecting monitoring metrics.
Step 22	history <i>number</i> Example: Router(config-pmap-c-mparam)# history 4	Specifies the number of historical intervals of collected monitoring metrics to display.
Step 23	timeout <i>number</i> Example: Router(config-pmap-c-mparam)# timeout 20	Specifies the number intervals before a stopped flow is removed from the database.
Step 24	exit Example: Router(config-pmap-c-mparam)# exit	Returns to policy class configuration mode.
Step 25	react <i>ID</i> { media-stop mrvt rtp-jitter-average transport-packets-lost-rate }	Enters a mode where you can specify what reaction occurs when a threshold is violated for the following metrics:

	Command or Action	Purpose
	<p>Example:</p> <pre>Router(config-pmap-c)# react 41 rtp-jitter-average</pre>	<ul style="list-style-type: none"> • ID-- ID for react configuration. Range is 1 to 65535. • media-stop --No traffic is found for the flow. • mrsv --Ratio calculated by dividing the difference between the actual rate and the expected rate, by the expected rate. • rtp-jitter-average --Average jitter. • transport-packets-lost-rate --Ratio calculated by dividing the number of lost packets by the expected packet count.
Step 26	<p>action {snmp syslog}</p> <p>Example:</p> <pre>Router(config-pmap-c-react)# action syslog</pre>	Specifies how violations of the thresholds with be reported.
Step 27	<p>alarm severity {alert critical emergency error info}</p> <p>Example:</p> <pre>Router(config-pmap-c-react)# alarm severity critical</pre>	Specifies which level of alarm will be reported.The default setting is info .
Step 28	<p>alarm type {discrete grouped {count <i>number</i> percent <i>number</i>}</p> <p>Example:</p> <pre>Router(config-pmap-c-react)# alarm severity critical</pre>	Specifies which types of levels are considered alarms that require reporting. The default setting is discrete .
Step 29	<p>threshold value {ge <i>number</i> gt <i>number</i> le <i>number</i> lt <i>number</i> range <i>rng-start rng-end</i>}</p> <p>Example:</p> <pre>Router(config-pmap-c-react)# threshold value ge</pre>	Specifies which types of levels values are considered alarms that require reporting.
Step 30	<p>description <i>description</i></p> <p>Example:</p> <pre>Router(config-cmap-c-react)# description rtp-jitter-average above 40</pre>	(Optional) Creates a description for the reaction.

	Command or Action	Purpose
Step 31	end Example: Router(config-pmap-c-react)# end	Exits the current configuration mode and returns to privileged EXEC mode.

Troubleshooting Tips

To check the configuration and status of your flow policy, use the **show policy-map type performance-monitor** command.

Applying a Cisco Performance Monitor Policy to an Interface Using an Existing Flow Policy

Before it can be activated, a Cisco Performance Monitor policy must be applied to at least one interface. To activate a Cisco Performance Monitor policy, perform the following required task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **service-policy type performance-monitor** {input | output} *policy-name*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.

	Command or Action	Purpose
Step 3	<p>interface <i>type number</i></p> <p>Example:</p> <pre>Router(config)# interface ethernet 0/0</pre>	Specifies an interface and enters interface configuration mode.
Step 4	<p>service-policy type performance-monitor {input output} <i>policy-name</i></p> <p>Example:</p> <pre>Router(config-if)# service-policy type performance-monitor input mypolicy-map-4 Router(config-if)# service-policy type performance-monitor input rtp Router(config-if)# service-policy type performance-monitor input tcp</pre> <p>Example:</p> <pre>Router(config-if)# service-policy type performance-monitor output rtp Router(config-if)# service-policy type performance-monitor output tcp Router(config-if)# service-policy type performance-monitor output test</pre>	<p>Attaches a policy map to an input interface or virtual circuit (VC), or an output interface or VC, to be used as the service policy for that interface or VC.</p> <ul style="list-style-type: none"> • input --Attaches the specified policy map to the input interface or input VC. • output --Attaches the specified policy map to the output interface or output VC. • policy-name --name of a service policy map (created by the policy-map command) to be attached. The name can be a maximum of 40 alphanumeric characters.
Step 5	<p>end</p> <p>Example:</p> <pre>Router(config-if)# end</pre>	Exits the current configuration mode and returns to privileged EXEC mode.

Troubleshooting Tips

To check the configuration and status of your service policy, use the following commands:

- **show performance monitor history**
- **show performance monitor status**
- **show policy-map ypre performance-monitor interface**

Applying a Cisco Performance Monitor Policy to an Interface Without Using an Existing Flow Policy

Before it can be activated, a Cisco Performance Monitor policy must be applied to at least one interface. To activate a Cisco Performance Monitor policy, perform the following required task.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **service-policy type performance-monitor inline** {**input** | **output**}
5. **match** {*access-group* {*access-group* | **name** *access-group-name*} | **any** | **class-map** *class-map-name* | **cos** *cos-value* | **destination-address** **mac** *address* | **discard-class** *class-number* | **dscp** *dscp-value* | **flow** {**direction** | **sampler**} | **fr-de** | **fr-dlci** *dldci-number* | **input-interface** *interface-name* | **ip** {**rtp** *starting-port-number port-range* | **precedence** | **dscp**} | **mpls experimental topmost** *number* | **not match-criterion** | **packet length** {**max** *maximum-length-value* [**min** *minimum-length-value*] | **min** *minimum-length-value* [**max** *maximum-length-value*]} | **precedence** {*precedence-criteria1* | *precedence-criteria2* | *precedence-criteria3* | *precedence-criteria4*} | **protocol** *protocol-name* | **qos-group** *qos-group-value* | **source-address** *mac address-destination* | **vlan** {*vlan-id* | *vlan-range* | *vlan-combination*}}
6. **flow monitor** {*monitor-name* | **inline**}
7. **record** {*record-name* | **default-rtp** | **default-tcp**}
8. **exporter** *exporter-name*
9. **exit**
10. **monitor metric ip-cbr**
11. **rate layer3** {*byte-rate* {**bps** | **kbits** | **mbits** | **gbits**} | **packet**}
12. **exit**
13. **monitor metric rtp**
14. **clock-rate** {*type-number* | *type-name*} *rate*
15. **max-dropout** *number*
16. **max-reorder** *number*
17. **min-sequential** *number*
18. **ssrc maximum** *number*
19. **exit**
20. **monitor parameters**
21. **flows** *number*
22. **interval duration** *number*
23. **history** *number*
24. **timeout** *number*
25. **exit**
26. **react** *ID* {**media-stop** | **mrp** | **rtp-jitter-average** | **transport-packets-lost-rate**}
27. **action** {**snmp** | **syslog**}
28. **alarm severity** {**alert** | **critical** | **emergency** | **error** | **info**}
29. **alarm type** {**discrete** | **grouped** {**count** *number* | **percent** *number*}}
30. **threshold value** {**ge** *number* | **gt** *number* | **le** *number* | **lt** *number* | **range** *rng-start rng-end*}
31. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	enable Example: Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> • Enter your password if prompted.
Step 2	configure terminal Example: Router# configure terminal	Enters global configuration mode.
Step 3	interface <i>type number</i> Example: Router(config)# interface ethernet 0/0	Specifies an interface and enters interface configuration mode.
Step 4	service-policy type performance-monitor inline { input output } Example: Example: Router(config-if)# service-policy type performance-monitor inline input	Attaches a policy map to an input interface or virtual circuit (VC), or an output interface or VC, to be used as the service policy for that interface or VC. <ul style="list-style-type: none"> • input --Attaches the specified policy map to the input interface or input VC. • output --Attaches the specified policy map to the output interface or output VC.
Step 5	match { <i>access-group</i> { <i>access-group</i> name <i>access-group-name</i> } any class-map <i>class-map-name</i> cos <i>cos-value</i> destination-address mac <i>address</i> discard-class <i>class-number</i> dscp <i>dscp-value</i> flow { direction sampler } fr-de fr-dlci <i>dlci-number</i> input-interface <i>interface-name</i> ip { rtp <i>starting-port-number port-range</i> precedence dscp } mpls experimental topmost <i>number</i> not match-criterion packet length { max <i>maximum-length-value</i> [min <i>minimum-length-value</i>] min <i>minimum-length-value</i> [max <i>maximum-length-value</i>]} precedence { <i>precedence-criteria1</i> <i>precedence-criteria2</i> <i>precedence-criteria3</i> <i>precedence-criteria4</i> } protocol <i>protocol-name</i> qos-group <i>qos-group-value</i> source-address <i>mac address-destination</i> vlan { <i>vlan-id</i> <i>vlan-range</i> <i>vlan-combination</i> }}	Specifies the classification criteria. For more information and examples, see the <i>Cisco Media Monitoring Command Reference</i> .

	Command or Action	Purpose
	<p>Example:</p> <pre>Router(config-if-spolicy-inline)# match any</pre>	
Step 6	<p>flow monitor {<i>monitor-name</i> inline}</p> <p>Example:</p> <pre>Router(config-if-spolicy-inline)# flow monitor inline</pre>	<p>Specifies an existing flow monitor to associate with a flow policy. If you do not want to use an existing flow monitor, you can use the inline option to configure a new one.</p> <p>If needed, you can also use the inline option to specify a flow record and flow exporter.</p>
Step 7	<p>record {<i>record-name</i> default-rtp default-tcp}</p> <p>Example:</p> <pre>Router(config-spolicy-inline-flowmon)# record default-tcp</pre>	<p>(Optional) If you do not want to use an existing flow monitor, and instead used the inline option, use this command to configure a flow record.</p>
Step 8	<p>exporter <i>exporter-name</i></p> <p>Example:</p> <pre>Router(config-spolicy-inline-flowmon)# exporter exporter-4</pre>	<p>(Optional) If you do not want to use an existing flow monitor, and instead used the inline option, use this command to configure a flow exporter.</p>
Step 9	<p>exit</p> <p>Example:</p> <pre>Router(config-spolicy-inline-flowmon)# exit</pre>	<p>Returns to service-policy inline configuration mode.</p>
Step 10	<p>monitor metric ip-cbr</p> <p>Example:</p> <pre>Router(config-if-spolicy-inline)# monitor metric ip-cbr</pre>	<p>Enters IP-CBR monitor metric configuration mode.</p>
Step 11	<p>rate layer3 {<i>byte-rate</i> {bps kbps mbps gbps} packet}</p> <p>Example:</p> <pre>Router(config-spolicy-inline-mipcbr)# rate layer3 248 mbps</pre>	<p>Specifies the rate for monitoring the metrics.</p> <ul style="list-style-type: none"> • byte-rate --Data rate in Bps, kBps, mBps, or gBps. The range is 1 to 65535. • packet --Packet rate in packets per second.
Step 12	<p>exit</p> <p>Example:</p> <pre>Router(config-spolicy-inline-mipcbr)# exit</pre>	<p>Returns to service-policy inline configuration mode.</p>

	Command or Action	Purpose
Step 13	monitor metric rtp Example: <pre>Router(config-if-spolicy-inline)# monitor metric rtp</pre>	Enters RTP monitor metric configuration mode.
Step 14	clock-rate {type-number type-name} rate Example: <pre>Router(config-spolicy-inline-mrtp)# clock-rate 8 9600</pre>	<p>Specifies the clock rate used to sample RTP video-monitoring metrics.</p> <p>For more information about the clock-type numbers and names, see the <i>Cisco Media Monitoring Command Reference</i>.</p> <p>The range for <i>rate</i> is 1 kHz to 192 kHz.</p>
Step 15	max-dropout number Example: <pre>Router(config-spolicy-inline-mrtp)# max-dropout 2</pre>	Specifies the maximum number of dropouts allowed when sampling RTP video-monitoring metrics.
Step 16	max-reorder number Example: <pre>Router(config-spolicy-inline-mrtp)# max-reorder 4</pre>	Specifies the maximum number of reorders allowed when sampling RTP video-monitoring metrics.
Step 17	min-sequential number Example: <pre>Router(config-spolicy-inline-mrtp)# min-sequential 2</pre>	Specifies the minimum number of sequential packets required to identify a stream as being an RTP flow.
Step 18	ssrc maximum number Example: <pre>Router(config-spolicy-inline-mrtp)# ssrc maximum 20</pre>	Specifies the maximum number of SSRCs that can be monitored within the same flow. A flow is defined by the protocol, source/destination address, and source/destination port).
Step 19	exit Example: <pre>Router(config-spolicy-inline-mrtp)# exit</pre>	Returns to service-policy inline configuration mode.

	Command or Action	Purpose
Step 20	monitor parameters Example: <pre>Router(config-if-spolicy-inline)# monitor parameters</pre>	Enters monitor parameters configuration mode.
Step 21	flows <i>number</i> Example: <pre>Router(config-spolicy-inline-mparam)# flows 40</pre>	Specifies the maximum number of flows for each monitor cache.
Step 22	interval duration <i>number</i> Example: <pre>Router(config-spolicy-inline-mparam)# interval duration 40</pre>	Specifies the duration of the intervals, in seconds, for collecting monitoring metrics.
Step 23	history <i>number</i> Example: <pre>Router(config-spolicy-inline-mparam)# history 4</pre>	Specifies the number of historical intervals of collected monitoring metrics to display.
Step 24	timeout <i>number</i> Example: <pre>Router(config-spolicy-inline-mparam)# timeout 20</pre>	Specifies the number of intervals before a stopped flow is removed from the database.
Step 25	exit Example: <pre>Router(config-spolicy-inline-mparam)# exit</pre>	Returns to service-policy inline configuration mode.
Step 26	react <i>ID</i> {media-stop mrsv rtp-jitter-average transport-packets-lost-rate} Example: <pre>Router(config-if-spolicy-inline)# react 6 rtp-jitter-average</pre>	Enters a mode where you can specify what reaction occurs when a threshold is violated for the following metrics: <ul style="list-style-type: none"> • ID-- ID for react configuration. Range is 1 to 65535. • media-stop --No traffic is found for the flow. • mrsv --Ratio calculated by dividing the difference between the actual rate and the expected rate, by the expected rate. • rtp-jitter-average --Average jitter.

	Command or Action	Purpose
		<ul style="list-style-type: none"> • transport-packets-lost-rate --Ratio calculated by dividing the number of lost packets by the expected packet count.
Step 27	action {snmp syslog} Example: <pre>Router(config-spolicy-inline-react)# action syslog</pre>	Specifies how violations of the thresholds will be reported.
Step 28	alarm severity {alert critical emergency error info} Example: <pre>Router(config-spolicy-inline-react)# alarm severity critical</pre>	Specifies which level of alarm will be reported.
Step 29	alarm type {discrete grouped {count <i>number</i> percent <i>number</i> }} Example: <pre>Router(config-ppolicy-inline-react)# alarm severity critical</pre>	Specifies which types of levels are considered alarms that require reporting.
Step 30	threshold value {ge <i>number</i> gt <i>number</i> le <i>number</i> lt <i>number</i> range <i>rng-start rng-end</i> } Example: <pre>Router(config-spolicy-inline-react)# threshold value ge</pre>	Specifies which types of levels values are considered alarms that require reporting.
Step 31	end Example: <pre>Router(config-spolicy-inline-react)# end</pre>	Exits the current configuration mode and returns to privileged EXEC mode.

What to Do Next

To check the configuration and status of your service policy, use the **show performance monitor status** command and **show performance monitor history** command.

Verifying That Cisco Performance Monitor Is Collecting Data

To verify that Cisco Performance Monitor is collecting data, perform the following optional task.



Note Flows are correlated so that if the same policy is applied on the same input and output interface, the **show** command will display a single flow for the input and output interfaces and the interface name and direction for the flow are not displayed.

If no data is being collected, complete the remaining tasks in this section.

Before You Begin

The interface to which you applied the input flow monitor must be receiving traffic that meets the criteria defined by the original flow record before you can display the flows in the flow monitor cache.

where *filter* = {**ip** {*source-addr source-prefix* | **any**} {*dst-addr dst-prefix* | **any**} | {**tcp** | **udp**} {*source-addr source-prefix* | **any**} {**eq** | **lt** | **gt** *number* | **range** *min max* | **src** {*ssrc-number* | **any**} | {*dst-addr dst-prefix* | **any**} **eq** | **lt** | **gt** *number* | **range** *min max* | **src** {*ssrc-number* | **any**}}

SUMMARY STEPS

1. **enable**
2. **show policy-map type performance-monitor** [**interface** *interface-name*][**class** *class-name*][**input** | **output**]
3. **show performance monitor status** [**interface** *interface name*[*filter*] | **policy** *policy-map-name* **class** *class-map-name*[*filter*]} | *filter*]
4. **show performance monitor history** [**interval** {**all** | *number*[**start number**]} | **interface** *interface name*[*filter*] | **policy** *policy-map-name* **class** *class-map-name*[*filter*]} | *filter*]

DETAILED STEPS

Step 1

enable

The **enable** command enters privileged EXEC mode (enter the password if prompted).

Example:

```
Device> enable
Device#
```

Step 2

show policy-map type performance-monitor [**interface** *interface-name*][**class** *class-name*][**input** | **output**]

For a description of the fields displayed by this command, see *Cisco Media Monitoring Command Reference*.

The following example shows the output for one flow policy:

Example:

```
Policy Map type performance-monitor PM-POLICY-4
Class PM-CLASS-4
  flow monitor PM-MONITOR-4
    record PM-RECORD-4
    exporter PM-EXPORTER-4
  monitor parameters
    interval duration 30
    timeout 10
    history 10
    flows 8000
```

```

monitor metric rtp
  min-sequential 5
  max-dropout 5
  max-reorder 5
  clock-rate default 90000
  ssrc maximum 5

```

Table 3: show policy-map type performance-monitor Field Descriptions

Field	Description
Policy Map type performance-monitor	Name of the Cisco Performance Monitor flow policy.
flow monitor	Name of the Cisco Performance Monitor flow monitor.
record	Name of the Cisco Performance Monitor flow record.
exporter	Name of the Cisco Performance Monitor flow exporter.
monitor parameter	Parameters for the flow policy.
interval duration	The configured duration of the collection interval for the policy.
timeout	The configured amount of time wait for a response when collecting data for the policy.
history	The configured number of historical collections to keep for the policy.
flows	The configured number of flows to collect for the policy.
monitor metric rtp	RTP metrics for the flow policy.
min-sequential	The configured minimum number of packets in a sequence used to classify an RTP flow.
max-dropout	The configured maximum number of packets to ignore ahead of the current packet in terms of sequence number.
max-reorder	The configured maximum number of packets to ignore behind the current packet in terms of sequence number.
clock-rate default	The configured clock rate for the RTP packet timestamp clock that is used to calculate the packet arrival latency.
ssrc maximum	The configured maximum number of SSRCs that can be monitored within the same flow. A flow is defined by the protocol, source/destination address, and source/destination port. The range is from 1 to 50.

Step 3 **show performance monitor status** [**interface** *interface name*[*filter*]] | **policy** *policy-map-name* **class** *class-map-name*[*filter*]] | *filter*
 where *filter* = {**ip** {*source-addr source-prefix* | **any**} {*dst-addr dst-prefix* | **any**} | {**tcp** | **udp**} {*source-addr source-prefix* | **any**} {[**eq** | **lt** | **gt** *number*] **range** *min max*| **ssrc** {*ssrc-number* | **any**} | {*dst-addr dst-prefix* | **any**} **eq** | **lt** | **gt** *number*| **range** *min max*| **ssrc** {*ssrc-number* | **any**}}

This command displays the cumulative statistics for the specified number of most recent intervals. The number of intervals is configured using the **history** command. The default settings for this commands is 10 of the most recent collection intervals. The duration of collection intervals is specified by the **interval duration** command.

To view statistics for other intervals, use the **show performance monitor history** command as described in the next step. For more information about these commands, see the *Cisco Media Monitoring Command Reference*

Step 4 **show performance monitor history** [**interval** {**all** | *number*[*start number*]}] | **interface** *interface name*[*filter*]] | **policy** *policy-map-name* **class** *class-map-name*[*filter*]] | *filter*]
 where *filter* = {**ip** {*source-addr source-prefix* | **any**} {*dst-addr dst-prefix* | **any**} | {**tcp** | **udp**} {*source-addr source-prefix* | **any**} {[**eq** | **lt** | **gt** *number*] **range** *min max*| **ssrc** {*ssrc-number* | **any**} | {*dst-addr dst-prefix* | **any**} **eq** | **lt** | **gt** *number*| **range** *min max*| **ssrc** {*ssrc-number* | **any**}}

This command displays the statistics collected by Cisco Performance Monitor during any or all intervals, including the current one. The duration of collection intervals is specified by the **interval duration** command.

For more information about this command, see the *Cisco Media Monitoring Command Reference*.

The following example shows the output for the **show performance monitor history** command:

Note If the same policy is applied on the same input and output interface, the display shows a single flow for the input and output interfaces and the interface name and direction for the flow are not displayed.

Example:

```
Codes: * - field is not configurable under flow record
       NA - field is not applicable for configured parameters
Match: ipv4 source address = 21.21.21.1, ipv4 destination address = 1.1.1.1,
transport source-port = 10240, transport destination-port = 80, ip protocol = 6,
Policy: RTP_POL, Class: RTP_CLASS
```

```
start time                               14:57:34
=====
*history bucket number                   : 1
routing forwarding-status                 : Unknown
transport packets expected counter       : NA
transport packets lost counter           : NA
transport round-trip-time (msec)         : 4
transport round-trip-time sum (msec)     : 8
transport round-trip-time samples        : 2
transport event packet-loss counter      : 0
interface input                           : Null
interface output                         : Null
counter bytes                             : 8490
counter packets                           : 180
counter bytes rate                        : 94
counter client bytes                      : 80
counter server bytes                     : 200
counter client packets                   : 6
counter server packets                   : 6
transport tcp window-size minimum        : 1000
transport tcp window-size maximum        : 2000
transport tcp window-size average        : 1500
transport tcp maximum-segment-size       : 0
application media bytes counter          : 1270
application media bytes rate              : 14
application media packets counter        : 180
application media event                   : Stop
```

```
monitor event                               : false
[data set,id=257] Global session ID|Multi-party session ID|
[data] 11                                  |22
```

Table 4: show performance monitor status and show performance-monitor history Field Descriptions

Field	Description
history bucket number	Number of the bucket of historical data collected.

Field	Description
routing forwarding-status reason	

Field	Description
	<p>Forwarding status is encoded using eight bits with the two most significant bits giving the status and the six remaining bits giving the reason code.</p> <p>Status is either unknown (00), Forwarded (10), Dropped (10) or Consumed (11).</p> <p>The following list shows the forwarding status values for each status category.</p> <p>Unknown</p> <ul style="list-style-type: none"> • 0 <p>Forwarded</p> <ul style="list-style-type: none"> • Unknown 64 • Forwarded Fragmented 65 • Forwarded not Fragmented 66 <p>Dropped</p> <ul style="list-style-type: none"> • Unknown 128, • Drop ACL Deny 129, • Drop ACL drop 130, • Drop Unroutable 131, • Drop Adjacency 132, • Drop Fragmentation & DF set 133, • Drop Bad header checksum 134, • Drop Bad total Length 135, • Drop Bad Header Length 136, • Drop bad TTL 137, • Drop Policer 138, • Drop WRED 139, • Drop RPF 140, • Drop For us 141, • Drop Bad output interface 142, • Drop Hardware 143, <p>Consumed</p> <ul style="list-style-type: none"> • Unknown 192,

Field	Description
	<ul style="list-style-type: none"> • Terminate Punt Adjacency 193, • Terminate Incomplete Adjacency 194, • Terminate For us 195
transport packets expected counter	Number of packets expected.
transport packets lost counter	Number of packets lost.
transport round-trip-time (msec)	Number of milliseconds required to complete a round trip.
transport round-trip-time sum (msec)	Total number of milliseconds required to complete a round trip for all samples.
transport round-trip-time samples	Total number of samples used to calculate a round trip times
transport event packet-loss counter	Number of loss events (number of contiguous sets of lost packets).
interface input	Incoming interface index.
interface output	Outgoing interface index.
counter bytes	Total number of bytes collected for all flows.
counter packets	Total number of IP packets sent for all flows.
counter bytes rate	Average number of packets or bits (as configured) processed by the monitoring system per second during the monitoring interval for all flows.
counter client bytes	Number of bytes sent by the client.
counter server bytes	Number of bytes sent by the server.
counter client packets	Number of packets sent by the client.
counter servers packets	Number of packets sent by the server.
transport tcp window-size-maximum	Maximum size of the TCP window.
transport tcp window-size-minimum	Minimum size of the TCP window.
transport tcp window-size-average	Average size of the TCP window.
transport tcp maximum-segment-size	Maximum TCP segment size.

Field	Description
application media bytes counter	Number of IP bytes from by media applications received for a specific media stream.
application media bytes rate	Average media bit rate (bps) for all flows during the monitoring interval.
application media packets counter	Number of IP packets produced from media applications received for a specific media stream.
application media event	Bit 1 is not used. Bit 2 indicates that no media application packets were seen, in other words, a Media Stop Event occurred.
monitor event	Bit 1 indicates that one of the thresholds specified by a react statement for the flow was crossed at least once in the monitoring interval. Bit 2 indicates that there was a loss-of-confidence in measurement.

Displaying the Performance Monitor Cache and Clients

To display the cache and the clients for Cisco Performance Monitor, perform the following optional task.

SUMMARY STEPS

1. **enable**
2. **show performance monitor cache** [*policy policy-map-name class class-map-name*][*interface interface name*]
3. **show performance monitor clients detail all**

DETAILED STEPS

Step 1

enable

The **enable** command enters privileged EXEC mode (enter the password if prompted).

Example:

```
Device> enable
Device#
```

Step 2

show performance monitor cache [*policy policy-map-name class class-map-name*][*interface interface name*]

Example:

```

MMON Metering Layer Stats:
  static pkt cnt: 3049
  static cce sb cnt: 57
  dynamic pkt cnt: 0
  Cache type: Permanent
  Cache size: 2000
  Current entries: 8
  High Watermark: 9
  Flows added: 9
  Updates sent ( 1800 secs) 0
IPV4 SRC ADDR  IPV4 DST ADDR  IP PROT  TRNS SRC PORT  TRNS DST PORT
ipv4 ttl ipv4 ttl min ipv4 ttl max  ipv4 dscp bytes long perm pktslong perm  user space vm
=====
10.1.1.1      10.1.2.3      17      4000      1967
0
1 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000
10.1.1.1      10.1.2.3      17      6000      1967
0
1 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000
10.1.1.1      10.1.2.3      17      4000      2000
0
1 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000
10.1.1.1      10.1.2.3      6      6000      3000
0
2 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000
10.1.1.1      10.1.2.3      17      1967      6001
0
1 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000
10.1.1.1      10.1.2.3      17      1967      4001
0
1 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000

```

```

10.1.1.1      10.1.2.3      6      3001      6001
0            0            0 0x00      124
3 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000
10.1.1.1      10.1.2.3      17      2001      4001
0            0            0 0x00      44
1 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000 0x00000000
0x00000000

```

Step 3 show performance monitor clients detail all**Example:**

```

Client name for ID 1 : Mediatrace-131419052
Type: Mediatrace
Age: 443 seconds
Monitor Object: _MMON_DYN_-class-map-69
Flow spec: (dvmc-acl#47) 10.10.130.2 1000 10.10.132.2 2000 17
monitor parameters
  interval duration 60
  timeout 2
  history 1
  flows 100
monitor metric rtp
  min-sequential 10
  max-dropout 5
  max-reorder 5
  clock-rate 112 90000
  clock-rate default 90000
  ssrc maximum 20
monitor metric ip-cbr
  rate layer3 packet 20
Flow record: dvmc_fnf_fdef_47
Key fields:
  ipv4 source address
  ipv4 destination address
  transport source-port
  transport destination-port
  ip protocol
Non-key fields:
  monitor event
  application media event
  routing forwarding-status
  ip dscp
  ip ttl
  counter bytes rate
  application media bytes rate
  transport rtp jitter mean
  transport packets lost counter
  transport packets expected counter
  transport event packet-loss counter
  transport packets lost rate
  timestamp interval
  counter packets dropped
  counter bytes
  counter packets
  application media bytes counter
  application media packets counter
Monitor point: _MMON_DYN_-policy-map-70 GigabitEthernet0/3 output
Classification Statistic:

```

```
matched packet: 545790
matched byte: 64403220
```

Displaying the Clock Rate for Cisco Performance Monitor Classes

To display the clock rate for one or more classes, perform the following optional task.

SUMMARY STEPS

1. **enable**
2. **show performance monitor clock rate** [*policy policy-map-name class class-map-name*]

DETAILED STEPS

Step 1

enable

The **enable** command enters privileged EXEC mode (enter the password if prompted).

Example:

```
Device> enable
Device#
```

Step 2

show performance monitor clock rate [*policy policy-map-name class class-map-name*]

If no class name is specified, information for all classes are displayed.

Example:

```
Device# show performance monitor clock rate policy all-apps class telepresence-CS4
Load for five secs: 6%/2%; one minute: 5%; five minutes: 5% Time source is NTP, 17:41:35.508 EST Wed
Feb 16 2011
RTP clock rate for Policy: all-apps, Class: telepresence-CS4
  Payload type      Clock rate(Hz)
  pcmu      (0 )      8000
  gsm       (3 )      8000
  g723      (4 )      8000
  dvi4      (5 )      8000
  dvi4-2    (6 )     16000
  lpc       (7 )      8000
  pcma      (8 )      8000
  g722      (9 )      8000
  l16-2     (10 )     44100
  l16       (11 )     44100
  qcelp     (12 )      8000
  cn        (13 )      8000
  mpa       (14 )     90000
  g728      (15 )      8000
  dvi4-3    (16 )     11025
  dvi4-4    (17 )     22050
  g729      (18 )      8000
  celb      (25 )     90000
  jpeg      (26 )     90000
  nv        (28 )     90000
  h261      (31 )     90000
  mpv       (32 )     90000
```

```

mp2t      (33 )      90000
h263      (34 )      90000
           (96 )      48000
           (112)      90000
default   90000

```

Displaying the Current Status of a Flow Monitor

To display the current status of a flow monitor, perform the following optional task.

Before You Begin

The interface to which you applied the input flow monitor must be receiving traffic that meets the criteria defined by the original flow record before you can display the flows in the flow monitor cache.

SUMMARY STEPS

1. **enable**
2. **show flow monitor type performance-monitor**

DETAILED STEPS

Step 1 enable

The **enable** command enters privileged EXEC mode (enter the password if prompted).

Example:

```

Device> enable
Device#

```

Step 2 show flow monitor type performance-monitor

The **show flow monitor type performance-monitor** command shows the current status of the flow monitor that you specify.

Example:

```

Device# show flow monitor type performance-monitor
Flow Monitor type performance-monitor monitor-4:
  Description:           User defined
  Flow Record:           record-4
  Flow Exporter:         exporter-4
  No. of Inactive Users: 0
  No. of Active Users:   0

```

Verifying the Flow Monitor Configuration

To verify the configuration commands that you entered, perform the following optional task.

Before You Begin

The interface to which you applied the input flow monitor must be receiving traffic that meets the criteria defined by the original flow record before you can display the flows in the flow monitor cache.

SUMMARY STEPS

1. **enable**
2. **show running-config flow monitor**

DETAILED STEPS

Step 1

enable

The **enable** command enters privileged EXEC mode (enter the password if prompted).

Example:

```
Device> enable
Device#
```

Step 2

show running-config flow monitor

The **show running-config flow monitor** command shows the configuration commands of the flow monitor that you specify.

Example:

```
Device# show running-config flow monitor
Current configuration:
!
flow monitor FLOW-MONITOR-1
  description Used for basic IPv4 traffic analysis
  record netflow ipv4 original-input
!
!
flow monitor FLOW-MONITOR-2
  description Used for basic IPv6 traffic analysis
  record netflow ipv6 original-input
!
```

Verifying That Cisco IOS Flexible NetFlow and Cisco Performance Monitor Is Enabled on an Interface

To verify that Flexible NetFlow and Cisco Performance Monitor is enabled on an interface, perform the following optional task.

SUMMARY STEPS

1. **enable**
2. **show flow interface** *type number*

DETAILED STEPS**Step 1****enable**

The **enable** command enters privileged EXEC mode (enter the password if prompted).

Example:

```
Router> enable
Router#
```

Step 2**show flow interface** *type number*

The **show flow interface** command verifies that Flexible NetFlow and Cisco Performance Monitor is enabled on an interface.

Example:

```
Router# show flow interface ethernet 0/0
Interface Ethernet0/0
  FNF: monitor:          FLOW-MONITOR-1
      direction:        Input
      traffic(ip):       on
  FNF: monitor:          FLOW-MONITOR-2
      direction:        Input
      traffic(ipv6):     on
```

Displaying the Flow Monitor Cache

To display the data in the flow monitor cache, perform the following optional task.

Before You Begin

The interface to which you applied the input flow monitor must be receiving traffic that meets the criteria defined by the original flow record before you can display the flow data in the flow monitor cache.

SUMMARY STEPS

1. **enable**
2. **show flow monitor name** *monitor-name* **cache format record**

DETAILED STEPS**Step 1****enable**

The **enable** command enters privileged EXEC mode (enter the password if prompted).

Example:

```
Device> enable
Device#
```

Step 2 **show flow monitor name** *monitor-name* **cache format record**

The **show flow monitor name** *monitor-name* **cache format record** command string displays the status, statistics, and the flow data in the cache for a flow monitor.

Example:

```
Device# show flow monitor name FLOW-MONITOR-1 cache format record
Cache type: Normal
Cache size: 4096
Current entries: 8
High Watermark: 8
Flows added: 24
Flows aged: 16
- Active timeout ( 1800 secs) 0
- Inactive timeout ( 15 secs) 16
- Event aged 0
- Watermark aged 0
- Emergency aged 0
IPV4 SOURCE ADDRESS: 10.251.10.1
IPV4 DESTINATION ADDRESS: 172.16.10.2
TRNS SOURCE PORT: 0
TRNS DESTINATION PORT: 2048
INTERFACE INPUT: Et0/0
FLOW SAMPLER ID: 0
IP TOS: 0x00
IP PROTOCOL: 1
ip source as: 0
ip destination as: 0
ipv4 next hop address: 172.16.7.2
ipv4 source mask: /0
ipv4 destination mask: /24
tcp flags: 0x00
interface output: Et1/0
counter bytes: 733500
counter packets: 489
timestamp first: 720892
timestamp last: 975032
.
.
IPV4 SOURCE ADDRESS: 172.16.6.1
IPV4 DESTINATION ADDRESS: 224.0.0.9
TRNS SOURCE PORT: 520
TRNS DESTINATION PORT: 520
INTERFACE INPUT: Et0/0
FLOW SAMPLER ID: 0
IP TOS: 0xC0
IP PROTOCOL: 17
ip source as: 0
ip destination as: 0
ipv4 next hop address: 0.0.0.0
ipv4 source mask: /24
ipv4 destination mask: /0
tcp flags: 0x00
interface output: Null
counter bytes: 52
counter packets: 1
timestamp first: 973804
timestamp last: 973804
```

```

Device# show flow monitor name FLOW-MONITOR-2 cache format record
Cache type:                               Normal
Cache size:                               4096
Current entries:                           6
High Watermark:                            8
Flows added:                               1048
Flows aged:                                1042
- Active timeout ( 1800 secs)              11
- Inactive timeout ( 15 secs)              1031
- Event aged                               0
- Watermark aged                           0
- Emergency aged                           0
IPV6 FLOW LABEL:                           0
IPV6 EXTENSION MAP:                        0x00000040
IPV6 SOURCE ADDRESS:                       2001:DB8:1:ABCD::1
IPV6 DESTINATION ADDRESS:                  2001:DB8:4:ABCD::2
TRNS SOURCE PORT:                          3000
TRNS DESTINATION PORT:                     55
INTERFACE INPUT:                           Et0/0
FLOW DIRECTION:                            Input
FLOW SAMPLER ID:                           0
IP PROTOCOL:                               17
IP TOS:                                    0x00
ip source as:                              0
ip destination as:                         0
ipv6 next hop address:                     ::
ipv6 source mask:                          /48
ipv6 destination mask:                    /0
tcp flags:                                 0x00
interface output:                          Null
counter bytes:                             521192
counter packets:                           9307
timestamp first:                           9899684
timestamp last:                            11660744
.
.
.
IPV6 FLOW LABEL:                           0
IPV6 EXTENSION MAP:                        0x00000000
IPV6 SOURCE ADDRESS:                       FE80::A8AA:BBFF:FE8B:CC03
IPV6 DESTINATION ADDRESS:                  FF02::9
TRNS SOURCE PORT:                          521
TRNS DESTINATION PORT:                     521
INTERFACE INPUT:                           Et0/0
FLOW DIRECTION:                            Input
FLOW SAMPLER ID:                           0
IP PROTOCOL:                               17
IP TOS:                                    0xE0
ip source as:                              0
ip destination as:                         0
ipv6 next hop address:                     ::
ipv6 source mask:                          /10
ipv6 destination mask:                    /0
tcp flags:                                 0x00
interface output:                          Null
counter bytes:                              92
counter packets:                           1
timestamp first:                           11653832
timestamp last:                            11653832

```

Displaying the Current Status of a Flow Exporter

To display the current status of a flow exporter, perform the following optional task.

SUMMARY STEPS

1. **enable**
2. **show flow exporter** [*exporter-name*]

DETAILED STEPS

Step 1

enable

The **enable** command enters privileged EXEC mode (enter the password if prompted).

Example:

```
Device> enable
Device#
```

Step 2

show flow exporter [*exporter-name*]

The **show flow exporter** command shows the current status of the flow exporter that you specify.

Example:

```
Device# show flow exporter EXPORTER-1
Flow Exporter EXPORTER-1:
  Description:           Exports to Chicago datacenter
  Transport Configuration:
    Destination IP address: 172.16.10.2
    Source IP address:     172.16.7.1
    Transport Protocol:    UDP
    Destination Port:      65
    Source Port:           56041
    DSCP:                   0x0
    TTL:                    255
```

Verifying the Flow Exporter Configuration

To verify the configuration commands that you entered to configure the flow exporter, perform the following optional task.

SUMMARY STEPS

1. **enable**
2. **show running-config flow exporter** *exporter-name*

DETAILED STEPS

Step 1

enable

The **enable** command enters privileged EXEC mode (enter the password if prompted).

Example:

```
Device> enable
Device#
```

Step 2 `show running-config flow exporter exporter-name`

The `show running-config flow exporter` command shows the configuration commands of the flow exporter that you specify.

Example:

```
Device# show running-config flow exporter EXPORTER-1
Building configuration...
!
flow exporter EXPORTER-1
  description Exports to datacenter
  destination 172.16.10.2
  transport udp 65
!
```

Enabling Debugging

To enable debugging for Cisco Performance Monitor, perform the following optional task in privileged EXEC mode.

SUMMARY STEPS

1. `debug performance monitor {database | dynamic | event | export | flow-monitor | metering | provision | sibling | snmp | tca | timer}`

DETAILED STEPS

```
debug performance monitor {database | dynamic | event | export | flow-monitor | metering | provision | sibling | snmp | tca | timer}
```

The `debug performance monitor` command enables debugging for the following performance monitor components:

- Flow database
- Dynamic monitoring
- Performance events
- Exporting
- Flow monitors
- Metering layer
- Provisioning
- Sibling management

- SNMP
- TCA
- Timers

The following example shows how to enable debugging for dynamic monitoring:

Example:

```
Device# debug performance monitor dynamic
```

Configuration Example for Cisco Performance Monitor

Example Monitor for Lost RTP Packets and RTP Jitter

This example show a configuration that monitors the number of lost RTP packets, the amount of RTP jitter, and other basic statistics for the **gig1** interface. In this example, Cisco Performance Monitor is also configured to make an entry in the syslog when the any of the following events occur on the interface:

- The percentage of lost RTP packets is between 5 percent and 9 percent.
- The percentage of lost RTP packets is greater than 10 percent.
- A media stop event has occurred.

```
! Set the filter spec for the flows to monitor.
access-list 101 ip permit host 10.10.2.20 any
! Use the flow record to define the flow keys and metric to collect.
flow record type performance-monitor video-monitor-record
 match ipv4 source
 match ipv4 destination
 match transport source-port
 match transport destination-port
 match rtp ssrc
 collect timestamp
 collect counter byte
 collect counter packet
 collect mse
 collect media-error
 collect counter rtp interval-jitter
 collect counter rtp packet lost
 collect counter rtp lost event
! Set the exporting server. The export message format is based on FNFv.9.
flow export video-nms-server
 export-protocol netflow-v9
 destination cisco-video-management
 transport udp 32001
! Set the flow filter in the class-map.
class-map match-all video-class
 access-group ipv4 101
! Set the policy map with the type performance-monitor for video monitor.
policy-map type performance-monitor video-monitor
! Set the video monitor actions.
class video-class
```

```

! Specify where the metric data is being exported to.
export flow video-nms-server
flow monitor inline
  record video-monitor-record
! Set the monitoring modeling parameters.
monitor parameters
! Set the measurement timeout to 10 secs.
interval duration 10
! Set the timeout to 10 minutes.
timeout 10
! Specify that 30 flow intervals can be kept in performance database.
history 30
priority 7
! Set rtp flow verification criteria.
monitor metric rtp
! Configure a RTP flow criteria: at least 10 packets in sequence.
min-sequential 10
! Ignore packets that are more than 5 packet ahead in terms of seq number. max-dropout
5
! Ignore packets that are more than 5 packets behind in terms of seq number.
max-reorder 5
! Set the clock rate frequency for rtp packet timestamp clock.
clock-rate 89000
! Set the maximum number of ssrc allowed within this class.
ssrc maximum 100
! Set TCA for alarm.
react 100 transport-packets-lost-rate
  description critical TCA
  ! Set the threshold to greater than 10%.
  threshold gt 10
  ! Set the threshold to the average number based on the last five intervals.
  threshold type average 5
  action syslog
  alarm severity critical
react 110 transport-packets-lost-rate
  description medium TCA
  ! Set the threshold to between 5% and 9% of packet lost.
  threshold range gt 5 le 9
  threshold type average 10
  action syslog
  alarm type grouped percent 30
react 3000 media-stop
  action syslog
  alarm severity critical
  alarm type grouped percent 30

interface gig1
  service-policy type performance-monitor video-mon in

```

Where to Go Next

For more information about configuring the products in the Medianet product family, see the other chapter in this guide or see the *Cisco Media Monitoring Configuration Guide*.

Additional References

Related Documents

Related Topic	Document Title
Design, configuration, and troubleshooting resources for Performance Monitor and other Cisco Medianet products, including a Quick Start Guide and Deployment Guide.	See the Cisco Medianet Knowledge Base Portal, located at http://www.cisco.com/web/solutions/medianet/knowledgebase/index.html
IP addressing commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	<i>Cisco Media Monitoring Command Reference</i>
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
Configuration commands for Flexible NetFlow	<i>Cisco IOS Flexible NetFlow Command Reference</i>
Overview of Flexible NetFlow	“Cisco IOS Flexible NetFlow Overview”
Flexible NetFlow Feature Roadmap	“Cisco IOS Flexible NetFlow Features Roadmap”
Configuring flow exporters to export Flexible NetFlow data.	“Configuring Data Export for Cisco IOS Flexible NetFlow with Flow Exporters”
Customizing Flexible NetFlow	“Customizing Cisco IOS Flexible NetFlow Flow Records and Flow Monitors”
Configuring flow sampling to reduce the overhead of monitoring traffic with Flexible NetFlow	“Using Cisco IOS Flexible NetFlow Flow Sampling to Reduce the CPU Overhead of Analyzing Traffic”
Configuring Flexible NetFlow using predefined records	“Configuring Cisco IOS Flexible NetFlow with Predefined Records”
Using Flexible NetFlow Top N Talkers to analyze network traffic	“Using Cisco IOS Flexible NetFlow Top N Talkers to Analyze Network Traffic”
Configuring IPv4 multicast statistics support for Flexible NetFlow	“Configuring IPv4 Multicast Statistics Support for Cisco IOS Flexible NetFlow”

Standards

Standard	Title
None	—

MIBs

MIB	MIBs Link
<ul style="list-style-type: none"> • CISCO-FLOW-MONITOR-TC-MIB • CISCO-FLOW-MONITOR-MIB • CISCO-RTP-METRICS-MIB • CISCO-IP-CBR-METRICS-MIB 	<p>To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:</p> <p>http://www.cisco.com/go/mibs</p>

RFCs

RFC	Title
RFC 3954	<p><i>Cisco Systems NetFlow Services Export Version 9</i></p> <p>http://www.ietf.org/rfc/rfc3954.txt</p>
RFC 3550	<p><i>RTP: A Transport Protocol for Real-Time Applications</i></p> <p>http://www.ietf.org/rfc/rfc3550.txt</p>

Technical Assistance

Description	Link
<p>The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.</p>	<p>http://www.cisco.com/cisco/web/support/index.html</p>

Feature Information for Cisco Performance Monitor

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

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

Table 5: Feature Information for Cisco Performance Monitor

Feature Name	Releases	Feature Information
Cisco Performance Monitor 1.0	15.1(3)T 12.2(58)SE 15.1(4)M1 15.0(1)SY Cisco IOS XE Release 3.5S 15.1(1)SG Cisco IOS XE Release 3.3 SG 15.1(2)SY	

Feature Name	Releases	Feature Information
		<p>This feature enables you to monitor the flow of packets in your network and become aware of any issues that might impact the flow before it starts to significantly impact your applications' performance.</p> <p>Support for this feature was added for Cisco ASR 1000 Series Aggregation Services routers in Cisco IOS XE Release 3.5S.</p> <p>There are some limitations to the monitoring of ingress or egress data on certain types of interfaces for the Cisco IOS XE Release 3.3 SG and Cisco IOS release 15.1(1)SG. For more information, see the "Limitations" section.</p> <p>For all other releases, the following commands were introduced or modified by this feature:</p> <p>action(policy react and policy inline react), alarm severity (policy react and policy inline react), alarm type(policy react and policy inline react), class-map, clock-rate(policy RTP), collect application media, clear fm performance-monitor counters, collect counter, collect flow direction, collect interface, collect ipv4, collect ipv4 destination, collect ipv4 source, collect ipv4 ttl, collect monitor event, collect routing, collect timestamp interval, collect transport event packet-loss counter, collect transport packets, collect transport rtp jitter, debug fm performance-monitor counters, debug performance-monitor counters, description (Performance Monitor), destination dscp (Flexible NetFlow), export-protocol, exporter, flow monitor type performance-monitor, flow record type</p>

Feature Name	Releases	Feature Information
		<p> performance-monitor, flows, history (monitor parameters), interval duration, match access-group, match any, match class-map, match cos, match destination-address mac, match discard-class, match dscp, match flow, match fr-de, match fr-dlci, match input-interface, match ip dscp, match ip precedence, match ip rtp, match ipv4, match ipv4 destination, match ipv4 source, match mpls experimental topmost, match not, match packet length (class-map), match precedence, match protocol, match qos-group, match source-address mac, match transport destination-port, match transport rtp ssrc, match transport source-port, match vlan, max-dropout (policy RTP), max-reorder (policy RTP), min-sequential (policy RTP), monitor metric ip-cbr, monitor metric rtp, monitor parameters, option (Flexible NetFlow), output-features, platform performance-monitor rate-limit, policy-map type performance-monitor, rate layer3, react (policy), record (Performance Monitor), rename (policy), service-policy type performance-monitor, show performance monitor history, show performance monitor status, show platform hardware acl entry interface, show platform software ccm, show platform software feature-manager performance-monitor, show platform software feature-manager tcam, show policy-map type performance-monitor, snmp-server host, snmp-server </p>

Feature Name	Releases	Feature Information
		enable traps flowmon, snmp mib flowmon alarm history , source(Flexible NetFlow), ssrc maximum, template data timeout, threshold value (policy react and policy inline react), timeout (monitor parameters), transport (Flexible NetFlow), and ttl (Flexible NetFlow).

Feature Name	Releases	Feature Information
Cisco Performance Monitor (phase 2)	15.2(2)T Cisco IOS XE Release 3.5S	

Feature Name	Releases	Feature Information
		<p>This feature enables you monitor IPv6 fields and also use all other Flexible Netflow collect and match commands not supported in the previous release.</p> <p>Flows are now correlated so that if the same policy is applied on the same input and output interface, the show command will display a single flow for the input and output interfaces.</p> <p>Support for this feature was added for Cisco ASR 1000 Series Aggregation Services routers in Cisco IOS XE Release 3.5S.</p> <p>The following commands were introduced or modified by this feature: collect datalink mac, collect ipv4 fragmentation, collect ipv4 section, collect ipv4 total-length, collect ipv6, collect ipv6 destination, collect ipv6 extensionmap, collect ipv6 fragmentation, collect ipv6 hop-count, collect ipv6 length, collect ipv6 section, collect ipv6 source, collect routing is-multicast, collect routing multicast replication-factor, collect timestamp sys-uptime, collect transport, collect transport icmp ipv4, collect transport icmp ipv6, collect transport tcp, collect transport udp, match application name, match connection transaction-id, match datalink dot1q vlan, match datalink mac, match datalink vlan, match interface, match ipv4 fragmentation, match ipv4 section, match ipv4 total-length, match ipv4 ttl, match ipv6, match ipv6 destination, match ipv6 extension map, match ipv6 fragmentation, match ipv6 hop-limit, match ipv6 length, match ipv6 section, match ipv6</p>

Feature Name	Releases	Feature Information
		<p>source, match routing, match routing is-multicast, match routing multicast replication-factor, match transport, match transport icmp ipv4, match transport icmp ipv6, match transport tcp, match transport udp</p>
<p>Cisco Performance Monitor (phase 3)</p>	<p>15.2(3)T</p>	<p>This feature enables you to configure multiple exporters and monitor metadata fields and new TCP metrics.</p> <p>The following commands were introduced or modified by this feature: collect application, collect transport tcp bytes out-of-order, collect transport packets out-of-order, collect transport tcp maximum-segment-size, collect transport tcp window-size maximum, collect transport tcp window-size minimum, collect transport tcp window-size average, match application, match transport tcp bytes out-of-order, match transport packets out-of-order, match transport tcp maximum-segment-size, match transport tcp window-size maximum, match transport tcp window-size minimum, match transport tcp window-size average</p>
<p>Performance Monitoring - IPv6 support</p>	<p>Cisco IOS XE Release 3.6S</p>	<p>This feature enables you to attach a monitor to IPv6 interfaces.</p> <p>Support for this feature was added for Cisco ASR 1000 Series Aggregation Services routers in Cisco IOS XE Release 3.6S.</p>

Feature Name	Releases	Feature Information
Performance Monitoring - transport packet out of order	Cisco IOS XE Release 3.6S	<p>This feature enables you to monitor the total number of out-of-order TCP packets.</p> <p>Support for this feature was added for Cisco ASR 1000 Series Aggregation Services routers in Cisco IOS XE Release 3.6S.</p> <p>The following commands were introduced or modified by this feature: collect transport tcp bytes out-of-order and collect transport packets out-of-order.</p>
Flexible NetFlow: IPFIX Export Format	15.2(4)M	<p>Enables sending export packets using the IPFIX export protocol. The export of extracted fields from NBAR is only supported over IPFIX.</p> <p>The following command was introduced: export-protocol.</p>